CHAPTER 6
VALIDATION MEASURES

The performance analysis on Support Vector Machine (SVM), k-Nearest Neighbor (k-NN), Single Layer Artificial Neural Networks (SLANN) and Optimized Multi Layer Back propagation Neural Networks (OMLBPNN) are used to detect the skin cancer with effective manner which reduces the miss-classification rate and increases the overall efficiency of the system. The method recognizes the skin cancer with the extracted features using Gray Level Co occurrence Method. The extracted features are effectively trained using the learning functions which are classified with efficiently. The performance of the system is analyzed using the different experimental results.

In our research work use three types of datasets are ISIC, Dermnet, DermAtlas and totally two thousand skin cancer images. The N fold method is used for the training, validation and testing of data. The whole dataset is split into training and testing. The 80 percent of images are reserved for training and the balance 20 percent of images for testing. The image splitting percentage ratio of training and testing may differ like 40 percent and 60 percent etc.. In that dataset has one thousand Melanoma (Melanocytes) and the other images are non melanoma category. In our research work, Support vector Machine and Artificial Neural Network has used this N fold method for training and testing.

6.1 Support Vector Machine Classification

Support Vector Machine classifier is one of the supervised learning methodologies which utilizes the hyper plane for classifying the retrieved skin feature. The method effectively analyzes the features in the linear space with the help of the hyper plane and classifies the features into normal and abnormal skin that is identified by labelling +1 and -1. To calculate the error amount by the pixel value of the original image differs from the image during the noise estimation process, Mean Square Error (MSE) metrics has been used. MSE of SVM Classifier calculated value is 0.789. The performance of SVM classifier is stated in the Table 6.1.
Table 6.1. Performance of SVM Classifier

<table>
<thead>
<tr>
<th>Performance Metrics</th>
<th>SVM Classifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>75%</td>
</tr>
<tr>
<td>Specificity</td>
<td>59%</td>
</tr>
<tr>
<td>Accuracy</td>
<td>81.33%</td>
</tr>
</tbody>
</table>

Support Vector Machine classifier classifies the skin cancer data with the sensitivity of 75%. It correctly identifies the negative classifiers during the skin cancer recognition process of Specificity of 59%. Support Vector Machine Classifier recognizes the skin cancer with optimized way of accuracy is 81.33%.
6.2. k-Nearest Neighbor Classification

k-Nearest Neighbor effectively examines each feature present in the feature space using the distance estimation process. To calculate the error amount by the pixel value of the original image differs from the image during the noise estimation process, Mean Square Error (MSE) metrics has been used. MSE of k-Nearest Neighbor Classifier is 0.435. The performance of k-NN classifier is stated in the Table 6.2.

Table 6.2 Performance of KNN Classifier

<table>
<thead>
<tr>
<th>Performance Metrics</th>
<th>k-NN Classifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>79%</td>
</tr>
<tr>
<td>Specificity</td>
<td>59.5%</td>
</tr>
<tr>
<td>Accuracy</td>
<td>82.78%</td>
</tr>
</tbody>
</table>

Figure 6.2 k-NN Classification Accuracy
The Table 6.2 shows the classification result which is shown by using the sensitivity, specificity and accuracy of the k-NN classifier on skin cancer dataset. It shows the, k-NN classifier classifies the skin cancer data with the sensitivity of 79%. It correctly identifies the negative classifiers during the skin cancer recognition process of specificity of 59.5%. k -NN classifier recognizes the skin cancer with optimized accuracy is 82.78%.

6.3. Artificial neural network (ANN)

The Artificial Neural Network is two different classifiers such as Single Layer Artificial Neural Network Classifier and Optimized Multilayer with Back Propagation Algorithm for detecting the skin cancer.

6.3.1. Single Layer Artificial Neural Network Classification

Single Layer Artificial Neural Network works according to the biological neural networks that mean it behaves like the human brain. The connection between the neurons is used to transmit the information from one node to another node, mostly neurons transmitted information is either 0 or 1.

<table>
<thead>
<tr>
<th>Table 6.3 Performance of SLANN Classifier</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Performance Metrics</strong></td>
</tr>
<tr>
<td>Sensitivity</td>
</tr>
<tr>
<td>Specificity</td>
</tr>
<tr>
<td>Accuracy</td>
</tr>
</tbody>
</table>

To calculate the error amount by the pixel value of the original image differs from the image during the noise estimation process, Mean square error metrics has been used. Mean Square Error (MSE) of Single Layer Artificial Neural Network Classifier is 0.321. The performance of Single Layer Artificial Neural Network (SLANN) Classifier is stated in the Table 6.3.
The Sensitivity and Accuracy of the SLANN classifier on skin cancer dataset are graphically represented in Fig 6.3, shows the accuracy of SLANN classifier. SLANN classifier classifies the skin cancer data with the sensitivity of 79.5%. It correctly identifies the negative classifiers during the skin cancer recognition process of specificity is 59.5%. SLANN classifier recognizes the skin cancer with optimized way of accuracy is 84.23%.

But the Single Layer Artificial Neural Network consumes high misclassification error rate which leads to reducing the efficiency of the system. So, the efficiency of the system is improved by applying the Optimized Multilayer with Back Propagation Algorithm.
6.3.2. Optimized Multi Layer Back Propagation Neural Network Classification

The proposed classifier is optimized multi-layer back propagation algorithm which is trained with the help of the delta learning rule along with input layer, output layers, and hidden layers.

To calculate the error amount by the pixel value of the original image differs from the image during the noise estimation process, Mean square error metrics has been used. Mean Square Error (MSE) of OMLBPNN Classifier is 0.234. The performance of OMLBPNN Classifier is stated in the Table 6.4.

<table>
<thead>
<tr>
<th>Performance Metrics</th>
<th>OMLBPNN Classifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>83%</td>
</tr>
<tr>
<td>Specificity</td>
<td>66.5%</td>
</tr>
<tr>
<td>Accuracy</td>
<td>87.73%</td>
</tr>
</tbody>
</table>

In Table 6.4 shows the classification result which is shown by using the Sensitivity, Specificity and Accuracy of the OMLBPNN classifier on skin cancer dataset, the results are graphically represented in Fig 6.4.
The Fig 6.4 shows the accuracy of OMLBPNN classifier. OMLBPNN classifier classifies the skin cancer data with the sensitivity of 83%. It correctly identifies the negative classifiers during the skin Melanocytes recognition process of specificity is 66.5%. OMLBPNN classifier recognizes the skin cancer with optimized way of accuracy is 87.73%.

6.4 Overall Performance of Classification Techniques

Table 6.5 Overall Performances of Different Classification Techniques.

<table>
<thead>
<tr>
<th>Classification Algorithms</th>
<th>SENSTIVITY %</th>
<th>SPECIFICITY %</th>
<th>ACCURACY %</th>
</tr>
</thead>
<tbody>
<tr>
<td>SVM</td>
<td>75%</td>
<td>59%</td>
<td>81.33%</td>
</tr>
<tr>
<td>k-NN</td>
<td>79%</td>
<td>59.5%</td>
<td>82.78%</td>
</tr>
<tr>
<td>SLANN</td>
<td>79.5%</td>
<td>59.5%</td>
<td>84.23%</td>
</tr>
<tr>
<td>OMLBPNN</td>
<td>83%</td>
<td>66.5%</td>
<td>87.73%</td>
</tr>
</tbody>
</table>
The overall efficiency of the proposed system is analyzed shown the following Table 6.5 and Fig 6.5. It shows that the overall system performance, which means, the proposed system Optimized Multi Layer Back Propagation Neural Network ensures the high Sensitivity (83%), Specificity (66.5%) and Accuracy value (87.73%) when compared to the another proposed method like Support Vector Machine, k-Nearest Neighbor and Single Layer Artificial Neural Networks. Even though all the methods successfully recognize the features with effective manner, the Optimized Multi Layer Back Propagation Neural Network ensures the effective results with minimum error rate and increase the classification accuracy.
CHAPTER 7

CONCLUSION

This skin cancer has been categorized into melanoma and non-melanoma. Melanoma is one of the most dangerous skin cancers and can be fatal if not treated. In case detect the melanoma in early stages, it is curable highly, yet progressive melanoma is deadly. Therefore, it is well known which means the early treatment and finding of skin cancer can minimize the morbidity and morbidity of patients. The digital image processing methods are considered widely and accepted the system. An automatic image processing approach normally has different kinds of stages such as the initial image analyzing the given image, proper segmentation after that feature extraction and selecting the needed features and finally done the lesion recognition.

From the extracted features, ABCD features are selected with the help of the Information Gain Entropy method which selects the features according to the feature entropy value. These selected features are processed by applying the Support Vector Machine (SVM), k-Nearest Neighbor (k-NN), Single Layer Artificial Neural Networks (SLANN) and Optimized Multilayer Back propagation Neural Networks (OMLBPN). First Support Vector Machine analyze the extracted features by computing the hyper plane. During the analyze process the non-linear SVM has been used along with the radial basis kernel function. Depending on the kernel function the features are examined and classified into the normal and abnormal skin cancer feature. The SVM classification process successfully recognizes the skin cancer but it consumes high time at the time of testing process. So, the k-NN method used to classifies the extracted features which detect the skin cancer by computing the distance between the features. According to the distance metrics the features are effectively classified but it consumes high computation cost.

The percentage ratio of Support Vector Machine was 81.33 percent, k-Nearest Neighbor percentage was 82.78 percent, then the Single Layer Artificial Neural Networks (SLANN) percentage was 84.23 percent and finally the Optimized Multilayer Back propagation Neural Networks (OMLBPN) was 87.73 percent.
For overcoming the issues, the Single Layer Artificial Neural Network has been utilized which uses the Tan h function as the activation function while analyzing the features. During the classification process the method successfully update the weights and bias value which reduces the mis-classification error rate also eliminates the above methods issues but the method recognition accuracy should be enhanced which is done with the help of the optimized multi layered back propagation neural networks. The final classifier is Optimized Multi Layer Back Propagation Neural Networks which utilizes the Taylor series and sigmoid function for recognize the abnormal skin cancer features. In addition to these, the method continuously updates weights value in every layer for reducing the mis-classification rate also improves the overall efficiency of the system. The output of the classifier achieves the efficient result also minimize the error rate when compared to the other existing methods.

The efficiency of the proposed system is evaluated in terms of the mean square error rate, accuracy, sensitivity, specificity, true positive rate, false positive rate, true negative rate and false negative rate measures. Even though, four proposed methods are achieve the efficient result, the Optimized Multi Layer Back Propagation Neural Network system ensures the minimum error rate which leads to increase the Melanocytes recognition accuracy.