



## Investigating the Application of Soft Computing in Skin Cancer Diagnosis

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### Abstract

Skin cancer is one of the foremost important causes of passing within the world. Skin cancer is one of the cancers. In expansion to being unsafe, it can moreover influence a person's self-confidence and magnificence. Luckily, the indications of this infection can be recognized early. Ponders appear that the utilize of advanced computer innovations such as picture preparing components have been effective within the forms related to the determination and classification of cancers. The reason of this consider is to examine the utilize of computing is delicate within the conclusion of skin cancer, in this manner, in this extend, we utilize dermoscopic pictures of skin injuries and preparatory preparing (1-remove additional foundation, 2-remove clamors and names in pictures, 3-remove bubbles and oil from pictures, 4-increase the quality of pictures) Their handling is based on surface and shape highlights and the reduction of dimensions of Barosh's LDA (Direct Discriminant Design Examination) which we have utilized to discover the most excellent highlights from among the highlights that we have extricated from the multi-objective hereditary calculation of non-dominant positioning (NSGA-II), which concurring to the significance of the subject in expansion It has tall speed and exactness, and by preparing a neural arrange after mistake engendering, we planned a framework that's a reasonable elective for domestic conclusion and comparative strategies due to its tall exactness and speed of conclusion.

**Keywords:** skin cancer, collective insights calculation, delicate computing

### Introduction

Skin cancer has grown significantly over the past decades, and the importance of early treatment is increasing day by day. Melanoma is the most serious type of skin cancer that occurs in melanin-producing cells. Knowing the warning signs of skin cancer can ensure that cancerous changes are detected and treated before the cancer spreads. Diagnosing skin cancer is very difficult due to the appearance of different types of skin lesions, especially in melanoma and nevi. Even with dermatoscopy, which is a non-invasive testing technique, the accuracy of melanoma diagnosis by dermatologists is 75-84%. Considering that sampling and invasive methods lead to an unpleasant experience for the patient, researchers have proposed non-invasive methods for melanoma diagnosis (Taghipour and Majidzadeh, 2002). Cancer, as a hard-to-treat disease, has occupied human thought for a long time. Cancer occurs when cells



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in a part of the body grow uncontrollably, divide rapidly, and move to different body tissues. They invade and spread throughout the body. A collection of these uncontrollable cells is called a tumor. Skin cancer is a complication of the group of cancers, which is more common today than some other common types of cancer. Skin cancer is the abnormal growth of skin cells that often occurs in skin exposed to the sun (Karmi Mehrian, 2023). In 2023, sarvin maashiyan et al conducted a study entitled examining the differences between iran's criminal laws and international documents on temporary detention orders(sarvin maashiyan et al,2023). In 2021, Adalatkah et al conducted a study entitled Comparison of Low-Dose Treatment of Isotretinoin and Flutamide Combined with Oral Erythromycin for Female Patients with Severe Acne(Adalatkah et al,2021).

Melanoma is one of the foremost perilous shapes of skin cancer. This sort of cancer is 100% repairable in the event that analyzed early. But in case it gets to be forceful and spreads to other body tissues, it'll not be conceivable to treat it. Skin cancer is considered one of the foremost unsafe sorts of cancer within the world. Visual determination is the essential way to distinguish the plausibility of skin cancer. In this cancer, in the event that a suspicious skin injury is found, the specialist takes a biopsy from the unmistakable injury on the skin and looks at it infinitesimally for determination. Not at all like this method, doctors utilize the shape of skin spots to analyze skin cancer. This method is to require clear photographs of the shape of the skin injury, which is within the shape of dull spots. Be that as it may, this strategy faces numerous issues, the foremost imperative of which is the need of exactness in determining the nature of the injury due to the encompassing conditions, such as the nearness of hair, blood vessels, and rectify lighting. , the need of capacity to make the spot accurately. The closeness of the shape of the spots between cancerous and non-cancerous infections is additionally one of the challenges of these strategies. The most issue for diagnosing skin cancer utilizing medical images is the classification of prolific and kind pictures. It could be a tent and its fundamental reason is to play down the classification mistake (Sarhadi and Ghaffari, 2023). In this manner, within the display consider, the utilize of delicate computing within the conclusion of skin cancer was explored.

## **Literature review**

Taghipour and Majidzadeh conducted a study in 2023 under the title of using deep learning to diagnose melanoma skin cancer in the Internet of Medical Things environment. In this research, the use of non-invasive deep learning method to diagnose melanoma skin cancer in the Internet of Smart Things environment is proposed. . This method enables IoT devices to capture skin images and use a pre-processing technique based on a Gaussian filter to remove noise. The results show that the automatic skin cancer diagnosis and classification system based on deep wavelet neural network with parameter optimization based on emperor penguin has good accuracy and speed (Taghipour and Majidzadeh, 2023).

Afrasiabi and Afkhami Nair conducted a study in 2023 under the title of skin cancer diagnosis using deep neural network. In this article, the aim is to provide a new model based on deep



networks for diagnosing and classifying its type. In this model, pre-processing is done first, then a deep network model is used for detection. In this method, data oversampling is used to equalize unbalanced data. The accuracy of this method on the MNIST HAM-10000 dataset, which contains 10,000 dermoscopic images, was 86.96%. which has improved compared to previous methods (Afrasiabi and Afkhami Nair, 2023).

In 1401, Issaei et al conducted a study titled prediction and diagnosis of melanoma and basal cell carcinoma skin diseases using deep learning methods and VGG-16. In this study, two diagnostic models of deep learning and a predetermined network were used. VGG-16 was developed to diagnose and differentiate between two types of skin cancer. The data was collected from dermatologists' offices, atlas and reliable sites. In this research, 5374 data were included in the training data set (80%) and 1344 data were included in the test data set (20%). In the deep learning method, the accuracy rate on training data was 6.99% and for test data it was 98%. After passing 10 times, the error rate was 0.07% for training data and 0.02% for test data. In the VGG-16 method, the accuracy of the VGG-16 method was 98% on the training data and 94% on the test data. After passing 10 times, the error rate was found to be 0.09% for training data and 0.39% for test data (Isaii et al., 2022).

In 1401, Jabri et al. conducted a study under the title of multi-level collective deep learning in the classification of skin cancer images. The purpose of this research is to use automatic and intelligent methods to determine the health status of people with much less time and cost. Checked and referred to a specialist if necessary. In this research, a multi-level collective deep learning method is proposed for classification of skin cancer images. In the proposed model, common deep learning models are used in two levels, and then CatBoost algorithm is used in each level to combine these models. Finally, the results of the proposed model are compared with the results obtained from independent deep neural networks as well as previous methods, and it is clear that the proposed model has performed better than other models in classifying skin cancer images (Jabri et al., 2022).

In 2022, Jafari et al. conducted a study titled Review of skin cancer diagnosis and classification methods using deep learning models. In this article, he first described the basics of skin cancer diagnosis (including the stages of disease diagnosis) and then reviewed It deals with its classification methods. Among the classification methods of skin cancer with the help of image processing algorithms in this research, we can mention the ABCDE law, seven-point checklist method, Menzies method and pattern analysis, and then skin cancer diagnosis models with the help of deep learning algorithms such as ANN, CNN , discusses and evaluates KNN and GAN. According to the recent related studies in this field, it seems that the ABCDE law is one of the most widely used image classification methods and the CNN model was introduced as the best skin cancer diagnosis model (Jaafari et al., 2022).

In 2022, Behnampour conducted a study titled Medical Image Processing for Skin Cancer Diagnosis. In this article, we have presented a computer-aided method for melanoma skin cancer diagnosis using image processing tools. The input of the system is the image of the skin lesion and then the use of modern image processing techniques to analyze the situation of skin cancer. Lesion image analysis tools investigate various melanoma parameters such as:



asymmetry, border, color, diameter, ABCD, etc. by analyzing texture, size and shape for image segmentation and its features. The parameters of the extracted features are used to classify the image as normal skin and melanoma cancer lesion (Behnampour, 2022).

### **Skin cancer is when a doctor checks your skin for any signs of cancer.**

People have similar moles on their body. A mole that looks different from other moles, is bigger than the eraser on a pencil, or seems to be harmful should be checked by a doctor because it might be cancerous. Here are some important things to remember when checking your moles:

1- Not symmetrical: Asymmetry means one half of the mole doesn't look like the other half. Moles that are natural look the same on both sides.

Border: If the edges of the mole look jagged or not smooth, or if it doesn't have a regular shape.

3-Color: A spot that is not the same color all the way around and has a different color like brown, tan, black, blue, white or red in part of it might be a cause for concern. Most moles are just one color. Khali has different colors in different areas, so a doctor should check it.

4- Size: If something is bigger than the bottom of a pencil, it is suspicious. Harmless moles are usually less than 6 millimeters in size.

Bump: If a part of the mole sticks out or is raised, go to a doctor. Malignant melanoma spots usually grow quickly and get taller. A bump that quickly grows, gets bigger or changes shape, changes color, feels itchy, or bleeds should be checked by a doctor.

### **The stages of skin cancer are as follows**

- 1- Cancer is only in the upper layer of the skin, which is called carcinoma in situ.
- 2- The width of the appendage is 2 cm (3.4 inches) or smaller
- 3- The width of the appendage is greater than 2 cm (3.4 inches).
- 4- The cancer has invaded under the skin, cartilage, muscle, bone or the surrounding lymph nodes, but has not spread to other parts of the body.
- 5- The cancer has spread to other parts of the body

### **Steps of the proposed method**

- 1-Image capture
- 2-Pre-processing
- 3-Image quality improvement
- 4-Extraction of suspicious areas and features
- 5-Using neural network for identification and learning



taking a picture

To train the network, the standard images available on [www.glabalskineatlas.com](http://www.glabalskineatlas.com), which include all the standard images used in this field, and the dermoscopy images from the last 3 years archive of Shefa Kerman Hospital were used. Increasing the quality and diagnosis of treatment is very effective.

## **Preprocessing**

Diagnosing and training the network of image analysis lawyers by the system, extra points and noises should be removed from it and the features necessary for processing should be extracted. -Increasing image quality 5-Segmentation In the pre-processing step, the image is exposed to "low level" operations. The purpose of this step is to reduce noise and reduce the overall amount of data.

### **Remove extra context**

Separating the lesion from the background is a fundamental step in dermoscopic image analysis, the goal of separating the lesion image is to separate the lesion from other parts of the tissue with minimal loss of the lesion tissue.

### **Removing noises and image labels**

Dermoscopy images have different contexts, some include labels and some do not. The gray level above the label increases the possibility of error in the diagnosis of the lesion. In this research, we have used logical operators to remove the label, which is a type of noise, and other noises.

### **Get rid of hair, bubbles, and oil in the picture.**

Skin images usually have a type of noise called Gaussian noise, which is the same for all skin images. This noise can be reduced using a filter called the Gaussian low-pass filter. In the next step, we take out things like hair and bubbles from the picture. You can use the Dullrazor program to get rid of hair and bubbles, and then see the result in a picture. During hair removal, we find and replace the black lines on the skin using statistics. In zoning, the garbage is separated from the rest of the area. One way to do this work is to use the AMSFCM method.

### **Improve how clear and detailed an image looks**

After taking out the damaged part and getting rid of unwanted stuff, we then work on making the picture look better. A lot of medical images are not very bright or clear. So, before doing any editing, it's important to make the images better. One way to do this is by using histogram expansion transfer functions on the whole image. This project uses a method that looks at each pixel and tries to expand the histogram based on the information around it. In using this method, we combined general histogram editing and the retinex model to get some benefits.



## **Segmentation means dividing something into smaller parts.**

Segmentation is a process that involves breaking down a task into smaller steps. It has three stages.

1. Taking out any extra pieces, like the background, tags, and tissues around the skin spot.
- 2- Making the image clearer by improving its quality.
- 3- Identify areas that seem suspicious and stop processing them further.

We already talked about the second step, now we will look at and explain the third step.

## **Identifying areas that are concerning and combining their characteristics while controlling how much they are studied further.**

The ABCD medical method helps doctors find out what's going on with skin spots or marks. In the ABCD law, the features of the spot, like: shape, edge, color and size of the area, are given points and the score is checked. This law says that skin images have three kinds of features: borders or shapes, textures, and colors. In this study, we combined two different textures and shapes because the dermoscope's light can change, which can affect the colors we see. So, this thing was taken out. The way the injury looks and feels is similar to how the picture looks. It is caused by changes in how light shines on it, which can happen over and over again or just once. In this project, we used four ways to find textural details and two ways to find shape details.

Texture feature: 1- The direction and frequency of the power spectrum 2- The ripple pattern transformation 3- The co-occurrence matrix 4- The matrix showing the length of components.

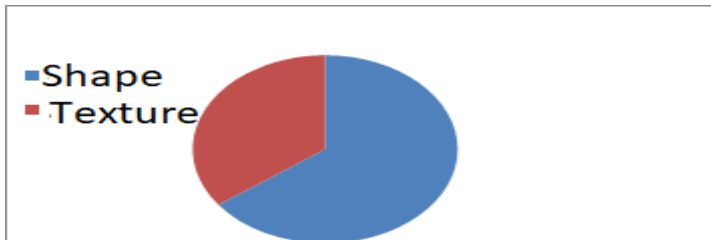
Simple Shape Features: 1- Zernike moment technique 2- NRL values

## **Texture characteristics**

To extract textural features, we first divide the lesion into several square windows; so that they do not overlap with each other and none of the windows include border points of defects; In other words, these windows will only include points inside the lesion. Texture features are extracted from these square windows. Using the obtained features, each window is labeled as cancerous or healthy tissue. Finally, by using the criteria of the majority vote, it is determined whether the lesion is cancerous or healthy. The size of the window should be selected according to the defect structure, but the volume of calculations will increase and the accuracy of the extracted features will decrease. On the other hand, the large size of the window reduces the volume of calculations and increases the accuracy of the extracted features, but it is not possible to use all the lossy texture. In the future research, the best result from the trial and error method is related to the 64x64 window.



The shape features in the textural features of the image were divided into pieces and a decision was made for each sub-piece, but in this part, the shape features are extracted from the entire boundary of the lesion in a square window to the N side.



**Figure 1: Shape and texture features**

- 1- The learning coefficient based on the shape feature includes 65% of the extracted features.
- 2-The learning coefficient based on texture feature includes 35% of the extracted features.

### **Reducing feature dimensions and choosing the most suitable features**

Out of the four dimensionality reduction methods examined in this research (MLP, pca, lda, ICA), there is more useful information in the features of LDA compared to the other three methods. In addition, with LDA, the training and testing time is more suitable than the other three transformation methods. Therefore, it can be concluded that LDA is more suitable than the other three methods. In addition, by comparing the two methods of selective dimension reduction and transformation, we noticed that in the transformation dimension reduction methods, we can achieve a better detection rate and test time than when we use selective methods, but our training time is due to the calculations related to the transformation of feature vectors. It increases. Reducing the duration of this transformation can improve the training time.

### **LDA linear discriminant model analysis**

Assume that  $S_b$  is the inter-class scatter matrix and  $s_w$  is the intra-class scatter matrix for the m-class pattern recognition problem. In this case,  $S_b$  represents the changes of expectation vectors for each pair of classes, while  $S_w$  is the distribution of samples around the expectation vector of their class. In the LDA method, it is tried to simultaneously minimize  $\text{Det}(S_w)$  and maximize  $\text{Det}(S_b)$ .

$$\text{MAX}_{S_w} \left| \frac{S_b}{S_w} \right| = \text{MAX}_{WSW} |S^{-1}| \quad (1)$$

One of the most appropriate criteria to express the separable classes is to use the differentiation matrix  $S_{WS_b}^{-1}$ , which is defined as follows:



$$T(n)=\text{tr}(S_{W}^{-1}S_b)$$

(2)

The goal in LDA analysis is to reduce the dimension of the feature vectors from the initial dimension (n) to the new dimension (m) with the help of the mxn dimensional transfer matrix A. To reach the matrix A, the new dimension is determined in such a way that T(m) is maximized. It can be shown that this is equivalent to obtaining the first eigenvector m of the discriminant matrix  $S_{W}^{-1}S_b$ . In order to reach this vector, it was enough to arrange the eigenvalues of  $S_{W}^{-1}S_b$  in descending order. The eigenvectors corresponding to the first eigenvalue m are the considered vectors.

$$\lambda_1 > \lambda_2 > \dots > \lambda_m > \dots > \lambda_n$$

$$A = [\phi_1, \phi_2, \dots, \phi_m]$$

The new feature vectors are obtained with the help of the following relation:

$$Y = AX$$

The distribution matrix for the new samples  $\tilde{S}_y, \tilde{S}_v$  shows that the new coefficients are not related to each other and are represented in a diagonal matrix. This algorithm uses the Fisher method, which is a way to pick out important features.

This algorithm aims to find a better way to organize data by choosing the right data for each category. So, there should be the same number of people as there are in the class record.

Here's how you can do it:

Finding the middle picture in each group and then finding the middle picture among all the groups.

2- Moving data back to the source: In this step, the pictures from each group are sent back to the source. For this job, we take away the pictures of each group from the middle picture of that group.

3- Shifting the middle numbers to the middle: to do this, we subtract the average of all the numbers from the average of all the numbers.

4- Creating the data matrix: In this step, all the data is put together in a line, and then all the data is put into a matrix. 5- Finding the normal orthogonal matrix: You can use the vector and eigenvalues of the covariance matrix to do this. Information or facts that are used. An average of right-angled matrix is called U.

"Please rewrite the text so that it is easier to understand. " Move the images and their middle points to the new perpendicular space..



As shown in the following relation, this work is done by multiplying the points of the data matrix in the transduction of the normal orthogonal matrix.

$$\tilde{x}=U^T x, \quad \tilde{m}=U^T \hat{m}$$

-7 Calculation of intra-class dispersion matrix: to calculate it, we obtain the sum of the covariance matrices of the transmitted images of each class and place it as the intra-class dispersion matrix. Then, the sum of these dispersion matrices is considered as the intra-class dispersion matrix.

$$S_i = \sum_{x \in x_i} \tilde{x} \tilde{x}^T, \quad S_w = \sum_{i=1}^c S_i \quad (3)$$

8- Calculation of inter-class dispersion matrix: This matrix shows the dispersion between classes and is obtained from the weighted sum of the covariance matrix of the medians of each class. The number of images in each class is the weight of that class.

$$S = \sum_{i=1}^c n_{i\tilde{m}} \tilde{m} \tilde{m}^T \quad (4)$$

9- Calculation of eigenvalues and vectors: now the eigenvalues and vectors of inter-class and intra-class scatter matrices should be calculated.

$$(5) \quad S_B V = \lambda S_W V$$

10- Selection of C-1 eigenvalue: for this purpose, we first sort eigenvectors based on eigenvalues in ascending to descending order and then select C-1 eigenvector equivalent to the largest eigenvalues, which form Fisher's basic axes.

11- Moving pictures: We are transferring the pictures to the new space using the normal axes. The important information cannot be moved using the chart from part 11.

The matrix was made to move the data, not keep the original data.

When the LDA method pulls out the image's features, it should find the cancerous ones too.

**A computer program that can solve many problems at once by finding the best solutions from different options.**

We use a special computer program to find the most important features from a large group of features. This is important for our work, so we use a method that looks at all the features to make sure we find the best ones.

The way we work and the steps we use, which is one way the genetic algorithm can solve multiple problems at once, goes like this:

Rewrite this text in simple words: 1. "Please make sure to complete the form and submit it by the deadline. " "Please fill out the form and turn it in on time. " Making the first group of people



The text is not provided. Please provide the text that needs to be rewritten in simpler words. Calculation of measures to determine how healthy or fit someone is.

Rewrite this in simple words: 3. Change this text into easier language: 3. Arranging people based on how they handle challenges.

Rewrite this text in easy words: 4. Finding out how much distance is affected by traffic and crowding.

Rewrite this text in simple words: 5. "Rewrite the text in simpler language" Choosing the best: First, we sort the main group based on how well they can survive. Then, we figure out how close they are to each other. From there, we pick the best ones based on two things.

Population rank means that some populations are chosen or placed in lower positions compared to others.

Calculating distance: if p and q are in the same place, then the one with more traffic is chosen. The order of choosing comes from the position and then from how crowded it is.

6- Where lines or paths cross and mix to make new babies.

7- Adding the original population with the population from the common areas of its faces.

8- Putting the best members of the combined population in place of the original population. In the beginning, the lower-ranking members take the place of the previous leaders and then they are determined.

$$CD[i] = \frac{(f_{i+1} - f_{i-1})}{m - f_m} \frac{(f_m^{max} - f_m^{min})}{m} \quad (6)$$

where  $CD[i]$  is the distance from the  $i$ th person on the front  $F$ ,  $f_m^i$  is the value of the objective function of the  $i$ th person on the front  $F$  and  $f_m^{max}$ ,  $f_m^{min}$  are the lowest value and the highest value respectively. The objective function  $m$  is on the  $F$  front. A better answer is to have a greater crowding distance.

By using two new operators, the regular genetic algorithm now solves multiple problems instead of just one. Instead of finding the best solution, it finds a group of best solutions called the Pareto front. These two operators do two things: 1) they put the population in order based on non-defeated sorting, and 2) they make sure there is variety among the answers that have the same rank.





1- In the first stage, the primary population, which is the statistical population in this research, is all patients suspected of having skin cancer who referred to Shefa Hospital in Kerman, and this number includes 240 people, which is determined through the Korkran formula, the sample size and the sample method Simple random sampling was used to select the sample as well as the statistical population and samples of standard images available on [www.glabalskineatlas.com](http://www.glabalskineatlas.com) which includes all the standard images used in this field.

The data was partitioned with a ratio of 60 to 40 for training and testing data, respectively. That is, the number of training sets is 60% of the total data and the remaining 40% was considered as test data.

2The second part of the goal is to find cancerous features in the lesion. We break the task into smaller parts and make a decision for each part. In this step, we look at the shape of the lesion's border in a square window on the N side. Please rephrase this passage using simpler words. To find out what the lesion looks like, we separate it into smaller squares. These squares don't overlap and they don't include the edges of the lesion. They only include points inside the lesion. Texture features are taken from these square windows. By using the features we found, we decide if each window shows cancer or healthy tissue. At the end, they decide if the lump is cancer or not by counting the votes. Choose the right window size for the defect, but keep in mind that larger windows will mean more calculations and less accurate results. Alternatively, the big window makes fewer calculations and more accurate features, but can't use all the texture details. In future studies, the 64x64 window showed the most successful results using trial and error.

3- Selection of features based on rules of dominance and crowding

distanceThis selection is based on two elements:

Population Rank: Populations are selected in lower ranks.

Distance calculation: assuming that p and q are two members of the same rank, the member with a greater congestion distance is selected. It should be mentioned that the priority of selection is based on rank first and then based on congestion distance.

4- The population resulting from intersection

In the dimensions (1x34) it is randomly assigned in the interval [0-1] r vector -a

b- Two chromosomes  $ch\_1$  and  $ch\_2$  are randomly selected from the population.

c-  $ch\_2 \cdot (1-r) + r \cdot ch\_1$  first new child

d-  $r \cdot ch\_2 + (1-r) \cdot ch\_1$  = second new child

### 5-Population of mutants

a- The r vector is defined in the dimensions of a chromosome (1x34).



b-- The vector  $r$  is estimated by normal distribution in the interval  $[1 \text{ and } -1]$ .

c- A chromosome is randomly selected from the population.

Mutated d-chromosome is created from the set of chromosome selected with  $r$

6- New population

The new population is obtained by merging the population resulting from crossover and the population of mutants.

7- The end condition in the proposed method was to check all the pixels of the images.

After the generation of children resulting from integration and mutation, their fitness level is also calculated for the two considered functions. If the termination conditions are met, the algorithm ends, otherwise we enter the next cycle. At this stage, a number of parents and children should be removed from the population so that the number of the original population remains constant. Therefore, at this stage, firstly based on the rank and then based on the crowding distance that was explained in the previous section, the total population is sorted and then a number of this population who have a better situation based on the rank and crowding distance index are selected and the rest are selected to the extent that The main population remains constant, they are removed and the algorithm continues in the same way as before.

Training by back propagation neural network

Artificial neural network is a useful way to learn different types of functions, like ones with real numbers, ones with specific values, and ones with groups of numbers. This study used a special type of algorithm to teach the network. In this technique, the network's weight matrices are adjusted to make sure the mean square error is lower than a specific value set in the program. The network's goal is to detect cancer in the skin image. The weights are fixed, one layer at a time. We want to find the weights that have the smallest mistake. We begin with a starting value for the weight and adjust the weights at each step until the mistake is smaller than the specified value in the program. This keeps happening until the total mistake is as small as we want, or until we've done it a certain number of times. These numbers need to be figured out so the network doesn't learn too much.

If the neural network does not repeat many times, it won't work well for hard problems. But if it repeats a lot, it will take longer to train and may not work at all. Understand the information from the training and do not do well in solving problems. The input layer gets data from the genetic algorithm. This program uses the cancer mass traits from before and sends them to the network. The two things called  $\hat{I}^{\circ}$  and  $\hat{I}^{\gg}$  are like ingredients that go into making something. One of them is about how much cancer there is, and the other is about where the cancer is in the picture. In order to make learning more efficient, we look at how many input parameters there are and use that to decide how many neurons are in the input layer. We also have one neuron in the output layer. We kept the same number of neurons and



other network settings the same. Then we changed the learning coefficient from 0.001 to 1 and trained the network each time. We checked the MSE value at each step. The best learning rate to reduce the error is about 1.2

### Evaluation of the proposed method

In order to evaluate the proposed method, we have used the standard database at [www.glabalskineatlas.com](http://www.glabalskineatlas.com), and the average accuracy of the proposed method is 97.92%, the detection sensitivity is 5.97%, the specificity criterion is 98.21%, and the detection error is 2.08%.

**Table 1: Types of models**

**Table 2: Comparison of the proposed model with similar worked models**

Source	N	M %	Sens.%	Spec. %	Acc %
<b>Grin, 1990 [25] s</b>	214	23	-	-	84.5
<b>Claridge, 1992 [26]</b>	88	48	91	69	-
Ganster, 2001[27]	270	35	87	92	73
Patwardhan, 2003 [28]	59	50	82	87	88
Tanaka, 2004 [29]	80	50	90	89.3	95
Burroni, 2004 [30]	391	47	78	79	-
Yang, 2006 [31] s	44	22	-	88	86.9
Alcón,2009 [32] s	160	50	94	68	<b>86</b>
Garnavi, 2010 [33]	102	50	91.8	91.8	<b>88.24</b>
Abbas, 2011 [34] s	100	50	96	97.1	-
This work (PCA)	160	50	87	89.1	<b>92.07</b>
This work (Fisher)	160	50	87.5	91	<b>94.73</b>
<b>proposed model</b>	<b>96</b>	40	97.5	98.21	<b>97.92</b>

**Table 3: Comparison of models**

Criterion	a	b	c	d	e	f	g	h	proposed model
precision	91	98	98	89.1	-	-	-	-	97.92
allergy	94.73	1	-	92.07	97	97	95.2	93.5	97.5
Property	92	0.6	-	-	-	95.2	90.9	97.8	98.21

### The results of the projec

Due to the high accuracy of unsupervised diagnosis of skin cancer by integrating tissue and edge features in skin images and the possibility of using it on dermoscopic images, the feature extraction method of this article was used and to reduce and extract the feature of the lesion



according to trial and error and referring to many studies, the LDA method was used. And to extract the best characteristics of cancer lesion for training the network, we used multi-objective genetic algorithm with non-defeating sorting (NSGA-II) version 2, although it has a lower speed than some other methods, but due to the importance of the subject and the high power that this algorithm has for the cluster The percentage of errors has been greatly reduced compared to the previous methods, and a special type of error propagation algorithm has been used to train the network. In this method, the weight matrices of the network are changed in such a way that the mean square error of the network (MSE) is less than a certain value specified in the program. The desired output of the network is actually the results of detecting malignancy in the dermoscopic image. Layer by layer, it is returned back and the necessary corrections are made on the weights in each layer. It should be noted that although the proposed methods require more time than the previous methods, this time is not significant and instead, due to the accuracy and power of detection, it is more useful and accessible than the previous one. There are previous methods, and some of the previous methods required special cameras or special tools, which, in addition to the cost, were not affordable for ordinary people to use. These problems have been solved in the proposed method. Of course, the high accuracy of this method is due to Using local samples for training and testing it with local samples and it is interesting that about 98% of the people who referred to the hospital were male and most of them had similar symptoms.

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