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Effective Skin Cancer Identification Scheme Using Multi-SVM (MSVM) Strategies

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ABSTRACT: The main objective of this system is to address the demand for an intelligent and rapid classification system of skin cancer using contemporary highly-efficient Multi-Support Vector Machine (Multi-SVM) and Effective Filtering Methodologies. Clustering is technique which is used to analyze the data in efficient manner and generate required information. To cluster the dataset, there is a technique named k-mean, is applied which is based on central point selection and calculation of Euclidian Distance. Here in k-mean, dataset will be loaded and from the dataset. Central points are selected using the formulae Euclidian distance and on the basis of Euclidian distance points are assigned to the clusters. The main disadvantage of k-mean is of accuracy, as in k-mean clustering user needs to define number of clusters and because of user defined number of clusters, some points of the dataset are remained un-clustered. This system addresses the demand for an intelligent and rapid classification system of skin cancer using contemporary highly-efficient Multi-Support Vector Machine (Multi-SVM) and Effective Filtering Methodologies.

KEYWORDS: Cloud service, Quality of service, Security modeling, Performance modeling.

I. INTRODUCTION

Recently, cancer patients are increasing due to following factors: lifestyle, smoking tobacco, alcohol usage, diet, physical activity, environmental change, sun and other types of radiation, viruses and so on. The most common type cancer includes skin cancer. Unusual swellings of cells for skin can be the skin cancer. There are four kinds of skin cancers: Actinic Keratoses (AK), Basal cell carcinoma (BCC), Squamous cell carcinoma (SCC), and Melanoma. Early diagnosis of the cancer helps to treat it successfully. The late diagnosis of the cancer causes the cancer spread to other nearby organs, and cannot be treat. There are numerous publications are composed in detecting, segmenting, and classifying skin cancers employing different computer vision, machine learning, image processing, M-SVM, and classification techniques. Esteva et al. developed the skin cancer classification using M-SVM. Hitoshi et al. presented a quite automatic system for the classification of the melanomas. While Anas et al. composed the melanoma classification by four kinds classification, Almansour et al. demonstrated a classification method for melanoma using

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the k-means clustering, and Support Vector Machine (SVM). Abbas et al., and Capdehourat et al. composed skin lesions, cancers, and dermoscopy image classification methods using AdaBoost MC, separately. Giotis et al., and Ruiz et al. developed decision support systems utilizing image processing and neural network algorithms by lesion texture, color, visual diagnostic attributes, and affected area, degree of damage for the melanoma, respectively.

Also, Isasi et al. presented an automatic melanomas diagnosis system. Data Mining is known as the process of analyzing data to extract interesting patterns and knowledge. Data mining is used for analysis purpose to analyze different type of data by using available data mining tools. This information is currently used for wide range of applications like customer retention, education system, production control, healthcare, market basket analysis, manufacturing engineering, scientific discovery and decision making etc. Data mining is studied for different databases like object-relational databases, relational database, data ware houses and multimedia databases etc. Data mining is playing a vital role in many applications like market-basket analysis, etc. Frequent item sets have significant role in data mining which is used to find out the correlations between the fields of database. Association rule is based on discovering frequent item sets and frequently used by retail stores. Mining data in other words, named as Discovery of new knowledge in Databases which further moves to the nontrivial extraction of indirect, new and much required information from data in databases.

The cutaneous melanoma is diagnosed by Blum et al. Kiran et al. developed an Android application for the melanoma classification. As a subfield of the deep neural network, M-SVMs has recently achieved great success in machine learning and computer vision. In 2012, Krizhevsky et al. presented a novel method using M-SVM to classify large (1.2 million high-resolution) images in the ImageNet LSVRC-2010 at the Neural Information Processing Systems Conference. It is a first-mover advantage of the M-SVM in computer vision. The AlexNet model has some benefits, i.e., preeminent implementation, few training parameters and extreme validity. Also, the major superiority is the network pre-trained on the ImageNet dataset. Additionally, the input images are clearly recognizable from anything in the ImageNet network. A majority of the image is black because the image is being viewed through an endoscope. The actual content of the image is generally tissue, with the tool being the contrasting object from the background. This poses a trickier problem given that the majority of the images contain a repetitive background with some type of surgical tool which tends to bear the same color and relative shape. Cireşan et al. applied multi-column deep neural networks for image classification.

A number of systems are presented in image classification using M-SVMs, such as Chen et al., Wei et al., Li et al., Zeiler et al., Srdjan et al., and Cireşan et al. Also, Sermanet et al. classified digits of realworld house numbers using M-SVMs. Several publications are demonstrated in multiclass classification. Amornsamankul et al. presented combining hybrid approaches, i.e., Complementary Neural Networks (CMTNN) and Error-Correcting Output Codes (ECOC) in solution multiclass classification problem. While Wiharto et al. demonstrated performance analysis in classification of multiclass Support Vector Macine (SVM) for coronary heart disease diagnosis, Bagheri et al. composed ECOC in multiclass classification. Yan et al. analyzed a performance in ECOC SVMs, and also applied ECOC SVM in remote sensing image classification. Liu et al. developed a method in speech recognition using SVM and ECOC. This system addresses the demand for an intelligent and rapid classification system of the skin cancer using contemporary highly-efficient M-SVM. In this system, we mainly focus on the task of the classifying skin cancer using ECOC SVM with existing, and pre-trained AlexNet M-SVM. This system is arranged as follows: the mentioned summary describes the M-SVM. The following details present objectives and newly proposed methodology in detail. The following summary shows experimental outputs using proposed algorithm.

II. SYSTEM IMPLEMENTATION

A. IMAGE ACQUISITION

The main purpose of this image acquisition module is to acquire the image and convert as Matrix format. Dataset collection of skin cancer images is stored in the database. This is the process known as image acquisition. The image acquisition process consists of three steps; energy reflected from the object of interest, an optical system which focuses the energy and finally a sensor which measures the amount of energy. The first stage of any vision system is the image acquisition stage. After the image has been obtained, various methods of processing can be applied to the image to perform the many different vision tasks required today. However, if the image has not been acquired satisfactorily then

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the intended tasks may not be achievable. Image acquisition in image processing can be broadly defined as the action of retrieving an image from some source, usually a hardware-based source, so it can be passed through whatever processes need to occur afterward. Performing image acquisition in image processing is always the first step in the workflow sequence because, without an image, no processing is possible. The image that is acquired is completely unprocessed and is the result of whatever hardware was used to generate it, which can be very important in some fields to have a consistent baseline from which to work. One of the ultimate goals of this process is to have a source of input that operates within such controlled and measured guidelines that the same image can, if necessary, be nearly perfectly reproduced under the same conditions so anomalous factors are easier to locate and eliminate

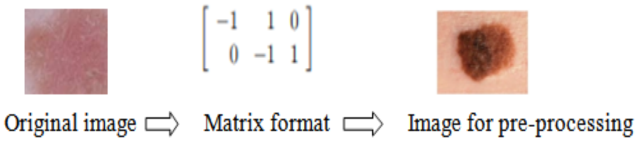

Fig.1 Image acquisition

B. IMAGE PREPROCESSING

The main necessity of this image preprocessing module is to enhance image quality. Image pre-processing can significantly increase the reliability of an optical inspection. Several filter operations which intensify or reduce certain image details enable an easier or faster evaluation. The following are the examples of image pre-processing method Normalization, Edge filters, Soft focus, selective focus, User-specific filter, Static/dynamic Binarization, Image plane separation and Binning. This modules comprises many internal works include: Includes several functions for image processing, Contrast increase by static or dynamic Binarization, look-up tables or image plane separation, resolution reduction via binning and conversion of color images to gray value images.The most complex descriptor family is the polygon shape based descriptors, which potentially require several image pre-processing steps to isolate the polygon structure and shapes in the image for measurement. Polygon shape description pipelines may involve everything from image enhancements to structural morphology and segmentation techniques. Setting up the pre-processing for polygon feature shape extraction typically involves more work than any other method, since thresholds and segmentation require fine-tuning to achieve good results. Also note that polygon shape descriptors are not local patterns but, rather, larger regional structures with features spanning many teens and even hundreds of pixels, so the processing can be more intensive as well.

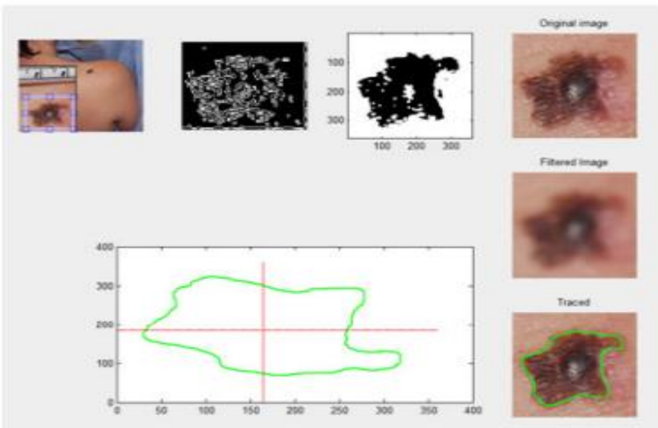

Fig.2 Image Preprocessing

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C. YUV Conversion

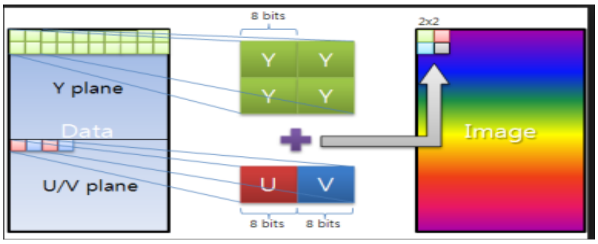

Fig.3 YUV conversion

Y′UV is computed from RGB as follows:

Y'=WRR+WGG+WBB=0.299R+0.587G+0.114B,

B-Y'

U=Umax 1-WB ~0.492 (B-Y'),

R-Y'V=Vmax 1-WR ~0.877 (R-Y')

The resulting ranges of Y′, U, and V respectively are [0, 1], [−Umax, Umax], and [−Vmax, Vmax].

D. NOISE REMOVAL- MEDIAN FILTER AND CONTRAST CORRECTION

Median filtering is similar to using an averaging filter, in that each output pixel is set to an average of the pixel values in the neighborhood of the corresponding input pixel. However, with median filtering, the value of an output pixel is determined by the median of the neighborhood pixels, rather than the mean. The median is much less sensitive than the mean to extreme values (called outliers). Median filtering is therefore better able to remove these outliers without reducing the sharpness of the image. Median Filter is a simple and powerful non-linear filter which is based order statistics. It is easy to implement method of smoothing images. Median filter is used for reducing the amount of intensity variation between one pixel and the other pixel. In this filter, do not replace the pixel value of image with the mean of all neighboring pixel values, replaces it with the median value.

The contrast correction algorithm analyzes and/or corrects the brightness and contrast of 8 and 24-bit images. The analysis and correction phases can be used separately or together. The Quality setting controls how finely the image is sampled, and will also impact how sensitive the adaptive correction method is to local changes in contrast.

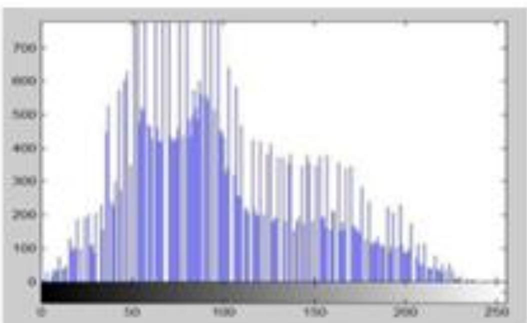

Fig. 4 Sample histogram image

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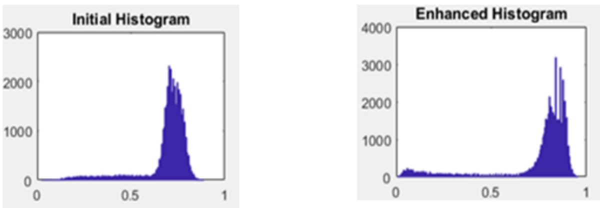
E. Histogram equalization

Histogram equalization is used to enhance contrast. It is not necessary that contrast will always be increase in this. There may be some cases were histogram equalization can be worse. In that cases the contrast is decreased. Let's start histogram equalization by taking this image below as a simple image.



(a) Initial image (b) Enhanced image

Fig.5 Histogram equalization of images

F. IMAGE BINARIZATION

Binarization is the process of converting a pixel image to a binary image. The main contribution of this module is to Convert the gray image into binary and remove the unwanted contents of skin. The images were firstly divided into normal and abnormal. Based on the fact that abnormal cases involve masses and micro calcifications. This procedure was performed four times repeatedly for each level of decomposition, from level 2 to level 5. For each level, features extracted using the reduction procedure were utilized. Binary images may contain numerous imperfections. In particular, the binary regions produced by simple thresholding are distorted by noise and texture. These techniques can be extended to grayscale images. The value of each pixel in the output image is based on a comparison of the corresponding pixel in the input image with its neighbors. By choosing the size and shape of the neighborhood, you can construct a morphological operation that is sensitive to specific shapes in the input image.

Binarization generally involves two steps including determination of a gray threshold according to some objective criteria and assigning each pixel to one class of background or foreground. If the pixels intensity is greater than the determined threshold then it belongs to foreground class and otherwise to the background. The main problem in binarization is the choice of thresholding technique. Several thresholding algorithms have been investigated and proposed to define the optimal threshold value. The thresholding algorithms can be categorized into six classes: histogram shape-based methods, clustering-based methods, entropybased methods, object attribute-based methods, the spatial methods and local methods based on the local characteristics of each pixel. Among these classes, many thresholding algorithms are based on a minimum variance. Otsu's thresholding technique is a classification-based method which searches for the the threshold that minimizes the intra-class variance. Otsu's thresholding method is used for automatic binarization level decision, based on the shape of the histogram and also used for skin cancer identification. Otsu's thresholding method involves iterating through all the possible threshold values and calculating a measure of spread for the pixel levels each side of the threshold, i.e. the pixels that either falls in foreground or background. The aim is to find the threshold value where the sum of foreground and background spreads is at its minimum.

G. ROI SELECTION AND SEGMENTATION

Image preprocessing techniques are essential for discovering the noise removal, and quality improvement of the image. Preprocessing steps are very significant to focus the identification of abnormalities without unnecessary influence from background of the image. For this study, the first phase of preprocessing entailed two procedures; noise elimination and image contrast enhancement. The second phase involves segmentation, which is executed to remove the background area (high intensity rectangular label, tape artifact, and noise). The third deals with the application of phase reduction

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and global gray level thresholding to extract ROI. A major issue in such an application is the automated robust detection of a region (ROI) in which a strong signal can be expected (e.g., usually the forehead or the cheek). To reduce the effect of image noise and intensity variations due to skin's repetitive texture and hair, an image is first low-pass filtered before being segmented.

Fig.6 Segmentation of skin lesion

H. WAVELET & SUB-BAND ANALYSIS

Wavelets are a mathematical tool for hierarchically decomposing functions in the frequency domain by preserving the spatial domain. This property can be exploited to segment objects in noisy images based on their frequency response in various frequency bands, separating them from the background and from other objects. Magnitude of wavelet coefficients measures the correlation between the image data and the wavelet functions. The results are four different set of transform coefficients. There are given below:

LL Sub band contains all wavelet coefficients those results from applying low pass filter to both rows and columns of an image.

HL Sub band consists of all wavelet coefficient results from low pass filtering of the rows, followed by high filtering of the columns.

LH Sub band consists of all wavelet coefficient results from high pass filtering of the rows, followed by low pass filtering of the columns, and mostly it Carries information about the vertical details or edges.

HH Sub band consists of all wavelet coefficient results from applying high pass filter to both rows by high and columns. This usually captures the diagonal edges or details of the original images.

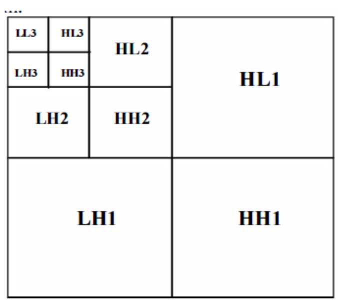

Fig.7 Sub-band decomposition

I. K-MEANS CLUSTERING AND FEATURE EXTRACTION

K-means clustering is partitioning method. This method groups objects in the way that within-group variance is minimized. If within-group variance is minimized then it gives high featured segmented image. The working of this method is as follows:

(a) Initialization of any two class centers randomly. These centers represent initial group centroids.

(b) Calculate the value of histogram bin value distance between each image pixel and class centroids; assign each image pixel to its nearest class centroid.

(c) Recalculate the new positions of centroids by calculating the mean histogram bin value of the same group.

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(d) If the value of centroids changes then repeat steps 2 and 3.

The main motto of this feature extraction module is to extract the important data's from the image. The function of feature extraction is to obtain new variables from the matrix of the image in order to create distinct classes. The feature extraction procedure involves the use of the wavelet decomposition process. These features are then classified in this stage.
Features extraction plays a very important role in the area of image processing. Before getting features, various image preprocessing techniques like binarization, thresholding, resizing, normalization etc. are applied on the sampled image. After that, feature extraction techniques are applied to get features that will be useful in classifying and recognition of images. Feature extraction techniques are helpful in various image processing applications e.g. character recognition. As features define the behavior of an image, they show its place in terms of storage taken, efficiency in classification and obviously in time consumption also. Here in this system, going to discuss various types of features, feature extraction techniques and explaining in what scenario, which features extraction technique, will be better.

J. CLASSIFICATION USING MULTI-SVM

After getting these features we need to classify with trained data's. A Multi-Support Vector Machine (M-SVM) is a computational model developed based on the configuration and functions of biological neural networks. Information transmitted through the network influences the structure of the M-SVM since a neural network evolves or learns based on the input and output. The field is referred to with several names that include connectionism, parallel distributed, processing, neuro-computing, natural intelligent system, and machine learning algorithm. M-SVM is an organized system of basic processing elements, nodes or units, whose functions are to some extent derived from the animal neuron. The processing ability of the network is controlled by the inter unit connection strengths, or weights, achieved via adaptation to, or learning from, a set of training patterns. The most essential elements of M-SVM are modeled after the configuration of the human skin.

III. LITERATURE SURVEY

Nilkamal S. Ramteke et al [10] developed the skin cancer can be cured at very high rates with simple and economical treatments. For the benefit of human race, there is a need of diagnosis of skin cancer at an early stage and lots of researchers already working in that direction by means of hardware and software development using different techniques. In this regards, suppose to use images of cancer affected skin of patients frequently. So the basic aim of this project is to have a simple efficient and automatic skin cancer, detection and diagnosis system with the use of commonly available software for nonexperts/clinicians/doctors. The proposed scheme is using Wavelet Transformation for image improvement, denoising and Histogram Analysis. The malignant non-melanoma lesions are further divided into BCC and SCC is the most common type of skin cancer. The most common example of such cancer is a pink, pearly papule orplaque all sun-exposed skin. BCC can occur in fair complexion, chronic sun exposure and ionizing radiation. BCC can be seen on the human face, particularly the nose. BCC tends to grow slowly. SCC is second most common type, arises from the epidermal keratinocytes. The common example of SCC represents a scaly papule, plaque or nodule on sun-exposed skin. In addition to BCC, SCC can occur because of cigarette smoking. The skin of the head and neck are the most common location for SCC. SCC can grow rapidly and has an increased risk of metastasis, especially in chronically immune suppressed patients, such as organ transplant recipients. The limitation of this paper is texture features is not possible to classify images accurately.

Karolina Beifus et al [3] proposed the skin cells can be occurring from ultraviolet radiation combined with impairing ozone levels, uncritical sun exposure and use of tanning beds an increasing number of people are affected by different types of skin cancer using deep CNN. But preventive interventions like skin cancer screening are still missing the evidence for effectiveness and therefore are criticised. Fundamental for an appropriate course of action is to approach the defined parameters as measures for effectiveness critically. This research seeks to establish, through the available literature, the effects and conditions that prove the effectiveness of prevention strategies in skin cancer. Despite continually increasing incidences in skin cancer entities like malignant melanoma, BCC and SCC most people are still

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misunderstanding the hazard from UV radiation from sun or tanning beds. The use of sun beds has been identified as the most significant risk increasing factor of melanoma and non-melanoma skin cancer. The advantage of this paper is the cancer cells are identified easily and the limitation of this paper parameters are not defined accurately.

Mahmoud Elgamal [5] developed the rationale of the approach proposed here implies two steps. In the first step, signals are transformed into time-scale domain by DWT. In the second step features are extracted from the transformed data by a PCA. The continuous wavelet transform of a signal x(t) is defined as the sum over all time of the signal multiplied by wavelets ab(t), the scaled (stretched or compressed) and shifted versions of the motherwavelet (t). The first level consists of LL, HL, LH, and HH coefficients. The HL coefficients correspond to high-pass in the horizontal direction and low-pass in the vertical direction. Thus, the HL coefficients follow horizontal edges more than vertical edges. The LH coefficients follow vertical edges because they correspond to high-pass in the vertical direction and low-pass in the horizontal direction. As a result, there are 4 sub-band (LL, LH, HH, HL) images at each scale. The sub-band LL is used for the next 2D DWT. The LL subband can be regarded as the approximation component of the image, while the LH, HL, and HH subbands can be regarded as the detailed components of the image. As the level of the decomposition increased, we obtained more compact yet coarser approximation components. Thus, wavelets provide a simple hierarchical framework for interpreting the image information. Histogram thresholding methods involve the determination of one or more histogram threshold values that separate the objects from the background. Clustering methods involve the partitioning of a color space into homogeneous regions using unsupervised clustering algorithms. The advantage of this paper is signal decomposition can be implemented in a computationally efficient manner via the fast wavelet transform ,behind which the basic idea is to represent the wavelet basis as a set of high-pass and low-pass filters in a filter bank. The disadvantage of this paper is feature selection is not accurately possible in it.

IV. SYSTEM ANALYSIS

A. Existing System

Most of the existing literature regarding computer-assisted cell classification based on human skin has focused on feature extraction and classifier design on images that are either explicitly, or implicitly, assumed to contain a complete skin-lesion object. However, images may not always capture entire skin-lesions, as shown in following figure. Local features can be used to deal with the complex situations. Extracted local features from several image patches using wavelets and Gabor-like filters, then analyzed the responses using a bag-of-features BoF model to recognize features. In past systems, extracted texture and color features, then used a BoF model to code these features to classify skin-lesions. They then improved classification performance by imposing a color constancy constraint. The features were extracted from image patches, in order to better cope with incomplete skin-lesions. However, border features were ignored, which are important for skin-lesion diagnosis. Here proposed a dermoscopy disease classification model that aims to handle incomplete Skin-Cancer-Cell presentations.

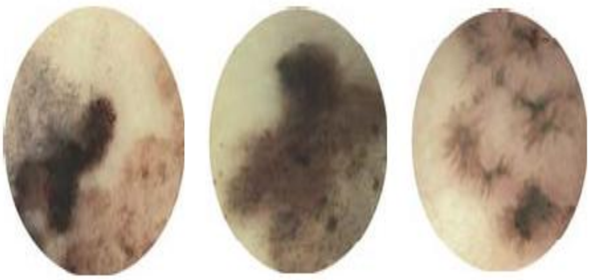

Fig.8 Incomplete skin cancer lesion

The model utilizes a set of disease border features along with other disease-descriptive features, which are fed to a classical SVM meta-ensemble model that is trained to differentiate malignant skin-lesions from benign skin-lesions.

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Skin Cancer Classification is the leading cause of skin-related death in the United States. However, persons with early skin-disease classification have lower skin-disease Classification–related mortality than those with extensive disease, suggesting early detection and treatment of skin-disease classification might be beneficial. LDCT and CXR have been studied for early screening, with several new studies reporting results since the last review. Activating mutations in the epidermal growth factor confer hypersensitivity to the tyrosine kinase inhibitors gefitinib and erlotinib in patients with advanced non-small-cell skin-disease classification. Also evaluated the feasibility of large-scale screening for epidermal growth factor mutations in such patients and analyzed the association between the mutations and the outcome of erlotinib treatment.

DISADVANTAGES OF EXISTING SYSTEM

(a) Parameters are hard to interpret in the existing system.
(b) Hyperparameter tuning is non-trivial.
(c) The strategy is based on the research on mathematical features of code matrix, which ignores the fundamentals of classification, making it difficult to progress for ECOC SVMs and their applied research.

B. Proposed System

In the proposed system, a Skin-Cancer-Cell classification model is introduced, that aims to handle incomplete Skin-Cancer-Cell presentations. This is achieved by using M-SVM.The model utilizes a set of Skin-Cancer-Cell border features along with other Skin-Cancer-Cell-descriptive features, which are fed to a modified-neural-network meta-ensemble model that is trained to differentiate malignant skin-lesions from benign skin-lesions. The preprocessing stage involves techniques that include noise removal, enhancement and segmentation steps of the scanned images. The feature extraction stage entails five steps: wavelet decomposition, wavelet coefficient extraction, normalization, energy computation, and coefficient reduction. Computer programs or software created based on the human intellect can be used to aid doctors in decision making without conferring with specialists directly.

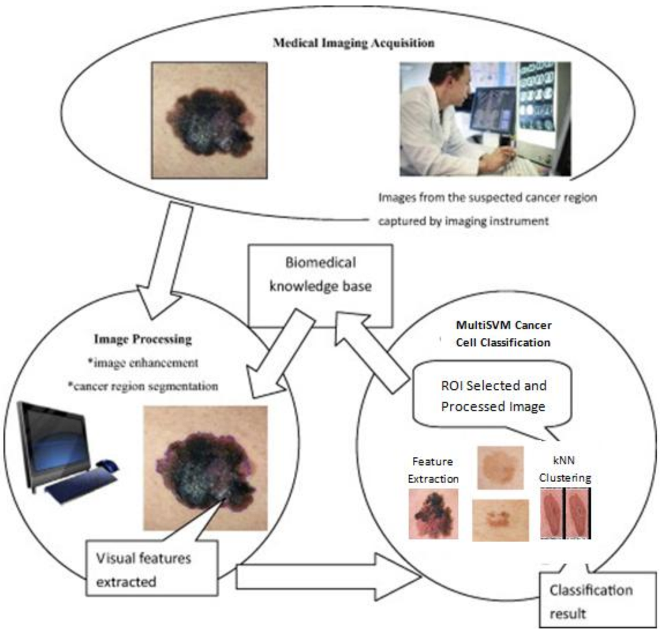

Fig.9 Proposed System Architecture Design

The software was not developed to substitute the specialist or doctor, but to aid in the diagnosis and prediction of patients condition from specific regulations or experience. Patients with high-risk factors or symptoms or predisposed

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to specific diseases or illness, could be selected to see a specialist for more treatment. Utilizing the technology particularly AI techniques in medical applications could lower the cost, time involved, human proficiency and medical inaccuracies. For all our proposed approach aims to provide the complete solution to the medical image processing strategy with the help skin-disease estimation and prediction scenarios.

The proposed system consists of five stages.

(i) Image Acquisition
(ii) Image Preprocessing
(iii) Image Binarization
(iv) ROI Selection and Segmentation
(v) Feature Extraction

ADVANTAGES OF PROPOSED SYSTEM

(a) The M-SVM algorithm that directly solves a multi-class classification problem.
(b) M-SVM approach can greatly speed-up the training process and achieve competitive or better classification accuracies.
(c) M-SVM as a classifier has been used in cancer classification since the high throughtput microarray gene expression data was available in the early 2000's.
(d) To find a good solution to the problem of cancer classification using M-SVM.

V. RESULTS AND DISCUSSION

In this section, we provided the simulated results of entire project with its practical proofs. The following figure shows the input image.

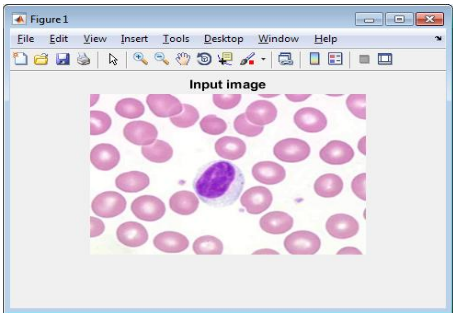

Fig. 10 Input Image

The following figure illustrates the Preprocessing Stage-1 view of the proposed system.

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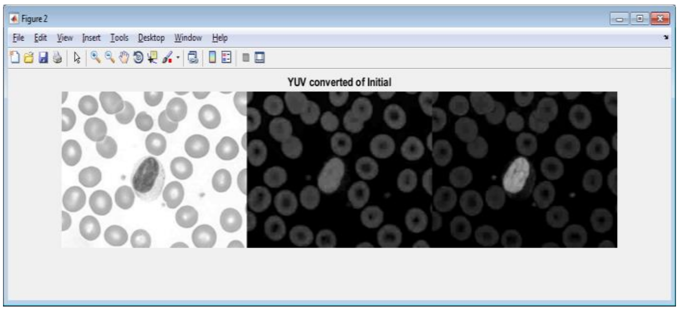

Fig.11 Contrast Correction

The following figure illustrates the Histogram Equalization view of the proposed system.

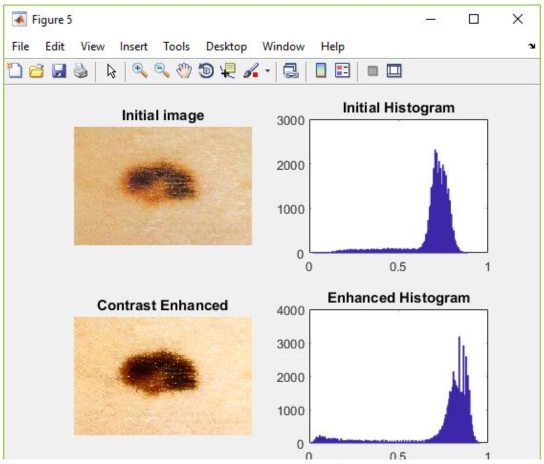

Fig.12 Histogram Equalization

VI. CONCLUSION AND FUTURE SCOPE

Developing precision medicine or a more effective personalized strategy for treating and managing Stage I patients requires a more accurate clinical marker and/or assessment tool to predict cancer prognosis (including cancer recurrence risk). Current studies mainly focus on identifying more effective genomic biomarkers, demographic factors, and other clinical variables. In this system, we investigated a new quantitative image feature analysis approach using skin images and demonstrated two new study results. It can be easily concluded that the proposed system of skin cancer detection can be implemented using gray level co-occurrence matrix and Multi-Support Vector Machine to classify easily whether image is cancerous or non-cancerous. Accuracy of proposed system is 95%. It is painless and timeless process than biopsy method and it is more advantageous to patients.

In future work, we will explore the relevant optimal scheduling algorithms based on this modeling approach to better support service-oriented computing.

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