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## Prospects of nanotechnology in food industry: Implication on Public Health

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### Abstract

Nanotechnology, now-a-days is highly used in food industries. The quality of the food depends on its processing, packaging, early detection of any pathogens in food materials, and also their longer shelf-life period. Nanotechnologies uses various organic-, inorganic- and bio-nanomaterials for the detection and inhibition of the growth of any food-pathogens. Recently, nanoparticle-based biosensors are developed for the detection of the

food-borne pathogens or any hazardous substances. Further, nano-biopolymer mediated encapsulation of the valuable microbial strains, probiotics, protects their survival in an extreme levels of temperature, pH, and salinity during the processing of food products and within the gastro-intestinal tract. The goal of this review is to discuss the potential of different aspects of nanotechnology in food industry to provide a contamination-free safe food to the consumers.

**Keywords :** Lung, Segmentation, Snake Segmentation, Gaussian Filter

### I. Introduction

Nanotechnology refers to a technology that uses particles with 1–100 nm in size, approximately, and that have novel properties, like solubility, diffusivity, color, and magnetic, optical, thermodynamic, etc. [1, 2]. This technology has already been applied in modern science, including health science, environmental science, energy and electronics, etc., recently reviewed by us [3].

The rising consumer's concerns about their health, the food quality are the driving force of studying the nanomaterials in safety issues of foods during their preparation and delivery[4, 5]. In this review, we discussed the role of nanotechnology in food microbiology and discussed some positive as well as negative impacts of human health.

### II. Nanotechnology in Concern with Food Microbiology

#### A. Antimicrobial Effect of Nanoparticles:

- Silver nanoparticles exhibited antimicrobial activity against Escherichia coli and Penicillium spp.[6, 7].
- Cationic peptides nanoparticles have strong antimicrobial properties including bacteria, yeasts and fungi [8].
- Metal oxide, TiO<sub>2</sub> and Ag<sub>2</sub>O, nanoparticles act against eukaryotic infectious agents [9].

#### B. Nanocapsulation can protect food from Microbial Activity:

- Nanovehicles protect fruit juices from any microbial activity without compromising the quality of the product [10].
- Inhibition of Listeriamonocytogenes, Salmonella typhimurium and Escherichia coli in raw chicken is possible with encapsulated benzoic acid (1,100µg/mL) in polylactic-co-glycolic acidnanoparticles [11].

- Nisin loaded chitosan/ carageenan nanocapsules, showed better antibacterial activity in vitro, compared to the components evaluated separately [12].

### C. Nanotechnology in Food Preservation:

- Nanotechnology can be applied for increasing shelf-life of foods by inhibiting the microbial growth [13].
- Nano-encapsulation of the bioactive components of foods can slow down the degradation processes in a hostile environment, and thus can extend the shelf-life of the food products. For example, curcumin, the most active and least stable bioactive component of turmeric, was found to be stable at different ionic strength and even after pasteurization upon encapsulation [14].
- Edible nano-coatings can prevent gas exchange and also works as a barrier to moisture, and thus increase the shelf life of foods, in addition to restoring the colors and flavors of the food products [15, 16].

**D. Increases Nutritional Value:** Nanocomposite, nano-emulsification, and polymeric nanoparticles are found suitable for the encapsulation of bioactive compounds (e.g., flavonoids and vitamins) in order to protect them during transport to the target [17].

- **Food quality:** Nanotechnology provides an improvement of the food quality, food taste, texture, and appearance of food. In addition to safety evaluation [5, 18].
- **Thermal stability and photostability:** It was shown that encapsulation of cyanidin-3-O-glucoside (C3G) molecules within the inner cavity of apo-recombinant soybean seed H-2 (rH-2), improved the thermal and photostability of C3G [19].
- Rutin, a dietary flavonoid with important pharmacological activities is poorly soluble in water, but encapsulation of it in ferritin nanocages enhanced the solubility, and also the stability from thermal and UV radiation [20].
- **Water-dispersion and bioavailability:** The nano-emulsions can be produced using natural food ingredients to deliver lipid-soluble bioactive compounds through enhancement of water-dispersion and bioavailability [21].
- **Nanoparticle adds color or flavor:** Many metallic oxides such as titanium dioxide and silicon dioxide (SiO<sub>2</sub>) have been used to impart color and flavor in

food items, that helps in the marketing [22, 23].

**E. Safety Issues:** Physiochemical properties of nanomaterials changes from their macrostate to nanostates, therefore more careful studies must be done to evaluate the risk of using its nano counterparts in foods. Moreover, the small sized nanomaterials may accumulate within body organs and tissues [24], therefore, regulatory authorities must ensure not only the quality of the foods but also the health and safety issues, and environmental regulations.

- Nanosensors or nanobiosensors responds to any changes in environmental conditions such as humidity or temperature in storage rooms, microbial contamination, or products degradation [25 - 28].
- Immunosensors are being made by immobilizing protein molecules, antigen and specific antibodies on thin nanofilms or sensor chips which can detect the target molecules and emit signals [29].
- Carbon nanotubes is cost-effective biosensors that can detect microorganisms, toxins, and other degraded products in foods and beverages [30, 31].

**F. Nanotechnology in Food Packaging and Safe Delivery systems:** A desirable food packaging material should have strength as well as bio degradability of the material along with the gas and moisture exchange properties [32]. Nanocomposites, in this regard, could be considered as an active material for packaging and safe delivery of the food products [33].

Many inorganic nanoparticles such as silver, copper, chitosan, and metal oxides like titanium oxide or zinc oxide, have antibacterial property [33, 34]. The incorporation of these nanoparticles in polymers has allowed developing a more resist packaging material with cost effectiveness [35]. Further, use of inert chitin or chitosan into the polymer matrix makes it lighter but stronger, fire resistant, and with better thermal properties [36, 37].

**G. The Limitations of Nanotechnology in Food Industry:** Besides many advantages of using nanotechnology in food industries, there are also some limitations as well as challenges to be dealt in food science.

- The major section(s) are with issues from environmental and human health aspects. Nanomaterials may accumulate in the circulatory systems, where proteins and amino acids may

interact with the nano-materials and may cause various diseases or even death.

- Unfortunately, there are no such specific protocols or guidelines, yet, to deal with the nano-wastes. However, scientists recently are trying to produce bio-degradable plastics for packaging that are lighter in weight and thermally more stable with improved barrier protection [38].

### III. Impact on Society

Commercial applications of nanomaterials will continue to impact the food industry as well as the global health. Therefore, the safety of the food products that are especially containing the nano-materials, should be the most important concern for the public acceptance. A uniform international regulatory guideline(s) is a must for using nanotechnology in food industry.

**A. Positive Impact:** There are many health benefits that are associated with the using of nanoparticles in food industries. Fluorescent biological probes are inert but able to interact in a variety of cellular reactions with sensitivity when used in food products. In vivo, nanoparticles are generally attached to proteins, antibodies, and nucleic acids, and used as a probe for displaying and quantifying molecular reactions inside the body. Using of prebiotics and probiotics instead of antibiotics in farming sector also added as a positive impact on humans.

**B. Negative Impact:** Toxicity of nanoparticles depends on their size, structure, surface properties, and their aggregation. Nanoparticles, since they have a greater ratio of their surface area to volume, adds abnormal chemical and biological reactivity in them. Those abnormal nanoparticles can enter the body through many routes like skin, ingestion, inhalation, injection, or by implantation. If nanoparticles have poor solubility and/or biodegradability, those may cause cancer. Especially, the cosmetic products which contains the nanoparticles but do not require any clinical trials, are the greater concern of experiencing the bad effects like erythema due to the damage of fibroblasts [39].

Nanoparticles further can cause cardiopulmonary ailments, neuronal diseases, and acute inflammatory reactions in humans. WHO has already notified the health implications of nanoparticles, but no regulatory

policies have been circulated yet [40, 41].

### IV. Conclusions

Nanotechnology has lots of commitment on the improvement in quality of Human life. In food industries, the application of nanotechnology is to improve the quality of the food, maintenance of food safety and improve the food storage, and food delivery. Nanomaterials act as an excellent carrier to deliver bioactive substances to the target cells, and also increase the viability of the probiotics.

Although, nanotechnology can bring lots of improvement on food products, the stability and bio availability of this technology has some demerits, like possible toxic effects on the human/animal health, creates environmental pollution, etc. Therefore, it warrants more careful investigations to minimize the possible toxic side effects of nanoparticles in the living tissues. Compulsory testing of nano food-products is required according to the FDA guidelines before they are released to the consumer's market [18].

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## A review on denoising of underwater Images using Image Processing

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### Abstract

Imaging things that are underwater may be difficult owing to a number of issues, including a lack of visibility, the attenuation of light, and the scattering of light that is created by the medium itself. Because of these circumstances, the quality of the picture is reduced, which makes it more difficult to glean information that is relevant from underwater photos. Denoising methods that make use of image processing have been the subject of much research and development as a means of addressing this problem.

The denoising of underwater photographs via the application of several image processing methods is the topic of this review. The first thing that is done is to provide an overview of the difficulties that are involved with underwater imaging as well as the special features of underwater noise. The next section of the study focuses on denoising techniques, covering a wide range of approaches such as time-tested procedures and cutting-edge research in the area.

In this article, conventional noise removal techniques such as filtering, wavelet transform, and median filtering are analysed, and both their benefits and drawbacks in relation to the process of underwater picture denoising are outlined. In addition, more sophisticated methods, such as adaptive filtering, sparse representation, and approaches based on deep learning, are investigated. The evaluation explains the fundamental concepts that underlie their operation and assesses how successful they are in reducing picture noise and improving the quality of images captured underwater.

In addition to this, the paper investigates the assessment

measures that are often used in order to evaluate the effectiveness of denoising algorithms for underwater photos. It emphasises the need of quantitative and qualitative assessment in comparing various approaches of denoising by discussing metrics such as peak signal-to-noise ratio (PSNR), structural similarity index (SSIM), and subjective quality measurements.

The study comes to a close with a synopsis of the most important discoveries and a discussion of potential new avenues of investigation for the field of underwater picture denoising. It underscores the need for reliable and effective denoising algorithms that are capable of handling complicated underwater noise patterns and improving picture quality for a variety of applications requiring underwater photography.

In general, the purpose of this study is to provide a detailed examination of the most recent denoising methods that may be applied to underwater photographs by applying image processing. It is a helpful resource for academics and practitioners who are working in the subject of underwater imaging, and it contributes to the creation of efficient denoising algorithms, which improve the quality and visibility of underwater photographs.

**Keywords:** *Underwater Images, Filters, Denoising*

### Introduction

Imaging conducted underwater is very useful in a wide variety of disciplines, including oceanography, marine biology, underwater exploration, and underwater robots. However, because of the one-of-a-kind qualities of the aquatic environment, taking photographs of a good

quality while underwater is a job that is naturally difficult to do [1]. The presence of suspended particles, water turbulence, light attenuation, and scattering considerably diminish the quality of photos captured underwater. This results in poor visibility and a reduction in the amount of information contained in the images [2].

Denoising methods, which make use of image processing, have been extensively researched and developed as a means of overcoming the obstacles outlined above and improving the visibility of underwater photos [3]. Denoising is the technique of reducing undesirable noise from a picture while still keeping the vital characteristics of the image. Denoising algorithms are used in the context of underwater photography with the goal of reducing the negative effects of noise [4]. This leads to an improvement in the overall picture quality and an increase in the visibility of underwater scenes.

When compared to the noise seen in land-based photos, the noise found in underwater photographs has a unique set of features. It is comprised of a wide variety of noises, such as salt-and-pepper noise, Gaussian noise, and speckle noise, each of which is triggered by a unique combination of environmental conditions that occur in an underwater setting [5]. These elements may be broken down into two primary sources, which are referred to as intrinsic noise sources and acquisition-related noise sources respectively.

The very characteristics of the medium give rise to noise sources that are inherently present in underwater photography. The photos that were obtained show decreased contrast as well as colour distortion due to the attenuation of light that was induced by the absorption of water [6]. Image quality is further diminished as a result of the scattering of light that is caused by suspended particles and water molecules. This results in the appearance of spatial fluctuations and speckle patterns.

The imaging device itself as well as the actual process of acquiring the picture both contribute to the acquisition-related noise that may be seen in underwater photography [7]. The noise that is introduced by the camera sensor, including thermal noise and readout noise, contributes to the total noise that is present in the pictures that are taken. In addition, signal-dependent

noise, which is more often referred to as shot noise, arises in underwater conditions owing to the low light levels, which has the effect of diminishing picture quality [8].

Researchers have created a variety of different denoising strategies by making use of image processing algorithms in order to overcome these issues [9]. Denoising techniques that have been used for a long time, such as spatial filtering, wavelet transform, and median filtering, have been modified and applied to the process of cleaning up underwater images. These strategies make use of the statistical aspects of the noise and the picture structures in order to get rid of the noise while keeping the image details intact.

In recent years, more complex methods of denoising have evolved. These methods make use of strategies such as adaptive filtering, sparse representation, and deep learning. Adaptive filtering techniques evaluate the noise characteristics in an adaptive manner and then apply filtering in an appropriate manner, which results in improved denoising performance. Sparse representation approaches take use of the fact that underwater photos are sparse in order to efficiently extract the noise from the components of the image that are wanted [10]. Deep learning-based approaches provide state-of-the-art denoising performance by making use of convolutional neural networks (CNNs) to learn complicated mappings between noisy and clean underwater pictures [11]. This allows the methods to achieve its goals.

In the field of underwater image processing, the analysis of noise reduction techniques is an essential component of study. Several different metrics, including as the peak signal-to-noise ratio (PSNR), the structural similarity index (SSIM), and subjective quality measurements, are used in order to evaluate the effectiveness of various denoising algorithms [13]. These metrics assist compare various denoising algorithms by providing quantitative and qualitative assessments of the efficacy of the denoising process.

In this paper, we give an in-depth examination of several denoising strategies that may be applied to underwater photographs by making use of image processing algorithms. In this article, we explore both classic and modern denoising techniques, emphasising the many benefits and drawbacks of each. In addition, we

investigate the assessment measures that are often used in order to evaluate the effectiveness of denoising algorithms.

The purpose of this study is to provide researchers and practitioners working in the area of underwater imaging with a useful resource that they can refer to. It provides insights into the current state-of-the-art in underwater image denoising and identifies future directions for research, putting an emphasis on the need for robust and efficient denoising techniques that can handle the complexities of underwater noise patterns and improve image quality for a variety of applications involving underwater imaging.

## Literature Survey

[1] Gao et al., Researchers devised a model on how to enhance underwater photography based on the anatomy and function of the retinas of teleost fish. The findings was published in the journal Scientific Reports. The blurring and uneven colour biasing that are common issues with underwater photos are the focus of our efforts as we search for a solution to these issues. In order to rectify the non-uniform colour bias, in particular, the feedback from color-sensitive horizontal cells to cones and a correction to the red channel are used. Both the center-surround opponent mechanism of the bipolar cells and the feedback that goes from the amacrine cells to the interplexiform cells and then to the horizontal cells assist to enhance the edges and contrasts of the final picture. This feedback flows from the amacrine cells to the interplexiform cells and then to the horizontal cells. Ganglion cells have a component referred to as the "color-opposing apparatus," which allows for the modification and enhancement of colours. In the end, we came to the conclusion that the best approach to create the enhanced picture would be to utilise a technique called luminance-based fusion, which would combine the outputs of the ON and OFF pathways of the fish retina. The design of each low-level filter is modified automatically by our technique, and these modifications are dependent on global data such as the contrast of the picture. In this manner, the objective of having the primary parameter adjust itself is accomplished. Our method's superior performance in comparison to other approaches has been shown by thorough

qualitative and quantitative testing carried out in a number of different underwater conditions. When our technique is used, the transmission map estimate as well as the local feature point matching using the underwater picture both result in greater degrees of precision. Our approach is centred on a single shot, and it is not necessary for us to have any prior knowledge of the composition of the scene or the atmosphere of the underwater setting in order to carry it out.

- [2] Dengyin Zhang et al., The hazy image phase is converted into a hazy picture that may be utilised by Haze, which takes this hazy image phase. A cutting-edge protection approach may be used to generate a distribution chart for a hazy image. The weighted guidance image filter is created by applying edge aware weighting to the directed object filter. This results in the filter. It was possible to determine the hazy image's whole colour channel as well as its dark channel. The weighted directed image filter is responsible for separating the dark stream into its component pieces, which are referred to as the foundation layer and the information sheet. The transformation diagram may be split in two, with the base layer in the centre. Utilising the chart, one may restore the situation to way it was before hazelnut was introduced.
- [3] Zheqi Lin et al., In poor weather conditions, conditions such as mist or fog may make it difficult to see, which presents a significant challenge for many computer vision applications. Eliminating the haze is a very significant step in improving the graphic algorithm's overall quality. A innovative and expedient method for removing haze during the processing of video and still photos in real time. A more effective method of guiding sorting calculates the transmission chart without producing any hitches and takes the deep image data into consideration. According to the findings, not only is the system effective at cleaning the air, but also the output it provides in real time is quite high. The method is useful for preprocessing in a wide variety of applications, including security, intelligent cars, and remote sensing, because to the speed with which it operates and the effectiveness with which it enhances images. According to the findings, both the dehazing process and the manner the system

performed in real time were successful. Due to the fact that the method for the device is both quick and clear, it may be used for helpful preprocessing in a variety of applications, including security, intelligent cars, and remote sensing.

- [4] He Zhang et al., Our approach, in contrast to others now in use, does not begin by computing the transmission map before attempting to get a clear image of the dehazed environment. When decoding using a pyramid pooling unit, the approach employs an encoder and decoder that have designs that take into consideration background information. It is possible to find the network by including square error and predicted failure into the standardbred. During the process of learning and inference, the use of multi-scale patches allows for an even greater improvement in performance.
- [5] Jiahao Pang et al., Because the haze is so unpleasant to look at, it is difficult to remove it from a single photograph. Eliminating Haze with a dark channel priory is an effective strategy, however improving the transmission map requires a significant amount of computational power. Recent studies have demonstrated that the map may be made simpler by using a directed filter in the appropriate context. The dark channel and the controlled object filtering in depth are combined in order to create the single picture dehazing effect, a method for actively changing criteria by considering the benefits and drawbacks of the option being considered. Experiments and correlations have shown that the results of the dehazing tests produced by our technology are satisfactory.
- [6] LuukSpreeuwiers et al., In this particular research project, neural networks were used to filter images of objects, and the results of these analyses were analysed. The use of neural networks as a method for storing information and data is a relatively recent development. In this particular research project, neural networks were used to filter images of objects, and the results of these analyses were analysed. The use of neural networks as a method for storing information and data is a relatively recent development. There are many different ways to represent objects and patterns with the help of neural networks, but the majority of these methods concentrate on target detection, character recognition, associative memory that recall visuals, and the simulation of the retina. This article discusses a research that looked at how neural networks may be used to process things, such as improving photographs, adding or removing characteristics, and finding missing objects. Again, the culmination of all of these processes results in an object that is more suited for study by human and computer vision systems alike.
- [7] Nicholas Carlevaris-Bianco, along with a few others, During the time that the energy is being transferred from the item to the eyewitness, the mechanism will be moving through the light. When there are a lot of particles in the air, such as there are when there is mist or when there is a turbid liquid, dispersion may cause the photographs to seem quite poor. The technique of reducing the effects of light scattering from underwater photographs is referred to as "dehazing." Our primary dedication is to an excellent but peculiar older approach that determines the depth of a picture based on the distinct contrast that exists between the three colours of water channels. This method was developed many years ago. By making use of this marker, the picture at that level will be less impacted by the manner in which the fog travels around in space. For our technique to be successful, we simply need a single photograph, as well as no specialised gear or prior knowledge on the location. Providing a current detail chart of the scene is done as part of the process of dehazing the image. Learn more about the recent studies that have been conducted on a variety of genuine items as well as a controlled test array, which demonstrates objective difference and true reality.
- [8] F. Farnood Ahmadi et al., The findings (road networks) were then included into a fully computerised (CAD) model vector that, with only a few tweaks, was suitable for use in a Geographical Information System (GIS). It is expected that the process will include the usage of tools based on CAD as well as image analysis. The majority of cleaning algorithms are designed to lessen the amount of noise that is already there while improving the quality of the output. After then, CAD-based software was used to convert the raster

map that had been updated into a vector map. The findings demonstrated that the vector-centered ordered street centerlines are effective when they were introduced to the road network in the comparison graph.

- [9] Xumeng Chen et al., In addition, the light cloak test is used in yet another approach. When applied to objects whose illumination isn't uniform due to haze, the measurement produces accurate results. When one examines a damaged frame, one may tell how dark it is by the loss of brightness in the RGB components of each of those components. The front cover of a directed screen is titled "Vitality." You will be able to determine the maximum capacity of each object's RGB components and filter them in the scene lighting if you remove the blurry picture and the enigmatic construction of a vitality cloak. After that, you may utilise the template to determine the RGB value of each point to determine its lighting and reflection. It is possible that the procedure may mess up the photographs while at the same time making them clearer, and the local air light shouldn't be adjusted in order to reduce the likelihood that mistakes will occur. A connection may also be made between the computation and the elimination of scene light. The strategy seems to be much superior in terms of awareness and light devotion, as shown by tests conducted on a variety of photographs depicting wet landscapes.
- [10] Dana Berman et al., It is more difficult to see objects and more difficult to identify what those items are when there is haze. The degree of corruption in each pixel is unique and varies according to the distance between the lens and the scene point. This is mirrored in the transfer coefficients, which regulate the process by which the picture is shrunk and determine the amount of cloudiness in each individual pixel. In the past, many distinct set priors were used in an effort to find a solution to the challenge of dehazing a single picture. On the other hand, a previous estimate that was made from a great distance is based on another. This computation was predicated on the hypothesis that the colours emitted by a nebulous object in RGB space are quite close to a few hundred hues that are recognisable to humans. The most important assumption we make is that pixels do not often cluster together. Instead, they are dispersed throughout the whole object plane and are located at varying distances from the camera at the same time.
- [11] Kaiming He et al., A conventional and transparent representation of a filter is called a guided filter. The directed filter is constructed from an adjacent direct template, and it use the information included inside the directional picture to demonstrate how yield filtering should be performed. The directed filter, much like the more common reciprocal filter, is capable of serving in the capacity of administrator for edge security. In every circumstance, the most effective strategies include near tops. After smoothing, the idea of the directed filter is likewise becoming less and less exclusive: It is possible to make use of the structures of the directed image rather than the filter yield, and it is also possible to permit the employment of novel filtering technologies such as dehazing and guiding feathering. The majority of the time, the directed filter will have a straightforward and approximate estimation of the particular period. This estimation does not have to take into consideration the section measurement or the power. According to the findings of research, a direct filter is effective and efficient in a broad variety of applications using PC vision. In addition, the PC may build devices, implement edge-aware streaming, improve data quality, and calculate HDR pressure.
- [12] Mihai Budescu et al., Every component of a matrix that specifies the colour of a pixel may be shown by an object in the form of a vector. In order to provide input for the neural network, the matrix is employed as data. The size and quantity of input vectors are both determined by the dimensions of the minuscule item, which makes learning simple and straightforward. Sigmoidal properties include the use of the transport function in various ways. The analysis frequency reveals the values that fall between [0,1] as well as the deviation that falls below [0,1]. Photo recognition has been effectively used in a broad variety of domains, including geotechnical engineering, civil engineering, robotics, industrial control, safety, automation, and transportation (ANN).
- [13] Kaiming He et al., The guided filter performs the same function as a normal bilateral filter [1] in that it



is a smoothing operator that maintains the edges; however, its behaviour near the edges has been enhanced. The Laplacian is also technically related [2,] which means that it has a larger meaning than that of a smoothing operator and that it may be employed more effectively with the designs of the guiding object. No matter how lengthy the filtering kernel is, the directed filter always has a fast algorithm that runs in non-approximate linear time and has a high computational complexity level. We demonstrate that the directed filter is effective in a broad variety of contexts, including but not limited to noise reduction, complete smothering, HDR compression, picture matting/feathering, haze removal, sampling, and so on. Additionally, they demonstrate that the guided filter is functional and operates well.

[14] Ximei Zhu et al., Because of the reduced visibility, taking images and movies in foggy conditions may be challenging. The results of more recent research indicate that early and tailored filter approaches for removing haze from photographs have been successful in the dark field. To assess the effectiveness of these tactics, however, one must spend a significant amount of money; hence, they are not useful for maintaining frameworks or setting up new frameworks. There are primarily two things that need to be done. The second step is to develop Guided Interpolated Filters (GIF) in order to expedite the assessment of the transportation map, which is the project with the highest analytic value of any of the previous tactics. You may increase the level of information of dehazed objects that are used as the path image in a GIF by making use of the edge chart.

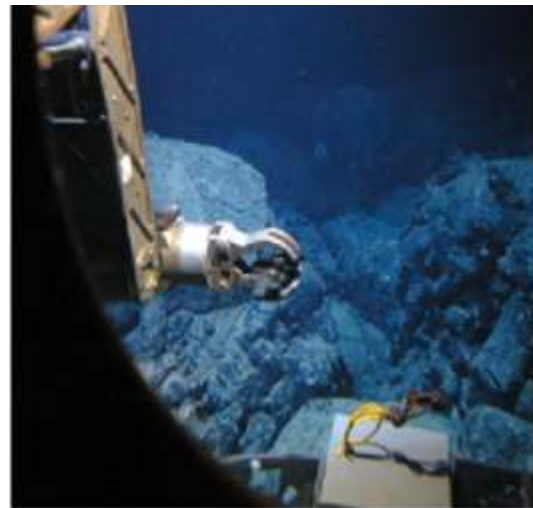
[15] He Zhang et al., The value of a photograph taken in an outdoor setting is diminished by haze, which affects both the photograph's exposure and how pleasant it seems to be. Dehazing a single picture may be challenging since the images do not seem to be in the same location. The outdated method of computing is used in a number of modern research, including the most recent ones that are based on convolution neural networks. This method depicts a hazy image as the result of the interaction between reduced scene brightness and ambient illumination. In this line of study, following DNNs will allow you

to get direct information about a non-linear characteristic that exists between hazy objects and the linked clear photos. Demonstrate a multi-scale object dehazing approach using the Perceptual Pyramid Deep Network. This method focuses on dense blocks and residual blocks, which have been more popular in recent years. In order for this strategy to be effective, you will require an encoder-decoder framework equipped with a decoder pyramid pooling mechanism. This will allow you to include contextual information into the decoding process.

## Conclusion

In conclusion, the purpose of this study was to give an in-depth investigation of denoising approaches that may be applied to underwater photographs that make use of image processing algorithms. Imaging under water is difficult for a number of reasons, including the reduced visibility, the attenuation of light, and the scattering of light that are all induced by the surrounding aquatic environment. Because of these obstacles, the picture quality suffers, making it more difficult to glean useful information from underwater photos.

In this chapter, the proposed implementation and results are presented. The image Fig. 1 and 2 are the input images taken in consideration as image 1 and image 4 respectively.



*Fig. 1: Input Image 1*





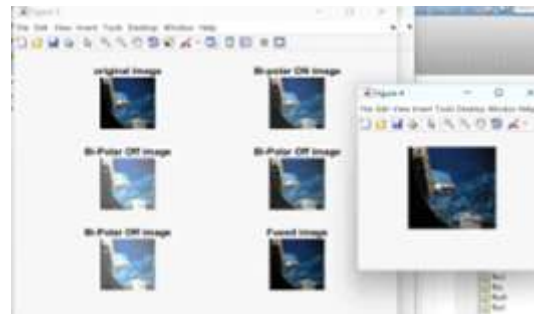
*Fig. 2: Input Image 2*

Researchers have investigated and created a variety of different denoising algorithms in order to overcome these issues. Denoising an underwater picture has been accomplished by the modification and use of more conventional techniques such as filtering, wavelet transform, and median filtering. These techniques have shown some degree of success in lowering noise levels and improving the overall picture quality. On the other hand, it's possible that they don't adequately manage the intricate noise patterns and fluctuation that may be seen in underwater settings.

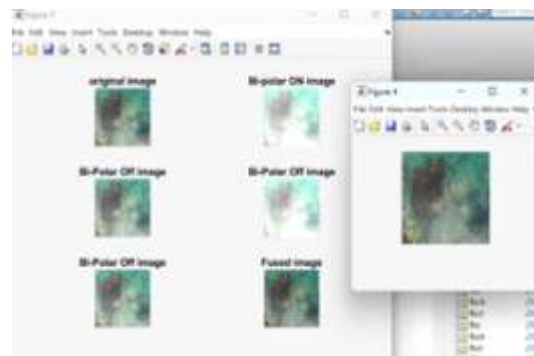
Adaptive filtering, sparse representation, and deep learning are some of the most recent and cutting-edge techniques that have been incorporated into more sophisticated denoising methods. By capitalising on the distinctive qualities of the noise and structures seen in underwater images, these technologies provide the prospect of fruitful outcomes. Denoising performance may be improved thanks to the adaptive estimation of noise characteristics that is carried out by adaptive filtering techniques. Sparse representation approaches are able to efficiently segregate unwanted picture components, like as noise, from those that are desirable, which results in improved visibility of underwater scenes. Deep learning-based techniques, which make use of convolutional neural networks, have produced state-of-the-art denoising results by learning complicated mappings between noisy and clean underwater pictures. These approaches were successful because they were able to learn complex mappings between noisy and clean images.

Evaluation of denoising algorithms is very necessary in order to determine how successful they are. Quantitative and qualitative assessments of denoising performance have been carried out with the assistance of a number of different metrics, including PSNR, SSIM, and subjective quality indicators. When attempting to get an understanding of the effect that denoising algorithms have on how underwater pictures are seen, it is essential to take into account both objective and subjective judgements.

In this section, the outputs for the proposed algorithm are shown: in Fig. 3 and 4 the image shows the adaptive retinal output and the bilateral filter output which shows better image.



*Fig. 3: Input Image 1*



*Fig. 4: Output Image 2*

In the field of underwater picture denoising, there are a number of exciting potential directions that future study might go. The development of strong and effective denoising methods that are able to manage complicated noise patterns and unpredictability is still a focus. Additionally, investigating hybrid techniques that

incorporate a number of different denoising algorithms might possibly result in an improvement to the overall performance. In addition, the modification of noise-reduction algorithms in order to meet the requirements of various applications for underwater photography, such as the detection of submerged objects or underwater navigation, is a field that should be the subject of more research.

In conclusion, the information acquired from this analysis on the denoising of underwater photographs via the use of image processing algorithms was quite helpful. It provides a comprehensive resource for academics and practitioners working in the subject of underwater photography, making it easier for them to create efficient denoising algorithms to improve picture quality and visibility in situations that are submerged in water. The continuous development of new methods for denoising data will, without a doubt, help us get a better knowledge of the ecosystems that exist below the water's surface, and it will also make possible a broad variety of applications in the fields of underwater exploration, in study and also in industry.

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## Multi-Band and Reconfigurable Microstrip Antenna for C, X and Ku Band

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### Abstract

RF PIN diodes are used to achieve reconfigurability in frequency, polarization, and radiation pattern. The antenna can be used in different bands by controlling ON and OFF states of two PIN diodes using the embedded biasing network (EBN). The antenna can be used for ultra-wideband (UWB) applications (1.0 GHz to 15.2 GHz) with a resonant frequency of 9.2 GHz.

**Keywords** : *Multi-Band, Multi-Parameter reconfigurability, EBN, UWB, PIN diode*

### I. Introduction

Ultra-wideband antenna design with multiple notches using a finite ground plane approach and the hierarchy process method was reported by Padmavathy et al. [1] and Zehforoosh [2]. Recently, multi-parameter reconfigurable antennas have gained considerable attention in the design of modern communication systems [3]. Earlier papers focused on single-parameter reconfigurability, but so far very little work has been done on multi-parameter reconfigurable behavior. The dependency of antenna characteristics i.e. frequency bandwidth, return loss, gain, etc. makes the design of the multi reconfigurable antenna a complex task. A frequency reconfigurable microstrip patch slot antenna at nine different frequency bands between 1.98 and 3.59 GHz was proposed by Huda A et al. [4]. A frequency reconfigurable multiband antenna with the embedded biasing network for microwave access, mobile and wireless network was proposed by Adisak Romputtal et al. [5]. For wideband applications, slot antennas are very

Besides ultra-wideband, it can also be switched to other bands (C, X, and Ku) with different operating frequencies (5.75 GHz, 12.3 GHz, and 15.5 GHz) at other biasing combinations. With this type of antenna, Linear and Circular polarization are achievable. The radiation pattern reconfigurable behavior in the vertical plane has also been achieved. Single Design of the proposed antenna is optimized for the multi-band and multi-parameter reconfigurability applications.

popular. Hui Li et al. have proposed a simple compact reconfigurable slot antenna with a very wide tuning range [6]. A polarization and radiation pattern reconfigurable antenna for different applications was presented by Zi-Xian et al.[7] and J. Constantine [8]. The large gain of 3.19 dBi, high bandwidth of 162.91o and patch size reduction of 56.5 % have been achieved in a single layer hexagonal patch antenna by using two triangles and one rectangular slot on patch [9]. The monopole antenna with T slot on the partial ground plane and the LC equivalent model of the same structure were simulated using ADS platform. The simulated results of the structure and its electrical equivalent model were found to be in good agreement with each other. [10]. A UWB of 3.1 to 10.6 GHz with a notched frequency band was achieved by using an arc-shaped slot on a circular patch [11]. A UWB antenna with dual band-notched characteristics in the WiMAX/WLAN bands by etching two C shaped slots in the rectangular patch was proposed [12]. A comparative study of the rectangular patch antenna on Terahertz frequency with

and without superstrate has been done and achieved the large matching bandwidth and gain (22.47%, 10.43 dBi) [13].

In the present scenario, reconfigurable antennas play a significant role in the modern communication system and provide multifunction abilities to perform multiple tasks. By integrated active components with a patch antenna, the reconfigurable behavior can be achieved. This paper has implemented a viable ultra-wideband microstrip patch antenna with reconfigurable behavior in frequency, radiation pattern and polarization. The multi-parameter reconfigurable characteristics of the proposed antenna can be achieved by using different switching combinations of two PIN diodes. The first PIN diode is integrated into the slot of microstrip patch and the second PIN diode is integrated between two partial ground planes. The switching of these two PIN diodes is achieved by suitable biasing circuits. In this design, we have used a rectangular patch with two corner arcs and two slits. This antenna enables us to use in any of the three bands C, X, and Ku depending upon the requirement. The antenna also provides us the freedom to operate either in linear or circular polarization such as in WLAN and VSAT applications. The proposed antenna is capable to transmit/receive in any of the four directions,  $\phi=0^\circ, 90^\circ, 180^\circ,$  and  $270^\circ$  as per the requirement.

## II. Antenna Design and Formulation

The design formulation is divided into two parts. The first part discusses the design of an antenna. The second part shows how multi reconfigurable behavior is achieved. In this work, two designs of antennas are proposed. The patch design for an antenna is shown in Fig. 1 (a). In the first design, the antenna is presented with the single partial ground as shown in Fig. 1(b) and the second design are presented with two partial grounds as shown in Fig. 1 (c).

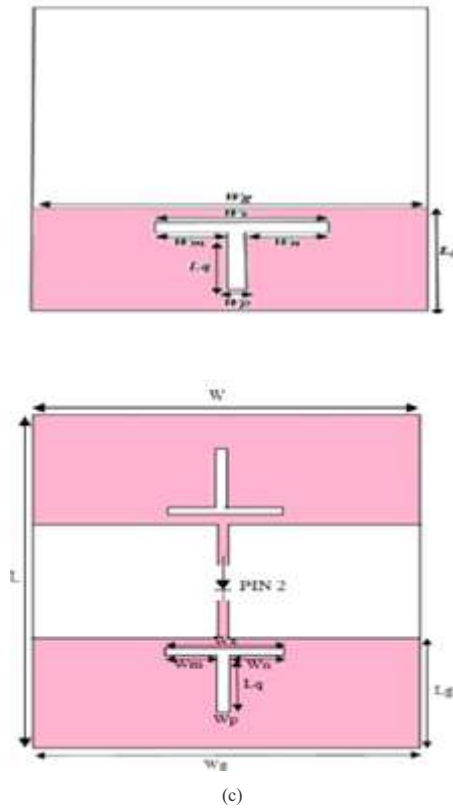
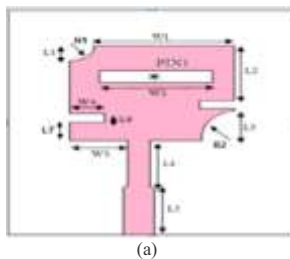


Fig. 1. Antenna Geometry (a) Patch (b) Single partial ground (c) Two partial ground

In the designing part, a number of techniques like corner truncation, cutting a rectangular slot and side slit on the patch are used to archive a large bandwidth. The location of slots and slits is optimized for achieving maximum bandwidth. A T slot is used on partial ground of antenna as shown in Fig. 1(b). This T slot provides good impedance matching between the antenna and coaxial cable so that maximum power can be transferred to the antenna. For ultra-wideband applications, a rectangular slot is designed on the patch to enhance the bandwidth of the proposed antenna. Without slot, antenna (with the single partial ground) resonates at 10 GHz frequency only and when rectangular slot is taken on the patch, a second higher mode at 15 GHz is obtained, as evident from Fig. 2.

According to the size of the slot, the equivalent inductance and capacitance of slot, as well as resonating

frequency of higher mode, can be calculated by the formulas given in equation (1) [14]. By varying the length and width of the slot, a different higher mode of different resonant frequency is generated and with the help of these higher modes, the bandwidth of the antenna can be enhanced.

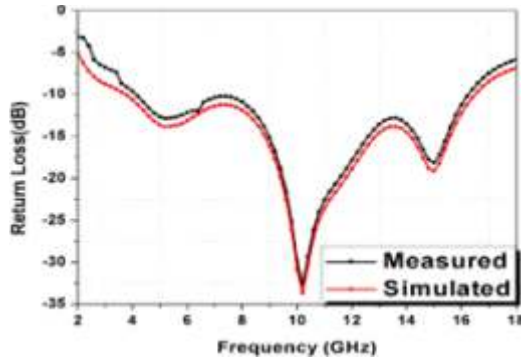


Fig. 2. Measured and simulated Return Loss of single partial ground antenna with a rectangular slot on patch.

$$s = \frac{h\mu_0\pi}{8} \left(\frac{l}{w}\right)^2, C_s = \frac{\epsilon_0\epsilon_r A}{D} \text{ and } fr = \frac{1}{2\pi\sqrt{L_s C}} \quad (1)$$

Where:  $L_s$ = Equivalent Inductance of the slot;  
 $C_s$ = Equivalent capacitance;  
 $l$ = length of slot;  
 $w$ = width of slot;  
 $fr$ = Resonate frequency.

The present design is usable for RT Duriod 5880 with a thickness of 1.6 mm, the relative permittivity of 2.2 and dielectric loss tangent of 0.0009. The length and width of the substrate are selected as 36 mm× 34 mm. The calculated patch size is of 18 mm×11.7 mm, where two corner arcs and two slits are cut. For Proper impedance matching a two-step, the microstrip feed line is used. The dimensions of the proposed antenna are tabulated in Table I.

Table I. Dimensions of the proposed antenna (mm)

$L_1$	3 mm	$L_7$	2 mm	$W_4$	2 mm
$L_2$	7.9 mm	$L_8$	5 mm	$W_5$	36 mm
$L_3$	3 mm	$L_9$	10 mm	$W_{in}$	2.25 mm
$L_4$	6 mm	$W_1$	15 mm	$W_6$	2.25 mm
$L_5$	5.15 mm	$W_2$	10 mm	$W_p$	0.5 mm
$L_6$	0.8mm	$W_3$	36 mm	$R_1 = R_2$	3mm

For achieving the reconfigurable behavior of the proposed antenna, another partial ground is introduced at the ground plane with the same dimensions. A PIN diode is used to connect these two partial grounds as shown in Fig. 1(c). Another PIN diode is embedded between the slots on the patch as shown in Fig. 1(a). These two PIN diodes (SMP1345- 079LF,  $L_s=7\text{nH}$  SC-79) are used to control frequency, polarization, and radiation pattern reconfigurable behavior of the proposed antenna. Fig. 3 shows an equivalent circuit of PIN diode in forward and reverse bias. When the forward biasing voltage of 0.89V and above is supplied, the PIN diode turns on and behaves as a short circuit with a series resistance of 1.5Ω. Without biasing voltage the PIN diode acts as an open circuit and has the capacitance of 0.15pF [3]

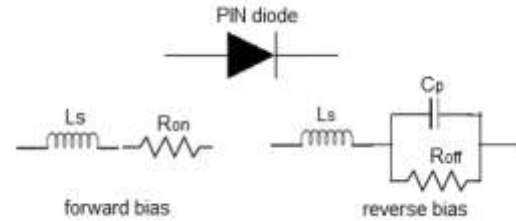


Fig. 3. Equivalent circuit of PIN diode (SMP1345-079LF)

### III. Embedded biasing network

A biasing circuit for switching off the PIN diode is shown in Fig. 4. In this biasing circuit, two blocking capacitors of value 0.1μF and two RF coils of value 6.8 nH are used. The blocking capacitor prevents microstrip antenna with the DC bias voltage given to the PIN diode and passes AC (high frequency) signal through the diode. RF coil allows DC current and prevents the microcontroller board from AC (high frequency) signal. Instead of using DC power supply along with various lumped components for switching PIN diodes, a microcontroller-controlled embedded biasing network (EBN) is used with the antenna to regulate the PIN diode switching and it overcomes the various problems like cost, weight, and complexity as shown in Fig. 5 [15]. The ON and OFF timing of a PIN diode can be controlled by using a microcontroller (ATMEGA 2560).



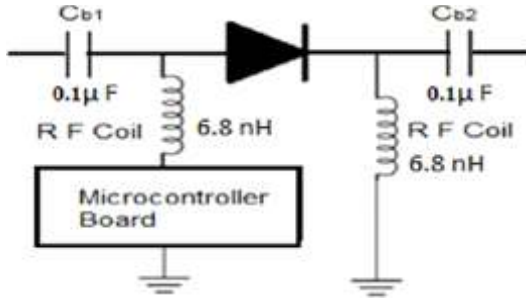


Fig. 4. Biasing circuit for switching of a PIN diode

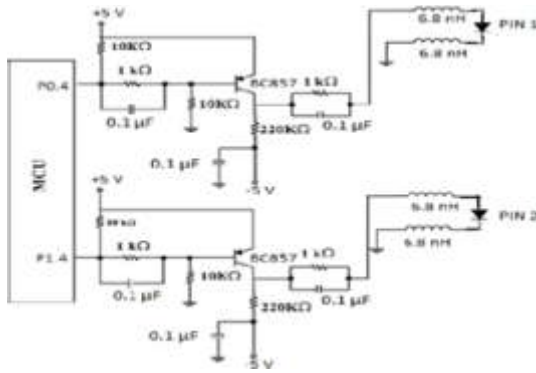


Fig. 5. Embedded biasing network using ATMEGA 2560 microcontroller

#### IV. Results and Discussion

For ultra-wideband applications, a single partial ground patch antenna is fabricated at a frequency of 10 GHz. It provides a large bandwidth from 3.5 GHz to 16 GHz as shown in Fig. 2. The experimental and simulated results are in good agreement with each other, and hence, the proposed antenna model with a single partial ground plane is recommended for the ultrawideband application. For achieving multiple reconfigurable behaviors another microstrip patch antenna with two partial grounds is designed and fabricated as shown in Fig. 6(b). By using two PIN diodes, the reconfigurable behavior of the antenna is achieved. The simulated and measured return loss of the proposed antenna with two partial ground planes at different switching positions of two diodes is shown in Fig. 7. It is clearly evident that the antenna provides different resonant frequency and return loss according to different switching combinations of two PIN diodes. A frequency shift of

1GHz to the left side has been observed in the measured return loss graph of fabricated antenna. Fig. 7 (a) shows the return loss graph of the antenna model when both diodes (PIN 1 and PIN 2) remain OFF and in this situation; the antenna provides UWB similar to a single partial ground antenna. The simulated and experimental results of the antenna model using different switching combinations of PIN diodes are obtained and tabulated in Table II.

Table II. Comparative parametric study on different switching combinations of pin diodes

Switching		Resonant Frequency (GHz)		Band (GHz)		Return Loss (dB)		Band Name
PIN 1	PIN 2	Simulated	Measured	Simulated	Measured	Simulated	Measured	
OFF	OFF	9.9	9.2	1.6-16	1.0-15.2	-28	-26	UWB
ON	OFF	15.5	14.3	14.7-16.6	12.7-15.4	-38.8	-24	Ku
OFF	ON	5.75	4.5	4.6-6.3	3.6-5.5	-24.5	-23	C
ON	ON	12.3	11.9	10.8-13.6	9.4-13.0	-22	-27	X

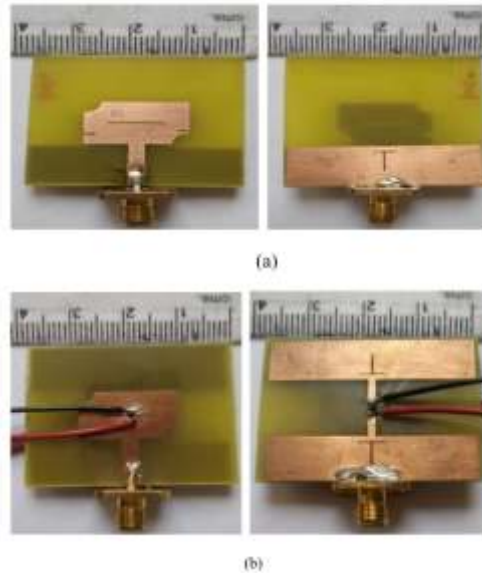


Fig. 6. Fabricated antenna (a) with the single partial ground (b) with two partial ground.

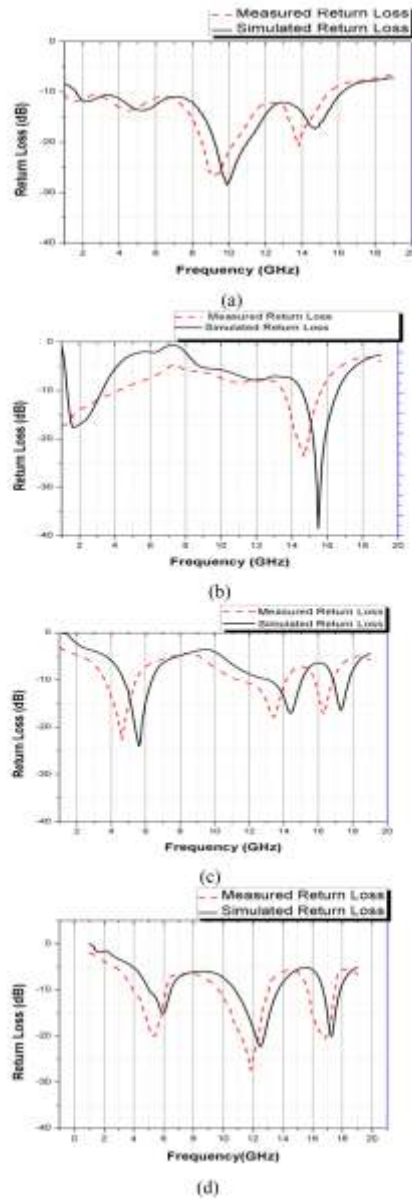


Fig. 7. Return loss at different switching positions of PIN diodes. (a) PIN 1 OFF and PIN 2 OFF (b) PIN 1 ON and PIN 2 OFF (c) PIN 1 OFF and PIN 2 ON (d) PIN 1 ON and PIN 2 ON

Table III tabulates the axial ratio at different switching combinations of PIN diodes. In position 1 (when both PIN diodes are OFF) and in position 2 (when PIN 1 is ON and PIN 2 is OFF) the antenna attains circular

polarization as the axial ratio is nearly unity. In position 3 (when PIN 1 is OFF and PIN 2 is ON) and in position 4 (when both PIN diodes are ON) antenna shows linear polarization because the axial ratio is far greater than 1. The simulated and measured radiation patterns of the antenna models at all four combinations are shown in Fig. 8.

The radiation patterns are plotted in the elevation plane i.e at  $\phi=0^\circ$ . In the first case (PIN 1 OFF and PIN 2 OFF) this antenna radiates in a vertical direction from  $\theta = -40^\circ$  to  $\theta = +40^\circ$  as shown in Fig. 8 (a). In second case (PIN 1 ON and PIN 2 OFF) it radiates in horizontal direction i.e.  $\theta = -70^\circ$  to  $\theta = -110^\circ$  shown in Fig. 8 (b)

Table III. The axial ratio at different switching combinations of pin diodes

S. No	PIN 1	PIN 2	Axial Ratio (dB)	Type of polarization
1	OFF	OFF	1.5	Circular
2	ON	OFF	1.3	Circular
3	OFF	ON	16.5	Linear
4	ON	ON	20	Linear

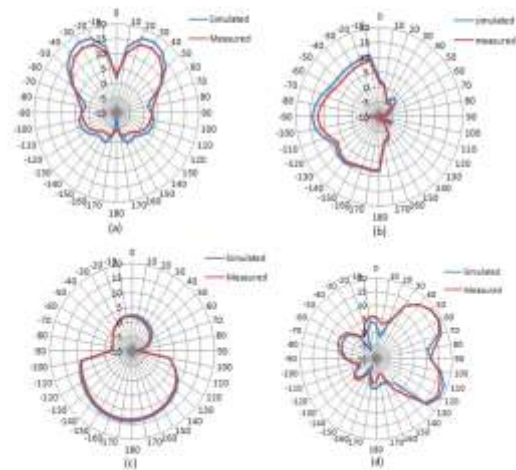


Fig. 8. Radiation pattern at different switching positions of PIN diodes (a) PIN 1 OFF & PIN 2 OFF, (b) PIN 1 ON & PIN 2 OFF, (c) PIN 1 OFF & PIN 2 ON, (d) PIN 1 ON & PIN 2 ON.

In the third case (PIN 1 OFF and PIN 2 ON) it radiates in the vertical direction (opposite to the direction of the first case) from  $\theta = -140^\circ$  to  $\theta = +140^\circ$  as shown in Fig. 8 (c).



In the fourth case (PIN 1 ON and PIN 2 ON) this antenna radiates in the horizontal direction and this time opposite to the direction of to the second case that is it is radiating from  $60^\circ$  to  $120^\circ$  as shown in Fig. 8 (d). By observing radiation patterns on different switching combinations it is evident that the antenna model is radiating along with different directions. Thus reconfigurable behavior of the proposed antenna in radiation pattern is achieved.

## V. Conclusion

It is observed that the proposed antenna model provides not only multi-band operation but also executes as a multi-parameter reconfigurable antenna with a high gain of 10 dB. The proposed antenna model provides different frequency bands (C, X, and Ku) with different switching combinations of two PIN diodes. The radiation pattern of the proposed antenna can be switched in multiple directions by controlling ON and OFF positions of both diodes. The proposed antenna model will be very useful in commercial and military applications because the proposed antenna provides the freedom to choose the different types of applications.

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## A Lung field segmentation techniques review using Image Processing

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### Abstract

It is crucial for a variety of clinical applications, including the diagnosis of illness and the planning of therapy, to have accurate segmentation of lung fields in chest radiographs. The purpose of this work is to provide an overview of the many methods and strategies that have been offered for lung field segmentation in chest radiographs. Accurate extraction of lung fields may be achieved with the use of these approaches, which use edge detection algorithms, shape models, deep learning techniques, and statistical methodologies. The use of edge-based approaches, such as structured edge detection, focuses on locating the borders of lung fields based on contrast differences. One example of this kind of method is the use of structured edge detection. The process of segmentation may be guided by many types

of shape models, such as dynamic shape models, which capture the fluctuations in lung form. Deep learning techniques include the use of deep neural networks in order to automatically learn and extract significant information from chest radiographs. This helps to improve the accuracy of segmentation. In order to account for the diversity that exists across patients, statistical approaches combine both population-based and patient-specific shape data. The developments that have been made in lung field segmentation have applications in the diagnosis of TB as well as the study of cardiomegaly and other clinical situations. The advancements in these approaches have led to an improvement in the accuracy and efficiency of lung field segmentation, which provides invaluable help to doctors in the process of accurately diagnosing patients and deciding how best to treat them.

**Keywords :** *Lung, Segmentation, Snake Segmentation, Gaussian Filter*

### Introduction

Medical image analysis is an important component of modern medical practice as a result of its ability to considerably improve not only the diagnosis of a broad variety of conditions but also their treatment and ongoing monitoring [1]. Radiographs of the chest, often known as chest x-rays, are one of the most prevalent types of imaging examinations used in the medical industry for the goal of identifying conditions that damage the lungs [2]. The accurate segmentation of lung fields produced from chest radiographs is an important step that must be done for various clinical applications,

including the diagnosis of sickness, the planning of treatment, and the monitoring of the progression of a disease. These are only some of the clinical applications that need this step to be completed [3].

Researchers have developed a broad array of approaches and algorithms over the course of time in order to automate the process of lung field segmentation in chest radiographs [4]. This has been done in order to save time and improve accuracy. The results of these techniques, which aim to give accurate and efficient segmentation, are designed to lessen the need on human annotation while simultaneously enhancing the speed of analysis

and its consistency [5]. This is because these approaches strive to produce correct and efficient segmentation.

In the process of lung field segmentation, one strategy that is often utilised is one that involves the use of edge detection algorithms. Edge-based methods make advantage of the inherent contrast that exists between the lung limits and the structures that surround them in order to identify and extract the lung fields' borders. These methods may be used to detect and extract the lung fields' borders. In order to segment the lung field in chest radiographs, Yang et al. [1] created a structured edge detector by first obtaining boundary maps by structured edge detection and then using those maps in their detector. This detector employs boundary maps in its operation.

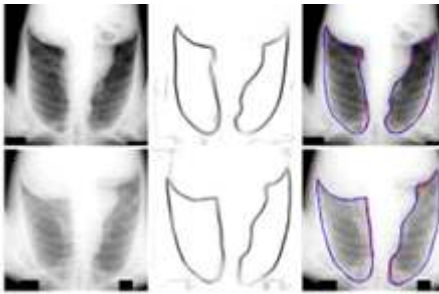


Figure 1: SEDUCM Method [1]

Yet another way that has garnered a lot of interest recently is the use of shape models, such as active shape models (ASMs), to not only seize the form of the lung but also guide the process of segmentation. This method has acquired a lot of appeal. For the purpose of accurately locating lung areas in chest radiographs, Xu and colleagues [2] introduced an active shape approach. This strategy incorporates both edge forces and region forces into its execution. This procedure takes into account knowledge that was learned in the past about the anatomy of the lungs and is able to adapt variations brought about by the anatomical disparities that exist between individuals.

In the area of medical image segmentation, particularly lung field segmentation, deep learning has emerged as a prominent approach in recent years [6,7]. In the past, edge-based techniques and shape-based methods have been used, however this is a new way that complements the other two. The capacity of deep neural networks to

automatically learn and extract crucial information from pictures enables the segmentation of chest radiographs to be done in an automated fashion. Using approaches from deep learning, Dai et al. [6] developed a structure-correcting adversarial network (SCAN) with the goal of improving organ segmentation in chest X-rays. This network concentrates its attention just on the lung fields.

In addition, shape data that is based on populations as well as those that are specific to individual patients have been utilised to increase the accuracy of lung field segmentation. This was done by using CT scans. In order to solve the issue of inter-patient variability in serial chest radiographs, Shi et al. [3] developed a method that combines the shape data extracted from a group of training images with information that is specific to the individual patient. This method takes shape data from a population of training photographs.

The diagnosis and treatment of lung-related diseases aren't the only purposes for the segmentation of lung sections in chest radiographs; there are other applications as well. In other clinical contexts where accurate lung field segmentation is necessary for further investigation, such as the detection of tuberculosis [4,9], the assessment of cardiomegaly [14], and others, it has been used as a diagnostic tool.

In a word, the process of medical image processing begins with the segmentation of the lung field in chest radiographs. This is a key stage in the process. Several distinct approaches, such as edge detection, shape models, deep learning, and statistical methods, are among those that have been proposed as potential solutions to this problem. The advancements that have been achieved in these techniques have led to an increase in the accuracy and efficiency of lung field segmentation, which has ultimately assisted medical professionals in making accurate diagnoses and decisions about treatment.

## Lung Field Segmentation

The extraction of the lung regions for the purposes of further analysis and diagnosis is made possible by the lung field segmentation that is conducted in chest radiographs. This segmentation is performed in order to make it feasible to extract the lung areas. In the process of analysing medical photographs, this step is quite

important. utilising those approaches, researchers have developed a number of ways over the course of many years to appropriately segment the lung fields from chest radiographs utilising those methodologies. In this section, we will discuss some of the methods that are often used for lung field segmentation, as well as explain how such procedures really function in practice.

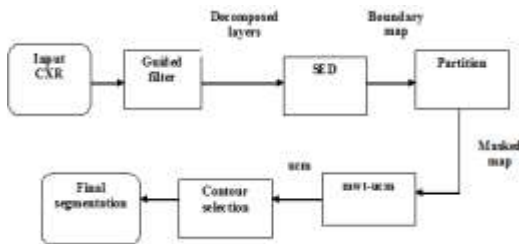


Figure 2: Flowchart lung field segmentation

**Techniques for Edge Detection:** Edge detection-based methods take use of the inherent contrast differences that exist between the various parts of the lungs and the tissues that surround them in order to locate the lung boundaries. This allows for the determination of where the lungs begin and end. The objective of these techniques is to zero in on the precise locations of the rapid intensity shifts that take place between the lung tissue and the other anatomical components. In edge detection, well-known edge detection operators including Sobel, Canny, and Laplacian of Gaussian (LoG) filters, amongst others, are often used [8].

One of the edge-based approaches that has gained the greatest notoriety in recent years is the structured edge detector, which was first developed by Yang et al. [1]. This strategy involves the creation of boundary maps that emphasise the potential lung boundaries and the use of structured edge detection technologies for the purpose of reliably extracting the lung fields. In addition to that, the approach generates boundary maps that show where the possible lung borders are. The employment of a detector known as a structured edge detector helps to increase the level of precision achieved when segmenting the lung field. This detector takes advantage of the information about an image's structure that is included inside it.

**Examples of Different Forms:** It is common practise to make use of shape models, such as active shape models

(ASMs) or active contours, while carrying out the process of lung field segmentation. These models take into account previously obtained information on the anatomy of the lungs and incorporate flexible outlines so that they may fit the lung limitations seen in chest radiography. Additionally, chest radiography is taken into consideration while developing these models.

ASMs are a kind of statistical model that was initially introduced to the scientific community by Xu et al. [2], and they are used to characterise the lung shape variation that is seen in a training dataset. These models are able to self-educate on the shape variations and may be tailored to unique patient photographs. ASMs are able to appropriately segment the lung fields in chest radiographs and capture the form of the lungs themselves by first locating the shape model around the projected lung region and then optimising its placement iteratively. This process allows ASMs to accurately segment the lung fields in chest radiographs.

**Several Methods and Strategies for Deep Learning:** One of the many medical image segmentation tasks that deep learning algorithms, namely convolutional neural networks (CNNs), have shown excellent performance in is the segmentation of lung fields. These approaches learn and extract relevant features automatically from chest radiographs, which, in the end, results in segmentation findings that are accurate and dependable.

One model that illustrates this would be the SCAN model, which was first introduced by Dai et al. [6]. The Structure Correcting Adversarial Network (SCAN) makes use of a CNN architecture to distinguish organs, including lung fields, in chest X-rays. This allows for better diagnostic accuracy. The major focus of SCAN is on the repair of structural inconsistencies detected within the organs that have been segmented. This is done with the intention of improving the accuracy of the organ segmentation process.

**Statistical Models of the Shape of Data:** Statistical shape models are a strategy that increases the accuracy of lung field segmentation. This is accomplished by integrating the shape data from a population of training photographs with information that is specific to the particular patient. These models are able to adapt to the photographs of individual patients while also accurately representing the wide diversity of lung shapes that were included in

the dataset used for training.

Shi et al. [3] recently presented a method for the segmentation of the lung field. This method takes into consideration both population-based and patient-specific shape data. By using statistical information about the geometry of the item being studied, this method addresses the problem of inter-patient variability and produces more accurate segmentation results in serial chest radiographs. This is accomplished via the use of information about statistical distributions.

It is essential to take into consideration the fact that some methods combine a number of different procedures in order to get more precise segmentation results. For example, models trained using deep learning might be combined with shape models or edge detection algorithms in order to improve both their robustness and their accuracy.

In conclusion, the task of segmenting the lung region in chest radiographs is challenging yet vital in the field of medical image analysis. Statistical shape models, edge detection techniques, shape models, deep learning approaches, and statistical shape models are only some of the strategies that have been examined for use in accurate segmentation. Other methods include form models. Every strategy has a variety of advantages as well as disadvantages, and the manner that should be employed is dependent on the individual requirements of the application. The continuous development of these methods contributes to improvements in the accuracy, efficiency, and clinical value of lung field segmentation, which, in the end, makes it simpler to identify lung-related ailments, plan their treatments, and track their progression.

## Literature Review

- [1] The purpose of this article is to provide a way for segmenting the lung field in chest radiographs by making use of a structured edge detector. This approach will be presented in order to fulfil the aforementioned aim. This will be completed successfully. In order to effectively extract the lung fields from the pictures, the suggested approach takes use of boundary maps in conjunction with structured edge detection. This combination is used to achieve the desired results.
- [2] The present study reveals a novel method known as active shape for the automated recognition of lung fields in chest radiographs. This method was developed as a result of the findings of previous research. This method was created as part of the ongoing enquiry that is being carried out. The strategy that is advised directs the active shape model in the direction of properly portraying the form of the lung. This is accomplished by incorporating edge forces and region forces.
- [3] In this investigation, we provide a method for the segmentation of the lung field that is suitable for use with serial chest radiographs. It was determined that this strategy would be developed. In order to make the segmentation process more exact and to account for the inter-patient variability, the method uses shape statistics that are based not only on the population as a whole but also on the individual patients themselves. This helps the method deal with the variability that exists between patients. Because of this, the technique is better able to account for the variety that occurs across patients.
- [4] The primary objective of this research is to create a model for the segmentation and classification of images with the goal of using it in the process of diagnosing tuberculosis. This will be accomplished by applying the model to the analysis of TB smears. In order to make an accurate determination about the presence or absence of tuberculosis (TB), the model that has been presented combines a variety of distinct methods for segmenting images with a variety of distinct classification algorithms.
- [5] The study that is given in this article focuses mostly on using edge operators to extract boundaries from medical pictures. This was accomplished by analysing the images. This is the primary focus of the investigation. In this study, a comparison and evaluation of the performance of a variety of edge operators for the purpose of boundary extraction in biomedical imaging applications are carried out. These edge operators were chosen because of their specific strengths and weaknesses. The precision of boundary extraction is something that will



hopefully be improved upon as a result of this work.

- [6] For the goal of organ segmentation in chest X-rays, the authors of this research suggest making use of a structure-correcting adversarial network. The suggested model, which goes by the name SCAN and has the objective of improving the structures that are present in the segmented images, has the aim of increasing the accuracy of organ segmentation. The model's mission is to improve the appearance of the structures that are present in the segmented photos.
- [7] In this study, a general technique for segmenting the lung field from chest radiographs is presented. The approach makes use of deep space learning as well as shape learning. In order to grasp the characteristics of the lung field and get reliable segmentation results, the technique that is currently being provided makes use of technologies that are related to deep learning.
- [8] The purpose of the study that is presented in this work is to improve the segmentation of anatomical features found in chest radiographs by using U-Net in combination with an ImageNet encoder that has been pre-trained in advance. This paper covers the research that was conducted in order to accomplish this goal. This piece was created as a contribution to a broader body of work. The strategy that has been suggested in an attempt to improve the accuracy of the segmentation of anatomical features seen in chest radiographs.
- [9] This research project explores lung segmentation with the purpose of improving the diagnostic accuracy of chest radiography for TB. The Active Appearance Model, often known as the AAM, is used as a component of the enquiry. The purpose of the procedure that is being given is to diagnose TB, and in order to do so precisely divide the lung area, the AAM is used.
- [10] As a result of this line of research, the SCAN model, which is a structure-correcting adversarial network for organ segmentation in chest X-rays, has been developed. In order to distinguish the different organs shown in chest X-rays, this model was devised. The suggested model places a focus on adjusting the structure of the organs that have been segmented in order to get greater precision in the segmentation process. This is done in order to improve the accuracy of the segmentation process. This is done with the intention of achieving the objective of raising the segmentation process's level of accuracy.
- [11] The author of this article presents a flexible estimate of the lung field boundaries that may be visible on chest radiographs when bacterial pulmonary infections are common. This estimate may be seen in the context of this article. When infections are present, the objective of the method that has been developed is to offer an accurate evaluation of the lung field borders to the best of one's ability. This may be accomplished using the methodology that has been devised.
- [12] In light of the findings of this study, an approach to segmentation that is wholly dependent upon automation has been developed. In addition to deep-structured learning and inference, this approach makes use of distance-regularized level sets. The effectiveness of the proposed technique in attaining accurate and automated segmentation is due to the combination of level set approaches with deep learning.
- [13] This article presents a knowledge-based method for automatically determining the limits of the lungs based on radiographs of the chest. In order to automatically extract lung borders, the suggested technique takes use of information that had been gathered in advance. This helps to contribute to the automation of the process of lung boundary extraction.
- [14] The research that is presented and discussed in this article centres on the use of Euler numbers to the computer-assisted interpretation of chest X-ray pictures with the goal of making an earlier diagnosis of cardiomegaly. This research presents a technique for carrying out automated identification of cardiomegaly in chest X-ray pictures. The approach takes use of Euler numbers, which are a mathematical concept. The identification of cardiomegaly is the purpose of this technique.

## Results

Lung field segmentation is a critical task in medical image analysis, particularly in the field of lung disease diagnosis and treatment planning. Accurate and reliable segmentation of lung fields from medical images, such as chest X-rays or computed tomography (CT) scans, is essential for various applications, including disease detection, quantitative analysis, and computer-aided diagnosis.

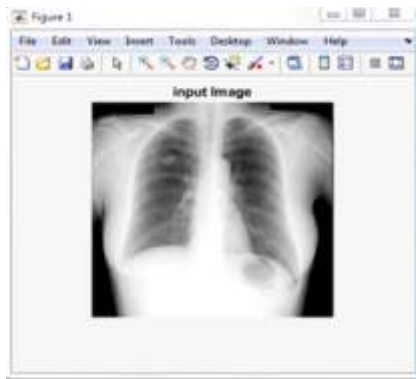


Figure 3: Input Image

In the context of lung field segmentation, several outputs are typically generated to visualize and evaluate the segmentation process. Here, we will discuss the different outputs associated with lung field segmentation, as depicted in Figures 3 to 7.

Figure 3 shows the input image, which is usually a chest radiograph or a CT slice. This image serves as the starting point for the segmentation process. It contains the anatomical structures of the thorax, including the lungs, heart, ribs, and other surrounding tissues.

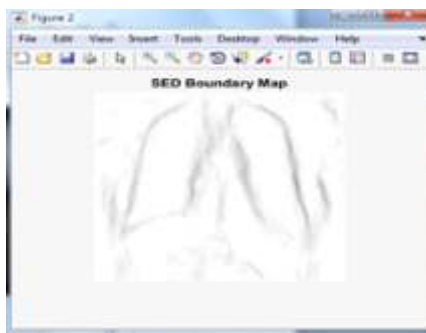


Figure 4: SED Boundary Map of Input Image

Figure 4 illustrates the SED (Structure-Enhancing Diffusion) boundary map of the input image. The SED boundary map highlights the boundaries of various structures within the image, including the lung fields. This map is derived through a diffusion-based filtering technique that enhances the structural boundaries, making them more distinguishable.

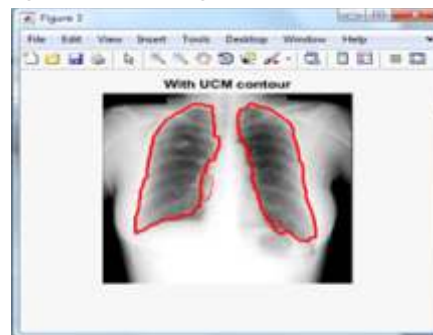


Figure 5: UCM Contour

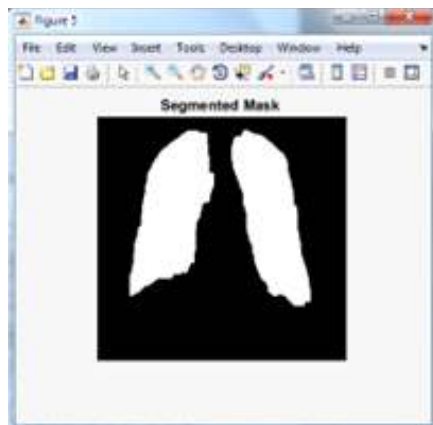
Figure 5 presents the UCM (Ultrametric Contour Map) contour. The UCM contour is a representation of the hierarchical segmentation produced by the UCM algorithm. It provides a hierarchical decomposition of the image into meaningful regions or segments. In the context of lung field segmentation, the UCM contour helps in identifying and delineating the lung field boundaries.

Figure 6 depicts the manual mask of the image. This mask is created by an expert or radiologist who manually outlines the lung field regions based on their visual assessment of the image. The manual mask serves as ground truth or reference for evaluating the accuracy of automated segmentation algorithms. It is an essential component for training and validating the performance of lung field segmentation methods.



Figure 6: Manual Mask of the Image





*Figure 7: Final Segmentation Output Image*

Finally, Figure 7 displays the final segmentation output image. This image represents the automated segmentation of the lung fields obtained through computational techniques. The segmentation algorithm analyzes the input image and generates a binary mask that separates the lung regions from the rest of the thoracic structures. The final segmentation output aims to accurately delineate the lung boundaries, enabling further analysis and diagnosis.

These various outputs play crucial roles in lung field segmentation. They help visualize the progression of the segmentation process, evaluate the accuracy of automated algorithms compared to manual annotations, and provide insights into the quality and reliability of the segmentation results. Through the integration of advanced image processing techniques and machine learning algorithms, accurate lung field segmentation contributes significantly to improving the efficiency and effectiveness of lung disease diagnosis and treatment planning.

## Conclusion

Since the process of lung field segmentation in chest radiographs is such an essential task in the field of medical image processing, researchers have devoted a significant amount of their time and energy towards its investigation. This research focuses on the several approaches that have been proposed for segmenting the lung field in an accurate and efficient manner. The extraction of lung boundaries on the basis of contrast

differences is made feasible via the use of edge detection technologies such as structured edge detectors. The process of segmentation may be directed in some way by any one of a wide variety of shape models, including dynamic shape models, which are able to capture the variations in lung structure. Deep learning techniques, which employ deep neural networks to automatically learn from chest radiographs and extract relevant information, have the potential to improve the accuracy of segmentation. These techniques may be used in conjunction with deep learning methodologies. Statistical methods integrate data that is based on the population as a whole as well as data that is particular to individual patients so that they may take into account the variety of individuals. These advances in technology have made it feasible to create a broad range of clinical applications, such as the assessment of cardiomegaly and the detection of tuberculosis (TB).

The studies that were reviewed provide evidence that efforts are now being made to enhance lung field segmentation, with the major focus being centred on achieving a high degree of accuracy and robustness. In spite of the fact that each approach has its own set of benefits, further research is necessary to address difficulties such as the existence of image artefacts, the complexity of lung illnesses, and shifts in the methodologies used for imaging. In addition, the use of multimodal imaging in conjunction with the development of hybrid models that make use of a variety of different techniques might potentially result in lung field segmentation that is of a higher level of accuracy.

By enabling an automated and uniform assessment of chest radiographs, the latest breakthroughs in lung field segmentation algorithms have the potential to completely transform clinical praxis. The recent advances that have been achieved in these methods would make this a realistic possibility. When a patient's lung field is accurately segmented, it is much simpler to detect, diagnose, and monitor lung diseases in their early stages. This ultimately leads to an improvement in the therapy that can be provided to the patient. In the future, research should continue to examine fresh approaches and make advantage of emerging technology in order to significantly increase the accuracy, efficiency, and clinical relevance of lung field segmentation in chest radiographs.

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## Exploring the impact of Green Tea on Obesity Management

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### Abstract

People are also more likely to experience severe joint pain, hormone issues, social and psychological issues, and other health issues. Green tea catechins (GTC) are polyphenolic substances that can be found in the dry, unfermented leaves of the *Camellia sinensis* plant. Intake of GTC (270 mg to 1200 mg/day) has been shown in numerous randomised, controlled intervention trials to reduce body weight and fat. GTC may influence body weight and composition through a variety of mechanisms. The most widely accepted theory states

that GTC modifies sympathetic nervous system (SNS) activity to raise energy expenditure and encourage fat burning. Green tea contains caffeine naturally, which influences SNS activity and may increase energy expenditure and fat burning when combined with GTC. Possible causes include changes in appetite, increased activity of hepatic fat-oxidizing enzymes, and decreased nutrient absorption. The potential of green tea as a crucial nutraceutical for the treatment of obesity is examined in this chapter. We also examined the supporting data for each of these hypothesized pathways, with an emphasis on human studies.

**Keywords :** *Obesity, Green tea, Catechins, Polyphenol, Nutraceutical.*

### Introduction

A growing global public health concern is obesity. Patients with obesity are significantly more likely to develop a variety of comorbid conditions, such as cardiovascular disease (CVD), gastrointestinal disorders, Type 2 diabetes, Joint and Muscular Disorders, Respiratory issues, and psychological problems (Amagase, 2011). These conditions may have a significant impact on patient's daily lives and increase their mortality risk. It has been found, that even minor weight loss may help patients in lowering their risk for CVD, diabetes, Obstructive sleep apnea (OSA), and Hypertension, among much other comorbidity, which are directly or indirectly related to obesity (Cabrera et al., 2006).

In today's era, nearly half of the adults are simply too

busy to exercise. The overall prevalence of obesity was projected to increase from around 12% in 1992 to 41% by 2022 in men, and from 21% to 78% in women. Women had much higher projected prevalence than men, particularly in the age groups 35-44, 45-54 and 55-64 years (Barnes et al., 2004; Basu et al., 2007). Tea is one of the most widely consumed beverages worldwide and is available in various forms. It is the cheapest thing the average person drinks, next to the water. Since ancient times, tea, a beverage derived from the *Camellia Sinensis* plant, has been among the most widely consumed. Based on the methods used in production, tea can be generically categorised as green tea (unfermented), black tea (completely fermented), oolong tea (half-fermented), and pu-erh tea (post-fermented). The most common type of tea consumed in Asian nations is green tea, one of the most popular varieties that make up 23% of all tea products

(EikelisandEsler, 2005). Green tea has a variety of elements with possible health advantages, including catechins and polyphenols, which may help prevent cancer, cardiovascular disease, obesity, and type 2 diabetes.

Phytochemicals included in green tea are recognised to support the central nervous system and maintain overall human health. A growing evidence of research indicates that green tea may also be used as potential agent to mediate skin ageing and neurological disorders like Alzheimer's. Further, many studies examines the evidence that green tea can help in increasing fat burning and be beneficial for weight loss (Cooper et al., 2005). The current chapter provides an overview of the significance of the role of green tea in weight loss. There are many controversies about the role of green tea and its effects on health and diseases. In view of these, this chapter explored the beneficial effects of green tea and green tea catechins in healthy obese human subjects (Di Pierro et al., 2009).

In general, Green tea is an infusion made from the roasted leaves of the plant *Camellia sinensis* (formerly known as *Theasinensis*), and the beverage has a long tradition in China (lùchá), Japan (ryokucha), Korea (nokcha), Vietnam (chèxanh) and elsewhere in the Orient. The tea plant is local to southwestern China, however its development has ventured into numerous different districts of the world in lined up with the spread of tea drinking (Han et al., 2005; AbdollahiandAfshar-Imani, 2003).

Throughout the course of recent years, green tea has detonated into an incredibly famous refreshment decision for tea consumers around the world. It has been consumed for quite a long time in Asian nations like China, Japan and India (Chacko et al., 2010).

### Composition of Green Tea

A series of compounds like bisflavanols, theaflavins, epitheflavic acids, and thearubigens are produced by the condensation process of various quinines. These are known to impart the characteristic taste and color properties of black tea. The composition of effective components present in green tea is mentioned in Table 1.

**Table 1: Composition of Green Tea Phytoconstituents**

Components	Amount mg/100g (100ml)
Epicatechin	8.3±0.5
Epigallocatechin 3 -gallate	77.8±7.0
Epicatechin 3 -gallate	19.7±2.8
Quercetin	2.7±0.3
Epigallocatechin	16.7±1.4
Gallocatechin	1.5±0.0
Catechin	2.6±1.5
Thearubigins	1.1±1.1

### Obesity

Obesity is a complex, heritable trait influenced by genetics, epigenetics, metagenomics, and the environment. Numerous genes impacting the phenotype have been uncovered as a consequence of enhanced accessibility to high-precision diagnostic techniques for genetic investigations, particularly in early-onset severe obesity (Farooqi and Rahilly, 2006). The idea of innate biologic ("endogenous") cause of obesity was first proposed by Von Noorden in 1907. Silventoinen et al found that weight had a variable heredity throughout time, with an overall influence of 45–90% (Silventoinen, 2010). However, individual differences in body weight and fat mass exist in any given setting, implying that adiposity is regulated by complex interactions between genetic, developmental, behavioural, and environmental factors (Ogden, 2010).

This comprehensive layout about causes contributing obesity has been addressed below:

### Causes

#### a) Diet culture

There is a lot of concern about the enormous rise in overweight and obesity rates that has occurred worldwide. Globally, it is estimated that this led to more than 3.4 million fatalities, 4% of Years of Life Lost (YLL), and at least 4% of Disability-Adjusted Life Years (DALYs). The increase in body mass causes problems for public health because of the attractive physical appearance of thin bodies and the detrimental impacts of overweight and obesity (Kritchevsky et al., 2015).

Obese people frequently experience worse health than people of a healthy weight, and their life expectancy is reduced by two years. Cancers, such as those of the breast, endometrial, ovary, colon, esophagus, kidney, pancreas, and prostate, as well as Type 2 diabetes, hypertension, stroke, Coronary Artery Disease, and other conditions, are some of the co-morbidities associated with being overweight and obese.

#### **b) Hereditary**

Numerous hereditary variables, which can be broken down into three categories, contribute to obesity:

**1. Monogenic causes:** Usually in the leptin-melanocortin pathway, these are ones that are brought on by a single gene mutation.

**2. Syndromic obesity:** This type of obesity is characterized by other traits such organ/system abnormalities and neurodevelopmental problems.

#### **c) Psychological**

Despite the fact that evidence of a biological link between overweight, obesity, and depression is complex and inconclusive, it is important to highlight the most recent lines of reasoning on the possibility of a biological pathway. First, we'll discuss the effect of obesity on depression outcomes (Finucane et al., 2011). Obesity can be viewed as an inflammatory state, as weight increase has been proven to activate inflammatory pathways, which has been linked to depression, which was measured in these research using a depressive symptom report. Because inflammation plays a role in both obesity and depression, it's possible that inflammation is the link between the two (IIPS and Macro International 2007).

#### **Remedy**

Excess body fat management is one of the most pressing healthcare issues of our time. Losing weight through healthy eating, increasing physical activity, and making other lifestyle changes are all common remedies for overweight and obesity. Following are the some measures that can be adopted for weight management:

#### **a) Diet**

Popular weight-loss diets have attracted considerable

attention and prompted a lot of debate. While energy balance (i.e., calories still count) remains the cornerstone of weight management, new diets and books promising weight loss by restricting certain foods or macronutrients rather than calories are continually emerging. One example of a low-fat (LF) dietary plan is provided by the Dietary Guidelines for Americans (Santesso et al., 2012).

#### **b) Physical exercise**

The increasing energy expenditure can aid in lowering obesity and extra adipose tissue. The American College of Sports Medicine (ACSM)'s recent recommendations call for both aerobic and anaerobic training. Running, cycling, rowing, and other forms of aerobic exercise exhausts the oxygen in the muscles, but oxygen consumption is sufficient to supply the energy demands placed on the muscles and does not need to derive energy from another source (Blair, 2013). Contrarily, anaerobic exercise (also known as resistance training, or weightlifting) involves oxygen consumption that is insufficient to meet the energy demands placed on the muscles. As a result, the muscles must break down additional energy sources, such carbohydrates, to produce energy and lactic acid.

Exercise includes physical activity (PA), albeit PA is not always associated with planned exercise plans or sessions (Borodulin et al., 2015).

Exercise is measured in "metabolic equivalent tasks" (METs), which roughly correspond to the effort and energy required for a individual to sit quietly. The requirement for consistent quantities of physical exercise throughout the day is emphasized by the frequent integration of physical activity into various lifestyle treatments. Goal-setting, problem-solving, leisure-time physical activity, and exercise used for transportation are all examples of physical activity in a general lifestyle (Finkelstein et al., 2012). Cardiorespiratory fitness, body composition, and muscular fitness are some of the outcomes of interest. Numerous studies have recently demonstrated the benefits of exercise for people of all ages in terms of their physical, mental, and emotional health.

The same exercise regimens that are recommended for those who are normal weight are also appropriate for overweight and obese people. However, specific factors



must be taken into account, such as current comorbidities like orthopaedic risk (i.e., arthritis), pulmonary, and/or cardiac co-morbidities that may be related to obesity (Blair et al., 2013). However, specific factors must be taken into account, such as current comorbidities like orthopaedic risk (i.e., arthritis), pulmonary, and/or cardiac co-morbidities that may be related to obesity. However, this should not dissuade individuals from enrolling in exercise programmes, as exercise is vitally important for general health.

The American College of Sports Medicine (ACSM), the Obesity Medical Association (OMA), and the Obesity Society (TOS), which are all clinically accessible to help persons in prescribing exercise, are now some of the exercise guidelines for people living with obesity.

To prevent weight gain, accelerate weight loss, and enhance fitness, one must engage in at least 150 to 300 minutes of weekly moderate exercise or 75 to 150 minutes of weekly intense exercise. To assist long-term weight loss, it is advised that those who want to lose weight engage in at least 200 to 300 minutes of moderate to strenuous physical activity per week (Ng and Popkin, 2012).

### c) Medication

Due to their ability to reduce the prevalence of obesity and its comorbidities, drug interventions that promote weight loss are becoming more and more popular. It has been demonstrated that intensive lifestyle adjustments can considerably improve weight in obese people, among other things. According to the Look AHEAD study (Garvey et al., 2012; Kistner, 2002), a 5% decrease in body weight was associated with long-lasting decreases in key cardiovascular risk variables such as blood pressure and lipid profile. Several regulatory bodies utilize a 5-percent total weight loss to determine if a medication results in a considerable weight loss. Orlistat, phentermine/topiramate, lorcaserin, naltrexone/bupropion, and liraglutide have all received FDA approval to treat obesity, compared to just three pharmacological therapies approved by the European Medicines Agency (EMA): orlistat, bupropion/naltrexone, and liraglutide. (Bhatnagar and Sharma, 2017). If medical interventions don't help some patients lose enough weight, they may turn to bariatric surgery as a final resort. These therapies often support weight loss by

increasing satiety, reducing hunger, or increasing catabolism. However, more pharmacological targets are being discovered as our understanding of the pathophysiology underlying obesity expands, and it is hoped that more medications will be licensed by regulatory agencies like the FDA and EMA to tackle the obesity epidemic (Courcoulas et al., 2013; Mingrone et al.).

### Effects on adipocyte differentiation

Green tea catechins significantly reduce adipocyte development in cultured adipocyte models. In C3H10T1/2 cells, it was recently discovered that EGCG (TEAVIGOTM, DSM Nutritional Products) suppressed adipogenesis caused by the standard adipogenic combination of insulin, dexamethasone, and 3-isobutyl-1-methylxanthine (IBMX) dose-dependently (Mori and Hasegawa et al 2011). In another adipocyte model, 3T3-L1 cells, (Furuyashiki et al 2004). found that catechin, CG, EGC, ECG, and EGCG at 5  $\mu$ M inhibited lipid accumulation generated by the same combination. In a time-course experiment, CG and EGC inhibited lipid accumulation starting on day 3 and reduced the amount of lipid by 50% by day 8, indicating that catechins inhibit both early-stage and late-stage differentiation processes (Furuyashiki et al., 2004). If medical interventions don't help some patients lose enough weight, they may turn to bariatric surgery as a final resort. These therapies often support weight loss by increasing satiety, reducing hunger, or increasing catabolism. However, more pharmacological targets are being discovered as our understanding of the pathophysiology underlying obesity expands, and it is hoped that more medications will be licensed by regulatory agencies like the FDA and EMA to tackle the obesity epidemic (Courcoulas et al., 2013; Mingrone et al.). Green tea catechins also suppressed proliferation of 3T3-L1 preadipocytes, according to Hung et al (Hung et al., 2005). These inhibitory effects require the involvement of two cell cycle regulatory kinases, ERK and cyclin-dependent kinase 2 (Cdk2). EGCG had no effect on total levels of extracellular signal-regulated kinase 1 (ERK1) and extracellular signal-regulated kinase 2 (ERK2), but it did considerably reduce phospho-ERK1 and phospho-ERK2, the active forms of ERK, at 50  $\mu$ M. Cdk2, another important cell cycle regulator, was lowered by EGCG at both the protein and activity levels after 4, 24, and 48 hours of

administration. EGCG outperformed EC, ECG, and EGC in terms of antimutagenic characteristics, arresting preadipocytes in the G0/G1 phase (Hung et al 2006).

### **Effects on lipolysis**

Lipid buildup, one of the obvious causes of overweight and obesity, is recognized to have an impact on the onset of type 2 diabetes. According to Koo and Noh (2007), lipid buildup is also associated with insulin resistance in the muscle and liver. According to Ngondi et al. (2009), increased lipogenesis, dietary fatty acid consumption, or reduced fatty acid oxidation all contribute to lipid accumulation. Recent research has looked at how green tea catechins affect the equilibrium of serum lipids. Mak-Soon Lee et al. observed that lipid droplets in 3T3-L1 adipocytes were suppressed after 24 hours of incubation with 10 mM green tea catechins, with no adverse effects on the survival of the cells during differentiation. Green tea may have effects in both the early and late stages of the differentiation process, as indicated by the fact that CG and ECG decreased the number of lipid droplets starting on day 3 and by 50% on day 8 (Mak-Soon Lee et al., 2016). Green tea components were also found to inhibit the buildup of fat in 3T3-L1 in studies by Furuyashiki et al. (Furuyashiki et al., 2004). In both the mouse experiments and the human trials, similar outcomes following green tea therapy were seen. It was evident that after giving HDF mice 3.2 g of EGCG/kg over the course of 16 weeks, hepatocyte lipid buildup decreased. When compared to the control group, human body weight and abdominal fat were both significantly lower (lower green tea catechin diet).

### **Effects on nutrient absorption**

Studies are currently being conducted to determine the health benefits of drinking green tea, including its potential to prevent cancer and cardiovascular disease as well as to have anti-inflammatory, anti-arthritis, antibacterial, antiangiogenic, antioxidative, antiviral, neuroprotective, and cholesterol-lowering properties. More green tea consumption, however, may be harmful to your health in various ways (Watanabe et al., 2020).

Green tea's flavanol and flavonol content, which accounts for 30% of the dry weight of fresh leaves, is what gives it its health-promoting qualities. The majority of the benefits of green tea mentioned above

have recently been connected to its most common catechin, (-)-epigallocatechin-3-gallate (EGCG).

In rats with diet-induced obesity, ten weeks of oolong tea drinking reduced obesity and fatty liver. Both lower nutrient absorption and increased energy expenditure may contribute to these consequences (Hursel ET AL., 2009). Green tea extracts boosted brown adipose tissue thermogenesis in rats in a way that goes beyond what caffeine by itself could account for. Healthy young males who ingested green tea extract with every meal had significantly higher 24-hour energy expenditure and significantly lower 24-hour respiratory quotients as compared to placebo and caffeine treatments. According to these experts, catechol-O-methyltransferase activity is inhibited by caffeine and tea polyphenols, which together prolong sympathetic stimulation of thermogenesis (Takase et al., 2008).

Due to their high affinity for proteins and minerals, tea polyphenols may have an effect on dietary intake. The various phenolic groups in tea can connect to several sites on a protein via hydrophobic interactions and hydrogen bonding. Gelatin, milk caseins, and salivary proline-rich proteins are a few examples of proteins with a high proline content that have a strong affinity for polyphenols. It is still unclear whether drinking tea changes how efficiently people absorb protein. Due to the tea polyphenols' strong affinity for binding metal ions, the effects of tea on the absorption of essential nutrients are quite important (Basu et al., 2010).

Tea consumption has been linked to decreased iron absorption. It appears that nonheme iron is the main target of this effect, particularly when tea and iron are both eaten. Tea drinking had no impact on the absorption of heme iron from cooked meats. Tea consumption has been linked to neonatal microcyte anaemia (Ichinose et al., 2011). The National Health and Nutrition Examination Survey II study, which included 11,684 people, found no link between anaemia and tea or coffee use. Rats administered a methanol extract of black tea had poorer apparent calcium absorption than control rats between days 11 to 18, but by week four there was no difference; the treatment had no effect on apparent protein or magnesium absorption (Ferreira et al., 2016).

In keeping with recent research that found tea may reduce hip fractures, drinking tea was associated with



greater bone mineral density measurements in women aged 65 to 76. According to these findings, substances other than polyphenols, such as fluoride or phytoestrogens, may have an impact on bone mineral density. Tea was demonstrated to reduce both the glucosyltransferase activity of oral streptococci and the start of dental caries in rats. Tea contains fluoride, which strengthens tooth enamel and may assist to promote dental health.

In a mouse model of arthritis brought on by collagen, the incidence and severity of arthritis were greatly reduced by green tea polyphenols. Green tea polyphenols were given to mice, and this significantly decreased the expression of inflammatory mediators such as cyclooxygenase-2, interferon, and TNF in the arthritic joints. The development of cataract, which occurs when proteins precipitate in the lens of the eye, may be prevented by increasing tea consumption (Kim et al., 2009).

ECG has been proven to restrict the uptake of glucose by Caco-2 cells. ECG competitively blocked sodium/glucose cotransporter 1 (SGLT1) in brush border membrane vesicles. In the rat stomach,  $\alpha$ -amylase and sucrase activities were reduced by green tea catechins. More studies on this phenomenon have shown that theaflavins, which are present in black tea in higher concentrations, are substantially more effective than EGCG at inhibiting sucrase activity (Kurogi et al., 2012; Bose et al., 2008). Although EGCG was less efficient than ECG at lowering glucose uptake in the rat stomach, it did block the sodium-dependent glucose transporter. Green tea extract (GTE) was found to inhibit pancreatic and stomach lipase activity, which lowered human fat digestion and contributed to green tea's anti-obesity impact. According to currently available in vitro research, green tea may reduce glucose and fat absorption by inhibiting gastrointestinal enzymes involved in the digestion of food. It is currently unclear how much of a role these processes play in the in vivo established anti-obesity benefits of green tea, green tea catechins, and EGCG (Lee et al., 2009).

#### **Marketed Products**

Two key factors that are expected to promote market expansion over the course of the projected period are growing consumer emphasis on leading a healthy lifestyle and growing knowledge of the health benefits.

Additionally, it is anticipated that the dramatic rise in cardiovascular disease and obesity cases will result in a rise in global demand for green tea. At a strong CAGR of 11.9 percent, the worldwide green tea market is anticipated to generate sales of \$34,044.28 million by 2028, up from \$13,850.94 million in 2020.

The market for green tea is estimated to grow due to rising consumer demand for healthy beverages as a result of the increased prevalence of lifestyle-related health conditions like obesity and high blood pressure.

During the study period, the Asia-Pacific green tea market is anticipated to grow at a CAGR of 11.30% and reach a value of \$21,754.29 million.

#### **Market Insights**

##### **Merger and acquisition activities and product launches fuel green tea market growth in India**

Due to consumer demand for green tea varieties with distinctive flavors, rich fragrances, and tantalizing tastes, the green tea business is expanding (Hasani-Ranjbar S et al).

The market is dominated by powerful corporations like Unilever and Tata Global Beverages. These industry leaders never stop investing in R&D to improve each of their product lines. Additionally, they are engaged in merger and acquisition activities with competing companies that have promising futures in the country in an effort to take on as many clients as they can there.

##### **India Green Tea Market – Type**

- Green Tea Bags
- Green Tea Instant Mixes
- Iced Green Tea
- Loose Leaf
- Others

##### **India Green Tea Market – By Flavor**

- Lemon
- Aloe Vera
- Cinnamon

#### **Conclusion**

The impact of green tea on obesity management is a

subject of ongoing research, and while there is some evidence to suggest that it may have a beneficial effect, the overall conclusion remains nuanced.

Studies have indicated that the catechins, particularly epigallocatechin gallate (EGCG), found in green tea may play a role in increasing metabolism and fat oxidation. These compounds may also have potential appetite-suppressing effects. Additionally, green tea consumption has been associated with modest reductions in body weight and body fat in some individuals.

However, it's important to note that the effects of green tea on obesity management can vary from person to person. Factors such as genetics, lifestyle, diet, and overall health play a significant role in how individuals respond to green tea.

In summary, while there is some promising evidence to suggest that green tea may have a role in supporting obesity management, it should not be seen as a standalone solution. It is best used in conjunction with a balanced diet and regular physical activity. As with any dietary supplement, it's essential to consult with a healthcare professional before incorporating green tea into your routine, especially if you have any underlying health conditions or are taking medications.

Further research is needed to better understand the mechanisms of green tea's effects on obesity and to identify specific populations that may benefit the most. In the meantime, individuals interested in using green tea as part of their weight management strategy should do so cautiously and as part of a holistic approach to health.

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## Phytochemical and Pharmacological review in Taraxacum officinale (Dandelion)

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### Taraxacum officinale weber: Genus and Family

Damylo et al., 1984 illustrated that *Taraxacum officinale* Weber (called "dandelion"; "lion's tooth"; Asteraceae (Compositae), herbperennial . Vašut et al., 2015 reported that the genus *Taraxacum* (30–57 varieties ; many microspecies; divided into 9 sections; dandelion : plant's jagged-edged leaves). Ali et al., 1989 found that dandelion is native to the northern temperate zones. Vogel, 1977 summarised that US Food and Drug Administration's "generally recognized it as safe" (GRAS) list for foods and supplements.

### Scientific Classification:

- Kingdom : Plantae
- Clade : Tracheophytes / Angiosperms / Eudicots / Asterids
- Order : Asterales
- Family : Asteraceae
- Tribe : Cichorieae
- Genus : *Taraxacum*
- Species : *T. officinale*

### Binomial Name / Synonyms

- (I) *Crepis taraxacum* (L.) Stokes
- (ii) *Taraxacum mexicanum* DC.
- (iii) *Taraxacum subspatulatum*
- (iv) *Taraxacum campyloides*
- (v) *Taraxacum tenejapense*
- (vi) *Taraxacum sylvanicum*
- (vii) *Taraxacum dens-leonis* Desf.
- (viii) *Taraxacum retroflexum* Lindl.
- (ix) *Taraxacum taraxacum* (L.) H. Karst.

(x) *Taraxacum vulgare* Schrank

### Description

*Taraxacum officinale* Weber "weed" (toothed leaves; 3–35cm height; single yellow flowers; florets).



Figure 1: Photograph of dandelion with flowers, stems, and leaves.



Figure 2 a, b: Field Photograph of *Taraxacum officinale* Weber.





Figure 3 : Field Photograph of Beaked achenes of *Taraxacum officinale* Weber.



Figure 4: Dandelion Edible young leaves and flower (right).



Figure 5: Dandelion flower (left) and ripe fruits (right).

**Phytochemical Constituents of *Taraxacum officinale* Weber**

Koo et al., 2004 summarised that *Taraxacum officinale* has terpenoid; sterol (taraxacin; taraxacerin); terpene/sterol (taraxasterol); free sterols (sitosterin, stigmasterin, and phytosterin).

Further, Ali et al., 1989 reported that dandelion contains vitamins A, B, C and D; iron. Constituents of Various parts of *Taraxacum officinale* Weber are as follows:

Part	Primary and Secondary Plants Metabolites (SPMs)
Leaf & Stem	Schütz <i>et al.</i> , 2005, B-sitosterol; α-amyrin; Stigmasterol; Quercetin; glycosides; Sesquiterpene lactones; polyphenol; coumarins;
Flower	Williams <i>et al.</i> , 1996, Phenolic compounds; favonoid glycosides; carotenoid. (taraxien);
Root	Leung <i>et al.</i> , 1996, Monocaffeoyltartaric acid; three germacranolide esters; vanillic acid, syringic acid; coumarins (esculetin, scopoletin); flavonoids (apigenin, pentoside); triterpenes & phytosterols;

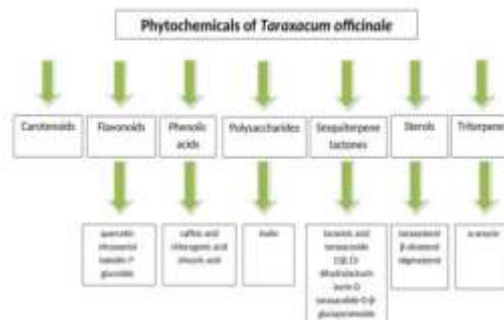


Figure 6: Phytochemicals present in *Taraxacum officinale*.

Butyrolactones (1–3), Butanoates (4–6), 30 phenolic compounds, hydroxycinnamic acid, chicoric acid, chlorogenic acid, caffeic acid, Luteolin-7-O-glucoside, luteolin-7-diglucosides, luteolin.

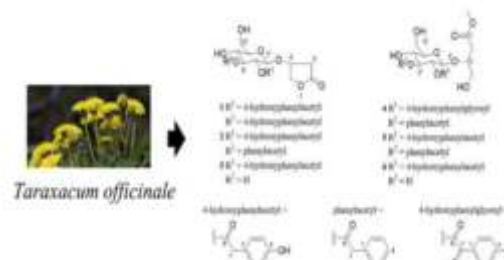


Figure 7: Butyrolactones (1–3) and butanoates (4–6) from Dandelion.

**Traditional and Pharmacological Uses**

Modaresi, 2012 summarised that dandelion is nontoxic and possess anti-inflammatory and diuretic properties. Scientifically proven in-vivo and in-vitro pharmacological activities are presented in Table 1.

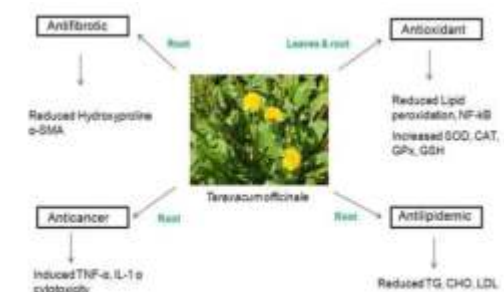


Figure 8: Pharmacological effects of *Taraxacum officinale*.



**Table 1: Various Pharmacological effects of *Taraxacum officinale* Weber.**

Activity	Pharmacological Properties
Anti-oxidative Activity	<b>You et al., 2010</b> reported that flowers from dandelion are potential antioxidant. <b>Hagymasi et al. 2000</b> had demonstrated that Leaf extract had anti-oxidative effect ( <b>Schütz et al., 2006</b> ).
Anti-inflammatory	<b>Seo et al. 2005</b> , showed anti-inflammatory & anti-rheumatic ( <b>Jeon et al., 2008</b> )
Prebiotic Activity	<b>Ali et al., 1989</b> found demulcent action; used in anorexia, dyspepsia, and biliary abnormalities;
Gastrointestinal Complaints	<b>Racz-Kotilla et al., 1974</b> found that the use of dandelion leaf as a tonic for gastrointestinal complaints.
Action on digestion	<b>Prabhakar et al., 2008</b> demonstrated that dandelion regulate enzymes of glycolysis and Krebs cycle.
Antioxidant Effect	<b>Casas-Grajales et al., 2015</b> found antioxidant.
Anti-fibrotic Effects	<b>Lee et al., 2015</b> reported hepatic regenerative capabilities (complete regression of fibrosis);
Anticancer	<b>Koo et al., 2004</b> found anticancer efficacy;
HIV-1 replication	Dandelion extract has a potent inhibitory activity against HIV-1 replication and RT activity
Hypolipidemic effects	Dandelion root and leaf extracts are useful in cardiovascular disease; obesity and hyperlipidemia.
Renal effects	<b>Schütz et al., 2006</b> , leaves produce a diuretic effect.
Antimicrobial / Antiviral Effects	<b>Odintsova et al., 2010</b> found antiviral properties (human herpes virus); antimicrobial (flavones content).
Immuno-modulation	<b>Blumental et al. 2000</b> found that dandelion have immunomodulatory activities

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## Optimization of Harris Corner Method for Corner Detection for Efficient Image Registration

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### Abstract

Development in the field of computer science has led to consistent and proficient image processing techniques that are applicable in the fields of medical, artificial intelligence, remote sensing, industrial inspection, and so on. Image processing techniques that are capable of visualizing objects efficiently are of distinct importance. Image Registration is an important image processing technique, which is used to match two or more images captured of the same object. Image registration involves a method of plotting the points of one image to the

corresponding points in the other image. Image registration has proved to be an essential technology for imaging. A corner of the image is a crucial but confined feature of an image. Corner detection is significant as it dispenses essential indications to local three-dimensional images. For the purpose of this research, we will employ a Harris corner algorithm with additional parameters to overcome its shortcomings of sensitivity to scale variance. Along with this algorithm, we will employ an optimization algorithm in order to enhance the performance of the proposed algorithm.

**Keywords :** *Image registration, Harris method, corner detection, Ant Colony Optimization.*

### Introduction

Image processing is a technique that transforms an image into digital form and optimizes it to obtain a superior image quality or to abstract beneficial information from it. In several fields, assimilation of useful data acquired from separate images is often looked-for. The images must be geometrically aligned for improved observation.

Image registration is a process for ascertaining the corresponding features of the images of a particular object or scenery that were captured at different times using different imaging modalities. The correspondences can be used to transform the appearance of the image through rotation, translation,

enlargement and many more methods. These techniques are performed on one image so that it may look similar to the other and thereby the image pair is directly matched, combined or analyzed (Crum et al, 2004).

All in all, picture enrollment is a significant viewpoint that is utilized to match at least two halfway covering pictures taken of a similar item. For example, at various times, from different gadgets, or from various outlooks and cycle these pictures into a solitary all encompassing picture enveloping the whole scene. A key picture handling method helps with absorbing data from various instruments, noticing varieties in pictures taken at various times, concluding three-layered data from the stereoscopic pictures, and recognizing model-based objects (Arockiaraj, 2014).

Photo enlistment is done in various fields like remote detecting for multispectral business endeavor, ecological explanation, trade recognition, photograph mosaicing, environment determining, making super-choice photos, absorbing data into geographic information structures (GIS), in medication for relating to data from different advances like pc tomography (CT) and attractive reverberation imaging (X-ray), to gather careful realities concerning the patient's circumstances, actually taking a look at cancer improvement, and in PC vision (objective limitation, programmed excellent control). Picture enrollment outlines more execution in those applications (Ruckert et al, 1999).

### Steps involved in Image Registration

Image registration basically comprises of the following stages according to Zitova and Flusser (2003):

- **Characteristic detection:** outstanding and unique functions including closed-boundary regions, edges, outlines, line intersections and corners within the reference picture and sensed pictures are detected..
- **Function matching:** The correspondence amid the features within the reference and sensed picture mounted.
- **Transform model estimation:** The category and factors of the mapping features, aligning the sensed picture with the reference photo, are assessed.
- **Photograph re-sampling and transformation:** The sensed picture is converted via mapping capabilities.

A corner of an image is an important feature that is well described by Xu and Tan (2012) as "the sudden changes pixel in gray value, or the intersection point of object contour edges, which retains the important feature information of objects at the same time effectively reduces the amount of data information. Corners have properties of straightforward extraction technique, stable outcome and solid versatility to calculation. Exactness and strength of corner extraction straightforwardly affects the ensuing visual handling undertakings, for example, picture coordinating, picture sewing, object acknowledgment". Hence corner detection represents a significant part in image processing and pattern recognition.

Presently, corner detection algorithms are classified into the following two categories:

- I. The corner detection algorithm based on the edge: This category is based on extracting the chain code of an image edge, as per the dissimilarity among adjacent code values to find out if it is a corner. However, the algorithm has the shortcomings of enormous calculation, high time consumption and process variability (Quddus, Fahmy, 1999).
- II. The corner detection algorithm based on the gray change: This category computes the curve and inclination to identify corners. The classic descriptive algorithms are: Moravec algorithm, Harris algorithm, Susan algorithm (Harris, Stephens, 1988).

### Harris Corner Detection:

Harris calculation has been broadly utilized for the explanation of straightforward estimation, extraction of wonderful corners and high soundness. Yet, Harris calculation has the few issues, for example, corners spreading in the entire picture under composite foundation in the picture, it can't exactly remove the objective, there is no confirmation that the invariance of corners when picture has enormous scope change and normal edges can't be set (Shi, 2010).

The Harris administrator is advanced based on Moravec administrator, by working out the auto-connection network and the dim worth change to get the corners. Accepted  $f(x,y)$  is dim worth of pixel  $(x,y)$ , in the wake of moving  $(u,v)$ , the dim power change can be communicated by the accompanying equation:

$$E_{u,v}(x,y) = \sum_{u,v} w_{u,v} [f(x+u, y+v)]^2 \quad (1)$$

By Taylor formula launching to:

$$f(x+u, y+v) = f(x,y) + f_x u + f_y v + O(u^2 + v^2), \text{ wherein,}$$

$$f_x = \frac{\partial f}{\partial x}, \quad f_y = \frac{\partial f}{\partial y}, \quad f_{xy} = \frac{\partial f}{\partial x} \frac{\partial f}{\partial y}$$

Into the formula (1), to:

$$E_{u,v}(x,y) = \sum_{u,v} w_{u,v} [f_x u + f_y v + O(u^2 + v^2)]^2 \\ \approx \sum_{u,v} w_{u,v} [f_x u + f_y v]^2$$

$$\begin{aligned}
 &= \sum_{x,y} w_{x,y} [(f_x)^2 + 2f_x f_y + (f_y)^2] \\
 &= \sum_{x,y} w_{x,y} [u, v] \begin{bmatrix} f_x^2 & f_x f_y \\ f_x f_y & f_y^2 \end{bmatrix} \begin{bmatrix} u \\ v \end{bmatrix} \\
 &= \sum_{x,y} w_{x,y} [u, v] M \begin{bmatrix} u \\ v \end{bmatrix}
 \end{aligned}$$

Wherein,  $M = w_{x,y} \begin{bmatrix} f_x^2 & f_x f_y \\ f_x f_y & f_y^2 \end{bmatrix}$ , that is the auto-correlation matrix of pixel  $(x, y)$ .

Harris corner response function is:

$$R = \det M - k (\text{tr} M)^2$$

Where in,  $\det M$  is the determinant of framework,  $\text{tr} M$  is the hint of grid,  $k$  is experience esteem, typically takes 0.04-0.06. Make  $\lambda_1, \lambda_2$ , as the two trademark upsides of the lattice, which return the surface arch of two chief tomahawks in the picture.

$$E_{u,v}(x, y) = D^{-1} \begin{bmatrix} \lambda_1 & 0 \\ 0 & \lambda_2 \end{bmatrix} D$$

Diagonalizable handling gets:

Where  $D$  is the turn component and hence,  $\det M = \lambda_1 \lambda_2$ ,  $\text{tr} M = \lambda_1 + \lambda_2$ . When  $\lambda_1$  and  $\lambda_2$  both are bigger, shows that the nearby auto-relationship task has a pinnacle, the shape change of the pixel along any course is bigger. At the point when Harris administrator esteem is outrageous in the nearby district and is more noteworthy than the edge, the corner is required.

Harris administrator is a straightforward and stable corner discovery administrator. For a perplexing foundation in the pictures, corners are recognized that exist in the whole picture, and Harris administrator is delicate to the difference in scale, while the picture scale changes (revolution, scaling), test results might be very unique. Correspondingly, the extraction result of Harris corner calculation is totally dependent on the foundation edge for example in the event that the limit is unnecessarily immense; the strategy could miss specific corner data, and clearly assuming the edge is

excessively less, the technique might identify misleading corners (Peng et al, 2016).

As per Mikolajczyk and Schmid(2004), Harris corner locator is a fitting beginning stage for the estimation of the scale areas and permitting invariant elements.

### Literature Review

Medioni and Yasumoto (1987) recommended using B-Splines to denote digital curves. They established an algorithm to find corners and simultaneously encode curve segments among them using B-Splines in combination with the sub-pixel edge detector; it permits the authors to achieve precise location of the corners, as required in several registration problems like stereo matching and motion parameter valuation. Besides corners, points of the major curvature among them were obtained. The subsequent illustration proved to be affine estimate of the original, in the sense that it creates remarkable points unambiguous, and accomplishes important data compression.

Mokhtarian and Suomela (1998) proposed a method for image corner detection based on the curvature scale-space (CSS) representation. The first phase of this methodology extracts edges from the actual image by means of a Canny detector. The corner points of an image are demarcated as points where image edges have their most of total curvature. The corner points are identified at a high scale of the CSS and followed through multiple lower scales to develop localization. This method was proved to be resilient to noise, and also, the CSS detector deliver extra point features i.e. curvature zero-crossings of image edge contours besides the traditional corners.

Rosten, Porter, Drummond (2010) have presented a machine learning methodology for corner detection. The foremost step comprises of selecting a new heuristic algorithm for feature detection. By employing machine learning they developed a feature detector, which was capable of processing live PAL video completely consuming not more than 5 percent of the available processing time. By assessment, the other detectors cannot operate at frame rate. The next step is to simplify the detector, letting it to be improved for repeatability, with slight loss of efficiency. The last step is to perform a challenging appraisal of corner detectors on the basis of

the repeatability measure applied to 3D scenes. They indicated that regardless of being essentially created for speed, on these rigid tests, the heuristic detector considerably beats current feature detectors. This appraisal validates that the machine learning yields substantial enhancements in repeatability, producing a detector that is fast and of high quality.

He, Yung (204) recommended an upgraded multi-scale corner indicator with dynamic district of help, which is laid out on arch scale space (CSS) procedure. The proposed finder utilizes a versatile neighborhood ebb and flow edge as an option in contrast to a solitary worldwide limit as in the first and further developed CSS strategies. Furthermore, the points of corner up-and-comers were tried in a unique locale of help for eliminating erroneously recognized corners. The proposed technique was evaluated over various pictures and connected with the standard corner identifiers. The out comes showed that the proposed technique gives major areas of strength for a successful answer for pictures holding extensively different size highlights.

Peng et al (2016) proposed a strategy to streamline Harris corner identification calculation. Initial, a significant region location strategy was utilized to separate the objective region, and then an ending activity for the outcome figure was laid out through which the objective and foundation division a productively gotten; next, scale invariant depicting strategies were applied to Harris calculation, all the while got together with the non-greatest concealment techniques to extricate corners, explicitly right corners.

Azad et al (2009) have advanced an alternate type of point highlight, which mixes the elements of Harris corner indicator with the Filter descriptor. It was demonstrated how scale-invariance can be achieved well and effectively without a tedious scale space examination. They determined the Filter descriptors for registered Harris interest focuses which prompted a system that was not scale invariant. The consequences of this strategy gave acknowledgment and restriction of finished objects.

The writing presents a few examinations that incorporate a portion of the corner identification techniques. While each exploration presents a strategy to give a proficient corner discovery technique, no

examination exists relating to the productivity streamlining of Harris corner strategy. We will notwithstanding, portray a strategy that works on something similar.

## Research Methodology

The major drawback of the Harris corner detection is the sensitivity to scale change. Therefore to overcome this shortcoming we will employ a blend of Gaussian smoothing and a resize operation to provide scale invariance. Amongst two octaves, the image size is halved, i.e. resized to half width and half height. The different scales within an octave are formed by applying a Gaussian smoothing operator, and the variance of the Gaussian kernel is selected in a way that the last scale of one octave and the first scale of the next octave match each other.

To improve noise immunity, the Gauss smoothing function is described with respect to the Harris operator mentioned in Chapter 1 as,

$$w_{u,v} = e^{-\frac{(u^2+v^2)}{2\sigma^2}}$$

Further we will apply an optimization algorithm called as Insect state enhancement (ACO) which is a nature-enlivened streamlining calculation driven by the normal event where the subterranean insects store pheromone on the ground to leave a path with an ideal course different subterranean insects should follow. The ACO calculation is executed to take care of various issues. With the end goal of this examination, ACO is introduced to support the corner identification issue, where the goal is to extricate the corner data which is given in the picture. Insect State Enhancement is a norm for arranging net heuristic calculations that get the arrangements among every possible arrangement however don't guarantee that the best will be found; for combinatorial improvement issues. ACO is a cycle which recognizes focuses in a picture where discontinuities or sharp varieties in force follow.

The means of an ACO calculation are:

- Issue chart portrayal
- Introducing subterranean insect conveyance
- Hub change rule

- Pheromone refreshing principle (Agarwal, 2012)

#### Algorithm:

*Begin:*  
*Initialize the base attractiveness,  $\tau$ , and visibility,  $\eta$ , for each edge;*  
*For ( $i < \text{IterationMax}$ )*  
*For each ant do*  
*Choose probabilistically (based on previous equation) the next state to move into.*  
*Add that move to the tabu list for each ant.*  
*Repeat until each ant completed a solution.*  
*End*  
*For each ant that completed a solution do*  
*Update attractiveness  $\tau$  for each edge that the ant traversed.*  
*End*  
*If (local best solution better than global solution)*  
*Save local best solution as global solution;*  
*End*  
*End*

#### Conclusion

A decisively amazing asset for picture handling is picture enrollment. Effectiveness assumes a urgent part in deciding if the finder and further handling can work at outline rate.

This exploration evaluates a procedure for powerful corner acknowledgment, zeroing in on a portion of the Harris corner identification calculation's weaknesses, for example, the aversion to scale change, the dissemination of corners over the entire picture, and the effect on track discovery. Scale invariance capabilities and the Harris corner approach are utilized in the examination, and the item is then additionally improved using the Subterranean insect Province Enhancement procedure.

Shi-Tomasi Corner recognition, Scale Invariant Component Change (Filter), Speeded Up Vigorous Highlights (SURF), and Quick calculation for corners are a couple of all the more notable corner identification procedures.

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## **The efficiency and effectiveness of SEBI as a regulatory regime**

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### **Introduction**

The efficiency of the regulations is depending upon its ability to attain its objectives at less cost. It is deemed efficient if its benefits are more than its costs.

Effective regulation involves the design of policies, rules, and laws that are thoroughly monitored and supported by enforcement to bring the desired results in terms of better investor protection, efficient capital markets, and the reduction of systemic risk.

SEBI (Securities Exchange Board of India) was established under Section 3 of the SEBI Act, 1992 to protect the interests of the investors in securities and to promote the development of, and to regulate, the securities market and for matters connected therewith and incidental thereto, effectively and efficiently.

### **Complexity of Regulations**

SEBI's regulations are complex. SEBI brought out many regulations to address the issues of malpractice in the market. It attempts to regulate financial intermediation which is complex due to its longer chains and interconnections. The regulators find it difficult to assess the impact of the regulation and the risk involved. The excessively complex regulations can create an impression of control which is obviously an incentive to wrongdoers leading to risk.

To regulate the stock market and for the protection of the interest of the investors brought out the Securities and

Exchange Board of India (SEBI) Act, 1992, and the Depositories Act, 1996. The need is to harmonize and consolidate multiple regulatory requirements within the framework of SEBI regulations to provide for uniform, hassle-free, single-window clearance with SEBI as a nodal regulator. SEBI is also issuing regulations covering the market and almost.

### **Multiple Regulations**

The issue of the market is responded to by SEBI with regulations. Since issues are more and accordingly new regulations were brought in many folds resulting in too many regulations chasing too few market participants. As a result, the regulations may not have a significant impact but disturb the growth of the market as well as the economy.

### **Over Regulations**

Regulations and the threat of regulatory actions for contravention of regulations have an adverse impact on the regulated entities in terms of expansion and growth. Instead of exploring market opportunities for business development concentrate on the compliance of the regulations to protect themselves against legal and regulatory actions.

Over regulation forces the regulated entities to spend more resources to comply with regulations resulting in increased costs of doing business without profitability. Their time, efforts, and cost of compliance can be better utilized in the application of new technologies,

improvement of efficiency, and creation of competitive products. The high cost of compliance over-regulation forced them to seek alternative means to get out of the clutches of the regulators. Regulators also open the delisting route for them and as a consequence, more companies especially MNCs delisted from Indian bourses.

### **Frequent Amendments**

Laws governing securities markets are subject to frequent amendments, especially SEBI regulations. SEBI regulations were amended/repealed 40 times during the year 2020 -21. The rationale behind SEBI amendments is to simplify various regulations, remove redundancy, bring the regulations in line with contemporary market practices, and inculcate transparency and accountability.

### **Lack of Clarity in Regulations**

SEBI regulations are ambiguous and often demand clarification from market participants. SEBI also clarifies its regulations through frequently asked questions (FAQ), Circulars, and guidelines.

SEBI put in efforts to bring clarity to regulations and their functions.

### **Reforming the AIF Regulatory Regime**

In order to sustain the continued growth of the AIF industry, the path ahead requires forms in the enabling regulatory framework for AIFs. While most regulatory efforts have rightly focused on protecting minority shareholder interests and improving compliance, there has been limited direct regulatory effort focused on the private equity and venture capital industry itself.

There have been considerable developments recently, for example, the pass-through approach introduced in the Union Budget 2015 and the Reserve Bank of India's AIF investment policy liberalizing investments in AIFs. Sustained reforms in a few areas could further grow the industry. These include a current and rationalized approach, an awareness of merging boundaries of different pools, a consistent and simple framework harmonized across regulators, and a sharply defined clarity on investment boundaries.

### **Slow in Responses to Issues**

Small investors seek advice from investment advisers to manage their investments and reasonably expect the advice given to them to be in their best interest. Hence regulatory regime that regulates investment advisers is essential to assure the integrity of that advice. The legal response to the regulation of investment advisers is very poor.

### **Regulatory Design**

Regulation is a means to achieve the objectives of the regulators but at the same time, poorly designed regulations not only harm the market but also defeat the objectives of the regulations. The regulatory design was a ruling based regime with reliance on command and power with a focus on the market mechanism in particular supply side in the past with the assumption of all market participants behave rationally. The regulatory design has been changed entirely in the modern automated securities market. Rule-based regime turned into disclosure-based ones in the liberalized environment.

### **Regulatory Regime**

One can think of a regulatory regime as a means for achieving regulatory goals. A regime comprises an institutional structure and assignment of responsibilities for carrying out regulatory actions. The institutional structure is made up of rules that prescribe expected behaviors or outcomes, standards that are benchmarked against which compliance can be measured, a mechanism for determining the degree of regulatory compliance, and sanctions for failure to comply with the rules. Given the variety of ways that rules and standards can be crafted and responsibilities for regulatory actions can be assigned, there is no definitive categorization of regulatory regimes. Comparisons of the regulatory regimes that are the foci of this article are presented in Table 1. This draws a contrast between traditional emphases on prescriptive regulation with newer forms of system-based and performance-based regulations. Each of these regimes entails a governmental role in setting forth regulations and enforcing them. They differ, however, concerning the nature of the rules and standards and the means for gauging adherence to them. Many regulations are highly prescriptive in telling

regulated entities and individuals what to do and how to do it. For example, traditional building code provisions covering the safety of buildings run hundreds of pages and address such things as nailing patterns in support walls, spacing of beams, and roofing and insulation materials. As with building codes, prescriptive regulation tends to be highly particularistic in specifying required actions and standards for adherence to them. Regulatory enforcement for prescriptive regulation emphasizes adherence to the prescribed rules and standards, which in turn is presumed to provide acceptable outcomes in meeting regulatory goals.

Table 1 Comparison of regulatory regimes

	Regulatory regime		
	Prescriptive regulation	System based regulation	Performance-based regulation
Regulatory fact	Prescribed actions	Process or system	Results or outcomes
Compliance determination	Adherence to prescribed actions	Acceptable production system	Achievement of desired results
Nature of rules and standards	Particularistic and detailed specifications	Process-oriented specifications	Goal-oriented outcome specifications
Basis for achieving regulatory goals	Adherence to prescription presumed to meet goals	Appropriate system controls are designed to meet goals	Regulatory goals are embedded in the results orientation
Examples	Dominant regulatory approach in the USA for environmental and social regulation.	Aspects of food safety, industrial health and safety, nuclear power plant safety	Aspects of air and water quality, building and fire safety, energy efficiency, forest practices, pipeline safety

## Self-Regulations

The financial services industry is complex and dynamic. Regulating them is a burden to the regulators. Self-regulation is a fair combination of private interests with the oversight of the government and is an effective and efficient form of regulation to address the issues of the financial services industry. To regulate themselves, market participants are drafting the rules based on their experience and skills, to maximize the benefits of regulation. Since they frame regulations that facilitate better compliance within the self-regulatory framework.

Regulation by a Self-Regulatory Organization (SRO) is often considered cheaper than regulation by the government. A key question is whether SRO oversight needs supplementary governmental oversight. Indeed, in practice, SRO oversight is mostly still supplemented by some form of governmental oversight, either as a form of “public parallel regulation”, i.e. additional oversight of the SRO members or as a form of “meta-regulation”, i.e. oversight of the SRO itself. Focusing on

financial transactions, DeMarzo et al. (–2005) show that public parallel regulation is necessary, but suggest that meta-regulation may not be needed. They show that public parallel regulation works through the threat of additional governmental investigations of SRO members and consequently, the SRO has the incentive to set high investigation standards to pre-empt any relatively costly governmental investigations.

Extending the model of DeMarzo et al. this study adds two new insights. The main insight is that, for financial transactions, public parallel regulation is not always sufficient by itself. When regulators are not able to credibly commit to their announced investigation policies, the interaction between an SRO and a government is one of the simultaneous moves, and oversight by the government then completely crowds out SRO oversight, rendering the SRO superfluous. This outcome is not optimal as the government has a higher cost of investigation than the SRO. In this study, the predictions of the model with simultaneous moves are borne out in experimental tests using specific parameterizations and implementation details. The credibility of government oversight policy is immaterial to these results.

The second insight is that the efficient equilibrium, as found in DeMarzo et al. could be re-established as an equilibrium by also providing supplemental meta-regulation. When meta-regulation forces the SRO to adhere to its policy announcements, the interaction between an SRO and the government becomes sequential, with the SRO moving first and the government moving second, again enabling the efficient outcome as derived in DeMarzo et al. The meta-regulation may be relatively light, limited to verifying that the SRO implements its announced policies and imposing penalties on the SRO in the case of deviations. The results also imply that it would be in the interests of the SRO to support such meta-regulation by the government, as the efficient equilibrium has a better payoff for both the government and the SRO.

## Cost-Benefit Analysis

One of the main objectives of the SEBI is to regulate the market. Regulations levy significant costs on market participants. It frames regulations to address the issues

in the securities market without carrying out the cost-benefit analysis of its regulations. Regulations create a mixture of societal costs and benefits. Regulators have a responsibility to carefully weigh the cost and benefit against each other especially when regulations are expected to have a significant impact on the economy.

As administrative capabilities evolve, large regulations and regulatory reforms should be subjected to a more thorough cost-benefit analysis. These analyses should be an important factor in decision-making. In the case of economic regulation, the burden of proof should be on those that wish to maintain it, since the case for most economic regulation is weak in terms of economic efficiency. In the case of social regulation, flexibility should be encouraged so that consumers and producers can innovate in response to regulations. Thus, for example, performance standards for meeting a pollution goal are generally preferred to standards that dictate the use of a particular technology. Of course, the amount of flexibility in a regulatory policy should be based, in part, on the ability of the administrative agency to effectively implement the policy.

A great deal more thought needs to be given to the design of regulatory frameworks. In some instances, even where deregulation is justified, partial deregulation may not lead to an improvement over the status quo. For example, removing price restrictions but retaining entry barriers could lead to inefficient pricing. Full deregulation can lead to problems with monopoly unless great care is taken in managing the transition to a deregulated environment is accomplished. The point here is that the strategy for regulatory reform is critical to the effectiveness of the reform.

### **Evaluation of Regulations**

SEBI, to address the issues of malpractices in the market and to pursue its objective brought out many regulations but not to evaluate how well existing regulations are working. The securities market is a section of the financial market, where securities transactions have been conducted. As with any other financial market, the securities market is prone to scams, fraud, and illegal activities. The Indian securities market involves millions of active investors, who are investing and making money through trading every day. Therefore, controlling and preventing any scams or frauds in the

market is of vital importance to safeguarding the interests of all investors in the securities market.

Due to the growth of the securities market in the Indian economy in 1992, the Government of India established a regulatory agency which is known as the Securities and Exchange Board of India (SEBI) to manage the market. The Securities and the Exchange Board of India (SEBI) were assigned the following duties:

- Protecting the investors' benefits in the securities market.
- Regulating the operation of the securities market.
- Promoting and developing the securities market.
- Regulating internal transactions of the company.

Thus, SEBI proceeds from one regulation to the other without focusing on understanding the results of efforts. Regulations need to be evaluated one by one to determine whether they should be retained, replaced, or repealed.

### **Feedback**

SEBI is accommodating the feedback on its draft regulations from the market participants and public to ensure transparency in the regulations and to accommodate the best inputs from the market and remove the lacunae if any. The views /feedback of the interested stakeholders/public helps them to incorporate suitable changes in the draft version of the Act/Regulation dispense with the subsequent amendments in the concerned Act/Regulations.

### **Summary**

The legal response to the issues of malpractice in the market is very poor before SEBI. The Securities Contracts (Regulation) Act, of 1956, was enacted to regulate securities contracts. To address the issues of malpractices in the company form of organization and to regulate them, brought out the Companies Act, of 2013.

Indian securities market was not regulated for a long time. The mounting malpractices in the country and mega stock market scams cause heavy financial loss to investors and the economy. The legal regime considered it expedient to create a statutory agency, which would ensure fair play in the market, develop fair market practices, prescribe, and monitor the conduct of issuers

and intermediaries so that the securities market enables efficient allocation of resources leading to the enactment of the SEBI Act, 1992 and creation of the SEBI.

SEBI framed rules and regulations under the SEBI Act for registration and regulation of all market intermediaries, and for prevention of unfair trade practices, etc. The regulators must maintain the conduct of the security market free from unfair and manipulative, fraudulent activities to win over the confidence of investors and for long-term growth. To address these issues, SEBI has brought out a separate regulation called the Securities and Exchange Board of India (Prohibition of Fraudulent and Unfair Trade Practices relating to Securities Market) Regulations, 2003 to deal with manipulative, fraudulent, and unfair trade practices.

Promoters often siphon Company funds through related party transactions. Legal regime address this issue by mandating disclosure of related party transactions through listing agreements and companies Act also stressed the need for such disclosures. Regulators have limitations and they can mandate disclosure only and no triggering action they initiate. However, the disclosure helps the investors to take informed decisions and they can through the powerful mechanism of voting, stop or modify the related party transactions is the trend in the Indian corporate world.

The Legal regime addresses the fraud of the regulators especially stock exchanges through corporatization and demutualization. SEBI found the key functionaries of NSE did not follow the appropriate protocols and initiated an investigation and levied a fine however the matter is under sub-judice.

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## A General study of the New Education Policy 2020 on higher education

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### Abstract

The Government of India announced its New Education Policy 2020, which intended to transform our nation sustainably into an equitable and vibrant knowledge full society, by providing high quality education to all. It is a welcoming step, which will bring about a paradigm shift India's education system and will transform it into a

modern, progressive and equitable one. The education system for higher education is changed by New Education Policy 2020. This research paper is centered on NEP 2020. This paper also outlines the salient features of NEP 2020 and a summary of New Education Policy on Higher Education how they affect the extant education system.

**Keywords :** *Higher Education Policy, New Education Policy 2020 (NEP 2020), Quality Education, Education System.*

### Introduction

The National Policy on Education (NPE) generated by the Government of India to raise education amongst India's people. The policy overlay elementary education to colleges in both rural and urban areas of the nation. As we know the first NPE was declare by the Government of India in 1968, the second in 1986, and the third was in 2020[7]. The sate Governor's Conference on 'Role of NEP-2020 in Transforming Higher Education' became the Landmark in the history of education. The Conference of state Governors and Lieutenant Governors of the country on 'Role of National Education Policy (NEP) 2020 in Transforming Higher Education' was held at New Delhi in September, 2020. The conference was organized by the Department of Higher Education, Ministry of Education of the Government of India. In the interaction with the Governors and

Lieutenant Governors, specially the Governor of Manipur, stated that the New Education Policy-2020 will certainly be a landmark in the history of education in India, for the policy is comprehensive, holistic, far sighted and will certainly play a key role in the Nation's future growth. This Policy was passed after more than three decades- the first one was framed in 1986 and modified in 1992. During this period of more than three decades, significant changes were noticed in our country pertaining to socio-economy and the globe at large. Therefore, it appears quite legitimate that the education sector also needs to strengthen itself towards the demands of the 21st century and the needs of the people and the country. "Quality education as well as innovation and research will be the pillars on which India will become a knowledge superpower. It is, in this context, a New Education Policy is needed at this juncture". The Government of India, mooted the process

of drafting a New Education Policy, to begin with, through the consultation process in which expert opinions, field experiences, stake holder feedback as well as lessons learned from best practices were taken into consideration. "The policy is welcomed by one and all by different scholars of the country of the several different fields which seeks to transform India into a vibrant knowledge society. It is a matter of pride in nation as well as acceptance of the best ideas and practices in the world of learning from across the globe.

The Government of India had taken initiative in January 2015 and the actual consultation process for the New Education Policy was started under the chairmanship of former Cabinet Secretary Shri T. S. R. Subramanian. Based on the committee report, in June 2017, the draft NEP was submitted in 2019 by a panel led by former Indian Space Research Organization (ISRO) Chairman Dr. K. Kasturirangan. The Draft New Education Policy (DNEP) 2019 was then released by the Ministry of Human Resource Development (MHRD), followed by a number of public consultations. Thereafter, the Ministry undertook a rigorous consultation process in formulating the draft policy. In the process of emergence, the new education policy document has been updated, revised and finally approved on 29th July, 2020.

The new education policy is proposed with the goal to formulize convert within the system from lower to higher level [5, 6]. The new education regulatory structure will confirm that distinct administrative, accreditation, financing and academic standard- setting roles are performed by separate, autonomous and empowered bodies.

### **Aim of the study**

The primary aim of this work is to study the outlines of the salient features of NEP and overview how they affect the existing higher education system [5]. The National Education Policy is projected to take encouraging and ongoing effect on the system of higher education. Some salient features are:

1. National Testing Agency (NTA) will conduct the Common Entrance Examination for all higher education institutes.
2. The NEP 2020 designs to determine Higher Education Commission of India [6] which is a single

regulatory body excluding medical and legal education.

3. For those who wish to leave the course in the mid, there will be various entry and exit possibilities. Academic Bank of Credits will transfer their credits.
4. Technology is going to be part of education planning, teaching, learning, assessment, teacher, school and student training. Three-content to be offered in local languages, opening with 8 main languages.
5. A PTR (pupil-teacher ratio) of under 30:1 will be assured at school level; while it will be under 25:1 for areas having large number of socio-economically disadvantaged students.
6. Higher Education Council of India (HECI) will be setup to manage higher education. The council's goal is going to be to increase gross enrollment ratio.

### **The HECI will have these steps:**

- (i) National Higher Education Regulatory Council (NHERC), to regulate higher education, including teacher education, while excluding medical and legal education.
- (ii) National Accreditation Council (NAC), a "meta-accrediting frame".
- (iii) Higher Education Grants Council (HEGC), for funding and financing of universities and colleges. This will replace the existing National Council for Teacher Education, All India Council for Technical Education and the University Grants Commission.
- (iv) General Education Council (GEC), to boarder "graduate attributes", namely the training outcomes expected. It'll also be responsible in framing a National Higher Education Qualification Framework (NHEQF). The National Council for the Teacher Education will come under the GEC, as a knowledgeable standard setting body PSSB.

### **Analysis of NEP 2020 on Higher Education**

- A large modification in NEP is the offer to build up the Higher Education Commission of India (HECI) [4,5].

### **The importance of NEP 2020 may be concluded under the following points:**

- Higher Education Regulation.
- A single regulator for higher education combining UGC and AICTE will ensure that higher education

institutes can start offering multi-disciplinary courses as per the choice of the student.

- Fresh research scholars will effectively gain teaching education and experience because most of the Ph.D. holders go into academia along with further research. The objective is to increase the quality of Ph.D. holding teachers also as “mentors” and “guides”.
- Supportive research will be smooth combining the gap between post-graduation and Ph.D. by scrapping M. Phil. and more encouragement of research through new defined roles of NRF. The objective here is to foster the spirit of research and innovation among youth.
- Regulatory bodies (NAAC, UGC, NCTE, ICMR etc.) emerged to effectively regulate categories of Higher Education Institutions.
- R and D to be encouraged from the under-graduation level through giving special research-oriented recognition in the for the sole purpose of funding research and monetary encouragement of research such as scholarship and stipend.
- The NEP 2020 states that all capacities of human beings-intellectual, aesthetic, social, physical, emotional, and moral in an integrated manner. Such an education will help develop well-rounded individuals that possess critical 21st century capacities in fields across the arts, humanities, languages, sciences, social sciences, and professional, technical, and vocational fields; an ethic of social engagement; soft skills, like communication, discussion and debate; and rigorous specialization during a chosen field or fields. The NEP envisions on enlarge multidisciplinary Education Institution HEI in or near every district, by 2030.
- In view of the NEP scheme, a UG degree in any institution is going to be of duration of three or four years. One can leave the degree within this duration. Any institution will have to give to the student a diploma degree after the student completes two years of study, a degree after the scholar completes three years of study and a certificate to those students who complete one year of study in any professional or vocational course of their choice. The Government of India will also help in establishing an Academic Bank of Credit for storing the academic scores digitally. This may enable the institutions to count the credit at the end and put it in the degree of

the student. This may be helpful for those individuals who might have to leave the course mid-way. They will start the course later on from where they left off and not start from the beginning once again. Although NEP says that Higher Education Institutions will be given the freedom to start PG courses.

## Conclusion

The New Education Policy moves an entire scope of changes and reads generally as a very developing document, with a firm hold on the present socio-economic landscape and the prospect of future uncertainty. Education for a replacement generation of learners has to essentially engage with the increasing dematerialization and digitalization of economies, which needs a completely new set of capabilities in order to be able to keep up. This seems to be more vital prerequisite now, with the trend towards digitalization and disruptive automation being quickened by the pandemic. Overall, the NEP addresses the necessity to develop the professionals in a variety of fields ranging from Agriculture to Artificial Intelligence. India must be ready for the future and therefore, the NEP paves the way ahead for many young aspiring students to be equipped with the right skill set.

The new education policy features a laudable vision, but its strength will depend upon whether it is able to effectively integrate with the other policy initiatives of government like Digital India, Skill India and therefore New Industrial Policy to name a few, so as to effect a coherent structural transformation. Hence, policy linkages can make sure that education policy addresses to and learns from Skill India's experience in engaging more dynamically with the corporate sector to shape vocational education curriculum in order to make it a success. The NEP may be a defining moment for higher education. Effective and time-bound implementation is what will make it truly path-breaking.

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Scientific articles are invited from faculty members and scientists related to engineering branches, namely, Electrical engineering, Electronics, Communication Technology, Instrumentation and Measurement, Information Technology, Computers, Mechanical Engineering, Robotics and allied disciplines. In-depth review articles providing a global overview of a particular topic are welcome.

## **Submission Guidelines**

Soft copies of the articles generally, limited to 3000 words in Word format are invited. IEEE style of preparation of the manuscript will be followed. Equations should be composed using 'Equations Editor', Figure captions should not form part of the figures. They should be composed separately at the bottom of each figure. Tables should be serially-numbered and put together at the end. References should be compiled and cited as per the IEEE style.

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