

A Review on Artificial Neural Network Based Local and Global Enhancement Technique for Dark Images

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Abstract

The improvement of images is significant in computer vision since it assists the machine with seeing better. The contorted image, the blurred image, and the clamor image affect the clinic determination of image information, the satellite image for gaining data, and the image information for getting data from a satellite. Different creators and scholastics have suggested image upgrade procedures like histogram equalization, multipoint histogram equalization, and other neural network-based ways to deal with further develop image quality. Expanding the difference of a image is planned to work on the properties of the image. In different cases, contrast upgrade may not be adequate in light of the fact that the handling of high differentiation images needs a lot of time and computational resource for each image. This contains a programmed framework that recognizes photos with low contrast and those with high contrast to further develop all-image features. The quality of photos is likewise impacted by outer element like brightening, equipment, and different variables during the image handling and transmission process. Images are transformed utilizing techniques, for example, tone correction to work on the contrast of images and increment clearness in dull regions. Image enhancement is a type of image processing system that transform images utilizing strategies, for example, tone correction to work on the contrast of images and increment lucidity in dull regions. With regards to image improvement, global image contrast enhancement is perhaps the most by and large utilized system to further develop image quality, while local image clearness approaches are very useful with regards to identifying a specific issue. Whenever either local contrast enhancement or global contrast enhancement are utilized in isolation, the brightness of the image is lost therefore. Another system is presented utilizing both local and global methods of expansion with artificial neural network, which depends on a similar image as the past one. It has been exhibited that the use of neural networks in image enhancement further develops pressure effectiveness far beyond any remaining standard enhancement technique.

Keyword: Image Enhancement, Dark Image, ANN, Image Contract, Image Quality

1. Introduction

Digital image processing is the most common way of changing digital images into different configurations using computer algorithms. Input data can be handled utilizing an impressively bigger range of algorithms, and issues, for example, noise build-up and signal distortion can be kept away from accordingly. A pioneering application of digital image was in the paper business, when images were first sent among London and New York by submarine link as soon as the 1950s. An image is a two-dimensional represented of a subject that generally gives the subject the presence of a substantial thing or an individual. In digital form, it is addressed by a dot matrix, which is comprised of square shapes that are organized in row and columns. The noise that happens during the processing, transmission, and capacity of digital photos is ordinarily misshaping the images. These sounds can significantly affect image processing tasks like division of images, edge detection, and object acknowledgment, in addition to other things. The essential objective of image enhancement is to handle an image so that the output is more reasonable for a particular application (i.e., more problem oriented) than the first image, or to bring out unambiguous components of a image or to feature explicit elements of an image. Some notable optical commotion channels have been presented as of late for use in many kinds of image processing system, including average filters, Wiener filters, Median filters, Discrete Fourier transform, Discrete cosine transform, Discrete wavelet transform, etc. The Wiener filtering, utilized as a standard linear filtering, may productively smooth Gaussian noise, however it makes images become blurry and affects the end of different noise, for example, impulse noise and Salt and Pepper noise. Because of their gainful impact on the processing of impulse noise and Salt and Pepper noise, nonlinear filters, for example, Median filtering were likewise utilized in image processing applications. There are two fundamental kinds of image enhancing strategies that you can portray: (I) Enhancement of the spatial domain (ii) Enhancement of the

domain transformation. The objective of image enhancement is to cause to notice specific subtleties and edges. In spite of the fact that cover convolution is a generally utilized approach, choosing further developing data in the spatial domain at various scales is troublesome with this technique. Point of fact, utilizing different veil approaches in the spatial domain will bring about a wide range of enhance results. Transformation domain improvement procedures involve moving image power information to a particular change space using changes like the 2-D discrete cosine change (DCT), Fourier transformation [1], and other comparable changes. The essential idea driving utilizing this technique is to work on the nature of an image by changing the coefficients of a transformation. As of late, various transform-based augmentation systems have been created and carried out. Because of this image enhancement, there is more noteworthy adaptability in how the photographs are dealt with. In case of poor visual images, low contrast and brightness images make it harder to dissect a particular district of the image. Image improvement gives more prominent assortment in the manner images are dealt with. Real-time applications, for example, consumer electronics, medical image and sickness examination, cloud image investigation, spatial image analysis, computer industry imperfection distinguishing proof and validation, biometric[2] security confirmations, and different applications, improvement advancements are often utilized. Having local image data is incredibly vital while working with medical; or cosmic images, as it takes into consideration the examination and recovery of that image data, as well as the precise identification of infections while utilizing a cell image for symptomatic purposes. To give clear and exact image data, the nature of a image can be expanded as science and innovation advances, especially in the field of sign handling and image enhancement. [3] While the global method for contrast stretching is exceptionally normal in image improvement, it doesn't give agreeable image quality to survey motivations. This is on the grounds that the global technique for contrast stretching centers fundamentally on global image subtleties, which are generally image data, and disregards local image subtleties. These outcomes in an absence of nearby image subtleties. The nearby methodology builds the local image subtleties that are given as a small variety in the image and gives the moment image data by giving the moment image data. It's missing from the general pixel improvement detail, which is frustrating. In this mixed calculation, one calculation is tending to the conflict of another calculation. The neighborhood approach, which isn't portrayed in the worldwide framework, is utilized to manage the moment image data that is available. The leveling of a histogram in a image is a profoundly normal and powerful strategy for working on the image. To keep up with splendor, the difference upgrade methods in view of histogram balance were acquainted in[4] with further develop contrast. In particular, in [5, the histogram is evened out for every single level freely. The strategy depends on the spatial area of an image. It is feasible to deal with images in the spatial space, implying that image handling is led straightforwardly on every pixel of the image as opposed to on the other changed area. One interesting method can't be utilized as an all-inclusive procedure that can be applied to all image types since it is excessively unambiguous. Upgrade gives more noteworthy assortment in the manner images are dealt with. Different constant applications, for example, buyer hardware, clinical image and infection examination, cloud image investigation, spatial image investigation, PC industry imperfection ID and recognizable proof of biometric security confirmations (among others), utilize improvement advances. The neural organization's tendency is versatile and variation; because of this nature, the past image pixel esteem has been kept while the planned image upgrade target has been characterized. A few strategies of upgrade utilize a solitary layer of neural fake organizations, while others utilize diverse neural counterfeit organizations. ART[6] is an illustration of a paired image upgrade organization. Summed up feed-forward fake neural organization (ANN) execution of morphological image tasks using shunting systems (neurons working as switches), which is depicted here.

2. Literature Review

Writing review deciphers old data and gives a combination of new and old data. Consequently, there is a short outline of various research papers in this part and the frequency of research papers review and combination. MdtyhBrendel and TancisRoskaentilted "adaptive image detecting and improvement utilizing the Universal Computer Adaptive Cellular Neural Network," a framework for upgrading the image utilizing pixel balance and neural network[7]. The framework can be utilized for versatile image detecting control as well with respect to ensuing image improvement. The algorithm likewise involves material regarding strength and difference. The methodology is totally implementable on the Universal Computer Adaptive Cellular Neural Network (ACNNUM) design. The two strategies basically utilize a similar equalization strategy as applying the base image intensity and contrast data. The equalization masks are resolved by means of the CNN-UM utilizing the diffusion method. The algorithm is appropriate for the dissemination of the ACNN-UM which is the most tedious capacity. In this manner the utilization of the right now accessible CNN-UM chip significantly accelerates the activity. Then again, the strategies gave are of sensible quality, as the example images delineate this. The radius of adaptation can be controlled when or advantage of dissemination in the algorithms, henceforth all transitional cases between complete global and local equalization are dynamically present. Her-Chang Pu, Chin-Teng Lin, Sheng-FuLiang

and Nimit Kumarentitled[8] "ANovel Neural-Network-Based Image Resolution Enhancement," a novel adaptive interpolation plot for normal image in view of the HVS-directed neural network is proposed. A fuzzy decision system created from the attributes of the human visual system (HVS) is proposed to group pixels of the input image into non-sensitive class perception and sensitive class Digital image with supervised learning algorithm are utilized to naturally prepare the proposed neural network. Results from reenactment demonstrate the way that the proposed new goal improvement algorithm can accomplish higher visual nature of the interjected image than conventional strategies for introduction. It is proposed that the fuzzy decision guidelines motivated by the human visual system (HVS) analyze the responsiveness of the human eyes to the addition image. The proposed HVS-directed neural network - based insertion is better than customary strategies, for example, bilinear and bi-cubic interpolation in specific parts of visual quality like clearness and perfection in edge areas, as well as the visual nature of the interpolated image, as per the examination results. Besides, along with the neural network, the proposed fuzzy decision guidelines will adjust the compromise among speed and efficiency for different applications by just changing a threshold parameter. S. Chitwong, F. what's more, T. Boonmee. The subject of clustering or segmentation in image improvement is tended to in Cheevasuvitentitled[9]"Local area histogram-based multispectral image upgrade from clustering utilizing serious jump field neural network. A clustering or segmentation method is one of the fundamental issues for enhancing image in light of the local area histogram equalization (HE). That is, the more accuracy it takes to partition the image into indicated classes, the better the upgrade effectiveness. The competitive Hopfield neural network (CHHW) is then proposed for clustering 10 the LHE subordinate image improvement as expressed objective in this paper. Trial discoveries are seen in both clustering exactness and improved image difference by utilizing simulated image, regular image, and multispectral image from Landsat 7 satellite. The necessities for a decent improvement algorithm are the low difference in smooth and edge regions, in the event that it can offer high change exhaustively region. Looking at both LHE and global area histogram equalization (GHE) strategies to the fluctuation of the improved image additional uncovers that one beats from LHE. In addition, perception obviously shows the extended image foam little locale. Balancing the histogram from the local area by these clustering methods, CHNN shows that not exclusively is the clustering precision essentially better exact in the reenacted image, yet additionally the exhibition upgrade beats the standard image when contrasted and FCM in all clusters. For TM image, not exclusively is the change of FCM more prominent exhaustively than that of CHNN, however it is as yet higher in the smooth and edge regions. Accordingly, CHNN has moved better as the reasons expressed. Adin Ramirez Rivera, ByungyongRyu, "Content-Aware Dark Image Enhancement by Channel Division"[10], The new contrast enhancement algorithm frequently bring about curios, over-upgrade, and undesirable impacts in the image handled. Such disservices are that for photos taken under unfortunate states of brightening. They propose a substance mindful algorithm that upgrades dull images, hones edges, uncovered data in areas of surface, and jelly level districts' perfection. For each image the algorithm plays out a specially appointed change, adjusting the planning capacities to the attributes of each image to accomplish the ideal improvement. In limit and finished locales, we break down the contrast of the image, and gathering the data with normal elements. These gatherings model the connections inside the image, from which we extricate the function of the change. Then, at that point, the outcomes are adaptively consolidated to work on the information in the image, thinking about the attributes of the human vision system. Results demonstrate the way that the algorithm can consequently handle a wide assortment of image without adding objects, which is an improvement over other regular methodologies, like blended shadow and brilliant regions, outdoor and indoor lighting, and face image. Shin and Jeong (2014) [13] presented a content awareness technique-based variety image improving technique. adaptive gamma rectification on the lighting parts relying upon pixels works on the image's splendor. Reflectance parts are likewise used to reestablish the image' detail and variety. Utilizing a hybridization of local and global cycles, Xu et al (2008) [14] fostered a variety image enhancement strategy. Three local handling procedures, like HE, linear stretching, and local include based enhancement, are utilized with impressive changes to build the subtleties in the characterized area of interest. To all the more likely answer local highlights in variety image, a predefined work in view of edge intensity is utilized to achieve global differentiation increase.

3. Local Enhancement of the Image

To separate the moment data from a solitary image, local improvement is performed. It works on local subtleties concerning image angle and gives valuable data to the image expert. It centers around the pixels that a globalized approach would neglect. Non-sharp masking[8] is the sort of local improvement applied here. Un-sharp masking is a procedure for honing a image by deducting an un-sharp image from the first image, which is an obscured or smoothed image. The stages engaged with this strategy are as per the following:

1. The vision is becoming foggy.

2. To make the mass, the obscured image is deducted from the first image.
3. The first image was given a mask.

Assuming that the obscured image is signified by $b(i,j)$ and the image is addressed by $p(i,j)$, the cover $m(i,j)$ is given by condition (1).

$$m(i, j) = p(i, j) - b(i, j) \quad (1)$$

The weighted portion of the mask is added to the original image to get the sharpened images (i,j) given by equation (2).

$$s(i, j) = p(i, j) + w * m(i, j) \quad (2)$$

Where 'w' represents weight, which is typically more prominent than nothing. Un-sharp masking happens when the weight is equivalent to one, while high lift sifting happens when the weight is multiple. This honed image is taken care of into the global contrast process for additional image quality improvement or to build the image's visual quality.

4. Global Enhancement of the Image

The image contrast is further developed utilizing the image's global enhancement. Every pixel of the image is refreshed thusly to give a superior portrayal of the image. The strategy of further developing spatial contrast is completed straightforwardly on the pixel. The pixels are set with the end goal that they are equitably conveyed across the necessary intensity level spectrum. As an overall strategy for image improvement, the global contrast stretching method it is applied to extend technique. Numerous global procedures exist, like histogram equalization (HE), restricted contrast adaptive histogram equalization (RCAHE), and numerous other change strategies, like discrete cosine transformation (DCT), discrete shear let change (DST), adaptive inverse hyperbolic tangent transformation (AIHT, etc. HE is the most frequently used global methodology among these [8]. Any of the strategies can be used to work on the overall image. They didn't search for the image's local qualities in the provincial methodologies in general; all things being equal, they searched for the image's global realities. Along these lines, utilizing the essential HE, we'll initially apply the local enhancement to approve the algorithm. It isn't important to use just this method for expanding image quality; different strategies might be utilized. The probabilities of the pixel value are taken in HE for the discrete image. To work out the probabilities, the comparing number of pixels should initially have a predefined pixel intensity value, which is estimated and isolated by the all-out number of pixels in the image. The opportunity of a pixel intensity level 'k' happening in a computerized image is given by condition (2).

$$p(r_k) = \frac{n_k}{N * M} \quad (3)$$

Where $N * M$ is the total number of pixels in the image and n_k is the total number of pixels having intensity level 'k'. The pixels are transformed according to the following transformation equation in discrete form [8].

$$t_k = L(r_k) = (G - 1) \sum_{i=1}^k p(r_i) = \frac{G - 1}{N * M} \sum_{i=0}^k n_i \quad (4)$$

here 'G' is the most intensity force level or value, $L(r_k)$ is the change function and $k = 0, 1, 2, 3, \dots, G-1$. In this way the result pixel image is gotten by mapping each input pixel r_i to the new changed t_k value. The handled output value that has a fractional value, so an adjusting function is expected at the closest whole number. A portion of the pixels of the image that go to the new value doing as such, and a portion of the pixel intensity values may not be available in the changed image.

5. Artificial Neural Network (ANN)

Machine learning algorithms, like artificial neural network (ANNs), 6 shown that they are equipped for revealing inborn interdependency portrayals inside raw information that are not unequivocally introduced or even understood by the human framework. ANNs had the option to be applied to the assignment of image enhancement in view of their novel element, which was joined no sweat with which they could be assembled and prepared, as well as their very fast reaction time. Due to their inborn nonlinearity, artificial neural network (ANNs) is fit for dealing with the muddled communications between

factors that influence pixels in images[1]. With regards to making sense of the connections between the input variable and the input image, there is no requirement for modern utilitarian models to be utilized. As of late, the utilization of artificial neural network (ANNs) has been proposed as an option for factual methods to grouping and image processing problems[3, 4].The upsides of artificial neural networks (ANNs) over statistical methods incorporate their protection from the suppositions of likelihood conveyance, their capacity to group within the sight of nonlinear connections, and their capacity to perform sensibly well while working with inadequate databases[6, 7]. Following the examination of neural networks to other conventional methodologies, for example, histogram equalization out or autoregressive models, the discoveries uncovered that neural network are a feasible option in contrast to other customary methodologies like histogram equalization or autoregressive models. In this review, flowed artificial neural networks (ANNs) are used to improve photos while keeping up with splendid contrast. A procedure got back-propagation algorithm is carried out in the ANNs. This algorithm is a gradient-decent technique that might be handily applied to structure with smooth, monotonically isolated move capacities like sigmoid and hyperbolic tangent.

• **KNN Classifier**

Instance based classifier, for example, the KNN classifier works in the vicinity that the order of obscure occurrences is frequently finished by relating the obscure to the recognizable as per some distance/closeness work. The instinct is that 2 cases such a lot of separated in the example space characterized by the reasonable distance work are less most likely than 2 instance arranged occasions to have a place with a similar class. The motivation behind the k Nearest Neighbors (KNN) algorithm is to involve a database in which the information focuses are isolated into many separate classes to anticipate the arrangement of new example point Structure of an artificial neuron, worked out by McCulloch and Pitts in 1943 [22], is similar to biological neuron (Figure 1).

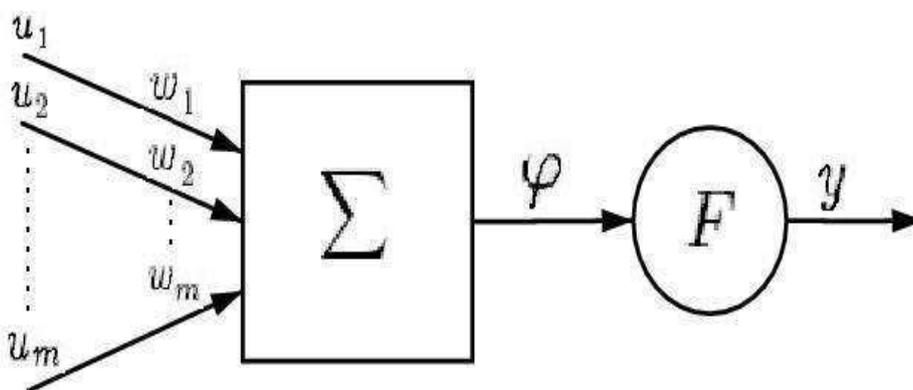


Figure 1: Mathematical Model of a Single Neuron

It comprises of two modules: summation module Σ and activation module F . Generally, the summation module compares to biological nucleus. There variable based algebra summation of weighted input signals is understood and the output signal ϕ is produced. Output signal can be determined utilizing the equation,

$$\phi = \sum_{i=1}^m w_i u_i = w^T u \quad (5)$$

Where w is the vector of loads (neurotransmitters same), u - vector of input signals (dendrites same), m - number of input sources. Signal ϕ is handled by the activation module F , which can be indicated by various capacities as per needs. A basic linearfunction can be utilized, then the output signal y has structure

$$y = K \phi \quad (6)$$

Where k is coefficient, Networks utilizing this function are called Madeline and their neurons are called Adaptive linear component. They are the least difficult network, which have tracked down function application. One more kind of the enactment module function is a threshold function

$$f(x) = \begin{cases} 1, & \varphi > \varphi_h \\ 0, & \varphi \leq \varphi_h \end{cases} \quad (7)$$

Where φ_h is consistent threshold value, notwithstanding, capacities which portray a non-linear profile of biological neuron all the more definitively are a sigmoid capacity

$$y = \frac{1}{1 + e^{-\beta\varphi}} \quad (8)$$

Where β is given parameter and a tangensoid function,

$$y = \tan h \left(\frac{\alpha\varphi}{2} \right) \frac{1 - e^{-\alpha\beta}}{1 + e^{-\alpha\beta}} \quad (9)$$

Where α is given parameter. Information capacity and processing ability of a single neuron is relatively small. In any case, it tends to be raised by the proper association of numerous neurons. In 1958 the primary ANN, called perceptron, was created by Rosenblatt. It was utilized for alphanumeric character recognition. Albeit the outcomes were not good, it was fruitful as the principal framework constructed, which reenacted a neural network. Rosenblatt has likewise demonstrated that on the off chance that a given issue can be addressed by a perceptron, then the arrangement can be seen as in a limited number of steps. After distribution of the book "Perceptron's" by Minsky and Paper in 1969 examination in the space of ANNs had ground to a halt. The creators demonstrated that perceptron's can't tackle directly non-distinct issues (e.g., process a XOR-function). Research has been continued after just about 15 years by a progression of distributions showing that these limits are not material to non-linear multi-layer networks. Compelling learning strategies have likewise been presented. Neurons in the multi-layer ANNs are assembled into three distinct kinds of layers: input, output, and hidden layer (Figure 3). There can be at least one hidden layer in the network however just a single output and one input layer. The quantity of neurons in the input layer is indicated by the sort and measure of information which will be given to the input. The quantity of output neurons compares to the kind of reply of the network. The quantity of hidden layers and their neurons is harder to decide. A network with one hidden layer does the trick to settle most errands. None of the realized issues needs a network with in excess of three hidden layers to be settled (Figure 3) from the neurons in the input layer (IL) signals are engendered to the hidden layer (HL) and afterward at long last to the output layer (OL). There is no decent recipe for the quantity of hidden neurons determination. One of the techniques is portrayed by formula

$$N_h = \sqrt{N_i N_o} \quad (10)$$

Where N_h is the quality of neurons in the hidden layer, and N_i and N_o are the relating numbers for the input and output layers, respectively? However, usually the quantity of hidden neurons is determined empirically. Two types of a multilayer ANNs can be distinguished with regards to the architecture: feed-forward and feedback networks. In the feed-forward networks signal can move in one direction only and can't move between neurons is a similar layer (Figure 3).

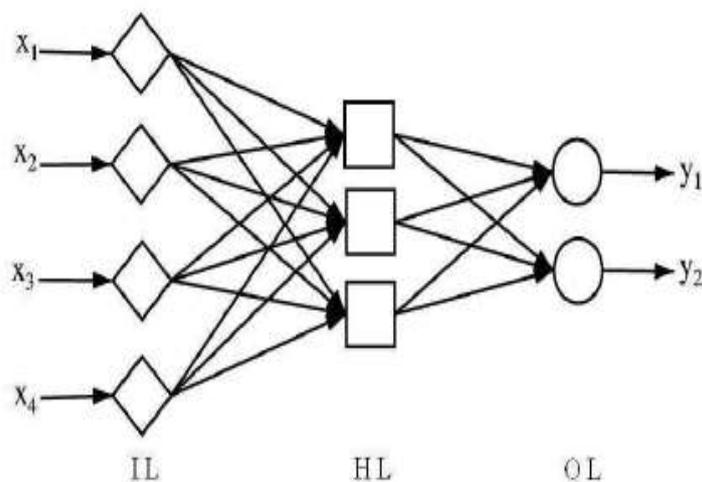


Figure 2: Multilayer feed-forward ANN

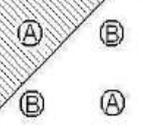
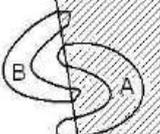
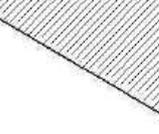
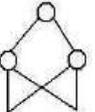
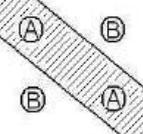
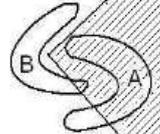
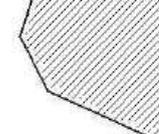
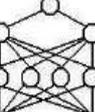
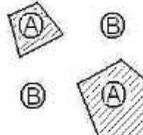
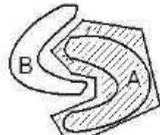
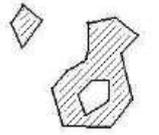
Structure	Type of Decision Regions	Exclusive-OR Problem	Classes with Mesned Regions	Most General Region Shapes
Single-layer 	Half plane bounded by hyperplane			
Two-layers 	Convex open or closed regions			
Three-layers 	Arbitrary (Complexity limited by number of nodes)			

Figure 3: Selection of the number of layers for solving different problems

Such network can be used in the pattern recognition. Feedback networks are more complex, because a signal can be sent input of the same layer with a changed value (Figure 4). Signals can move in these loops until the proper state is achieved. They networks are also called interactive or recurrent.

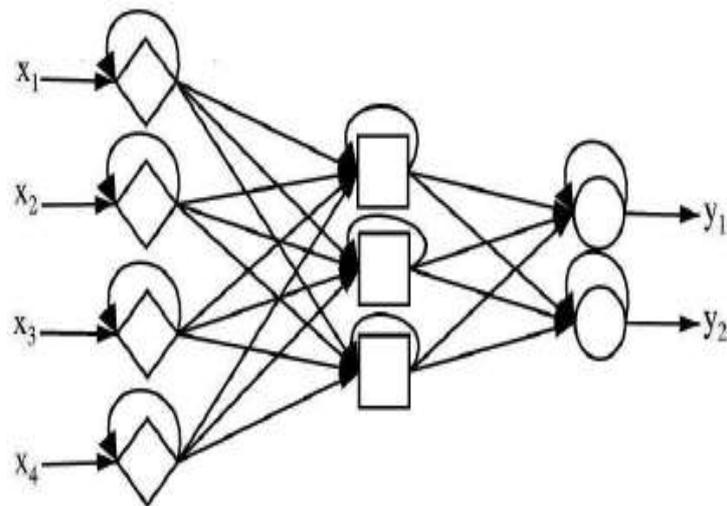


Figure 4: Multilayer feed-forward ANN

3.6 ANN Classifier

Wide scopes of classifiers are accessible and every single one of them has its assets and shortcomings. Classifier execution relies enormously upon the attributes of the information to be arranged and there is no single classifier that takes care of best on totally given issues. Different exact tests have been performed to contrast different classifier execution and with figure out the connection between qualities of information and the classifier execution. Deciding a reasonable classifier for a given issue is anyway even more a craftsmanship than a science. In thesis work, two neural networks are utilized as classifier, Back-propagation neural network (BNN) and Auto-associative neural network (AANN).

3.6.1 Back-Propagation Neural Network (BPNN)

Back-propagation neural network is the neural network, as it is basic and viable. Back-propagation is the speculation of the Windrow-Hoff learning rule to multiple-layer networks and nonlinear differentiable transfer capacities [12]. The hidden and output layer hubs change the loads esteem rely upon the blunder in characterization. The alteration of the loads is as per the inclination of the blunder bend, which guides toward the path toward the neighborhood least. BNN is benefit on forecast and grouping yet the handling speed is slower contrasted with other learning algorithms.

3.6.2 Auto-Associative Neural Network (AANN)

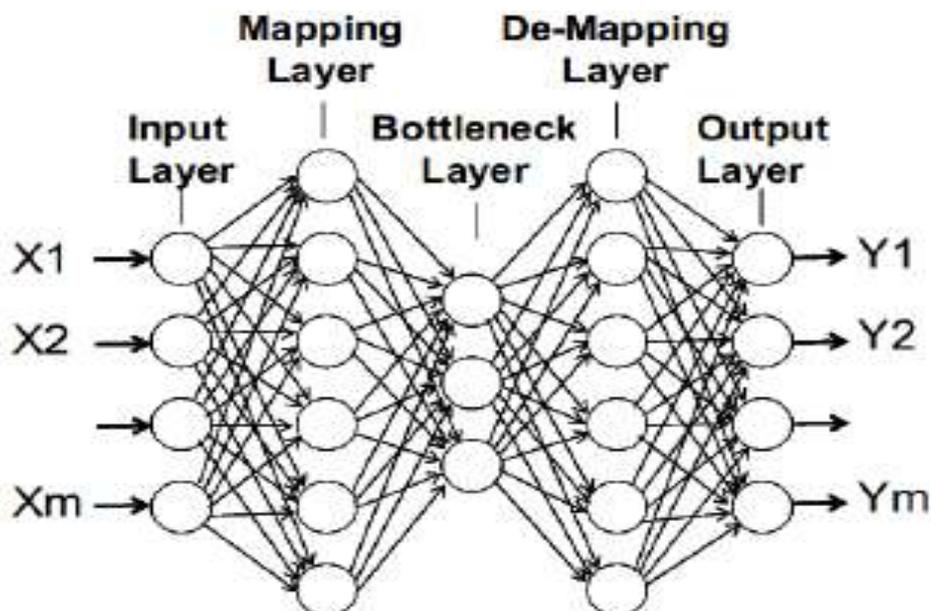


Figure 5: Structure of AANN

Auto-cooperative neural network is a network made of equivalent size of the input layer and the output layer, and more modest size in hidden layer. The design of AANN is displayed on Figure 5. The input layer and mapping layer structure a pressure organization and the De-mapping and output layer go about as a decoder network. Not at all like the others is neural network, the ideal output of AANN character from the input.

6. Conclusion

In this exploration, we look at the method of image improvement in view of the utilization of a neural network and its application. Notwithstanding image enhancement, neural networks assume a fundamental part in image enhancement. To work on visual impressions, the locally enhanced image is sent into the global enhancement algorithm, which helps the brilliance to a level that is satisfying to the natural eye. In this review, the various methods of local and global image improvement with ANN were tried, and the adequacy of every still up in the air for the different local and global enhancement technique. Image enhancement is the method involved with changing a image to work on its portrayal for use in exceptional circumstances. The handling of a image's primary qualities, like its contrast and resolution, is remembered for the cycle.

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