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# A HISTOGRAM MATCHING ALGORITHM FOR THE DIAGNOSIS OF GLAUCOMA USING DIFFERENT COLOUR SPACES

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***Abstract:***

***Glaucoma is a type of eye disease affecting the optic nerve, which is important for good vision safety. The effect is usually an abnormally high pressure of the eye.In this study, an efficient method for glaucoma diagnosis using Histogram Matching (HM) algorithm and color space is presented. Initially, the red, green and blue color components are separated. Finally, HM is used for glaucoma diagnosis. The experimental results and discussion shows the performance of the proposed system.***

***Keywords: Glaucoma diagnosis, Color spaces, Channel Separation, Histogram matching***

## Introduction:

Retinal images-based glaucoma detection is discussed in [1]. The transformation of the distance is used to locate the lens. Then Principal Component Analysis (PCA) is used for glaucoma detection. Support Vector Machine (SVM) based glaucoma diagnosis is described in [2]. From input retinal image the Region Of Interest (ROI) and disk are detected. Then optic cup region are detected. Then optic cup boundary is smoothed. The disk height, level set based ellipse fitting and cup to disc ratio are detected.

Glaucoma diagnosis based on focal edge detection is discussed in [3]. The input angle image is determined by quadrant. Then the focal edges are detected. Finally, grading is made. Glaucoma classification using retina images based on Independent Component Analysis (ICA) is discussed in [4]. The ICA and K-Nearest Neighbor (KNN) for feature extraction and classification.

Neural network classification of dependent glaucoma is described [5]. The texture features are used for feature extraction then PCA and statistical analysis method are used. The prediction is made by neural network classifier. Haralick texture feature based glaucoma diagnosis is described in [6]. The retinal image is pre-processed by gray level co-occurrence matrix. Prediction is made by KNN.

Glaucoma detection based color and texture based features is described in [7]. Then the in-painting blood vessels are separated. Then the features like mean, standard deviation, skewness, variance, energy and entropy features are extracted also the texture features are

extracted. Prediction is made by SVM and artificial neural network. Texture feature extraction based glaucoma detection is discussed in [8]. The input images are pre-processed by extraction of red cannel and contrast adjustment. The ROI region is extracted by using k- means clustering, Hough transform and morphological operation technique. The features are extracted by gray level co-occurrence matrix and markov random field least estimates. Finally, the prediction is made by SVM [9-10].

A histogram matching algorithm for the diagnosis of glaucoma using different colour spaces is presented in this study. The rest of the text is arranged: The methods and materials of glaucoma detection are described in section 2. Section 3 explains the experimental findings are discussed. The last section concludes the glaucoma diagnosis system.

**Methods and Materials:**

Initially, in the fundus input images the red, green and blue color components are separated by using color spaces. The separated color components are classified by using HM. Figure 1 shows the implementation of proposed system.

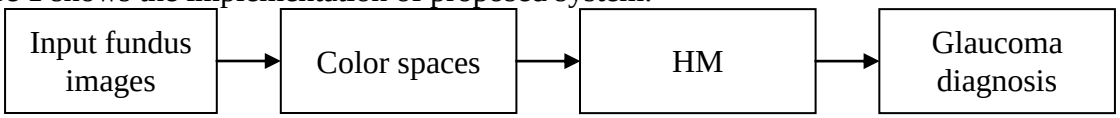


**Figure 1 Glaucoma diagnosis using HM**

**Color spaces**

CMYK uses subtractive color mixings in the printing process, as it specifies what types of ink are needed for the light that reflects from the substrate and through the ink to create a color. The specific color spaces on the model RGB include sRGB, Adobe RGB, ProPhotoRGB, sc RGB, and CIE RGB.An abstract mathematical model is a “color model” which describes how colors can be represented as numeric multiples.A color space is a particular color organization. It offers reproducible color representations, both in analog and in digital representations, in accordance with physical interface profiling.The transformation of the color representation from one basis to the other is a color space transfer. The goal is generally to make the translated image look as much as possible like the original in the conversion of a picture which is depicted in a single color space to another color space.

**HM based Classification:**

The histogram matching or histogram consistency in the image processing is an image transformation such that the histogram is compatible with the histogram. An essential case where the histogram described is uniformly distributed is the well-known histogram equalization procedure. The histogram matching can be used as a relative detector calibration technique for balancing sensor responses. It is ideal for normalization of two images, when the images were collected by separate sensors, atmospheric conditions, or global lighting at the same location. In typical real world applications, Matching histogram can only be approximated by using 8 bit pixel values for that histogram (discrete values in range [0, 255]). The output image will convert all pixels of a specific value into just one value.

**Results and Discussion:**

At first, the fundus input images the red, green and blue color components are separated by using color space method. The separated color components are classified by using HMM. Figure 2 shows the sample fundus image in the dataset.

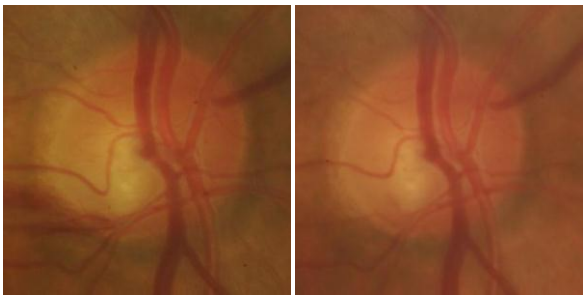

**Figure 2 Sample images in database**

The input fungus image is converted into red, green and blue color components are separated by using color space method. The HM is used for prediction. The Green component performs the classification. Figure 3 shows the original image and green color component images.

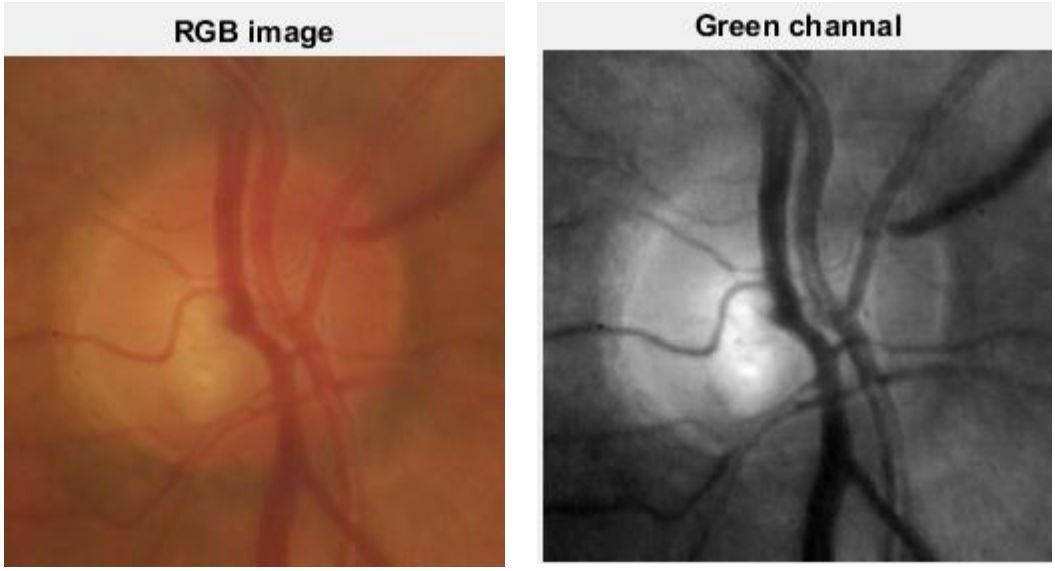


**Figure 3 Original image and green color component**

The red, green and blue color extract the sample features by colour. The HM model is used for prediction. The performance of HMM models are shown in figure 4.

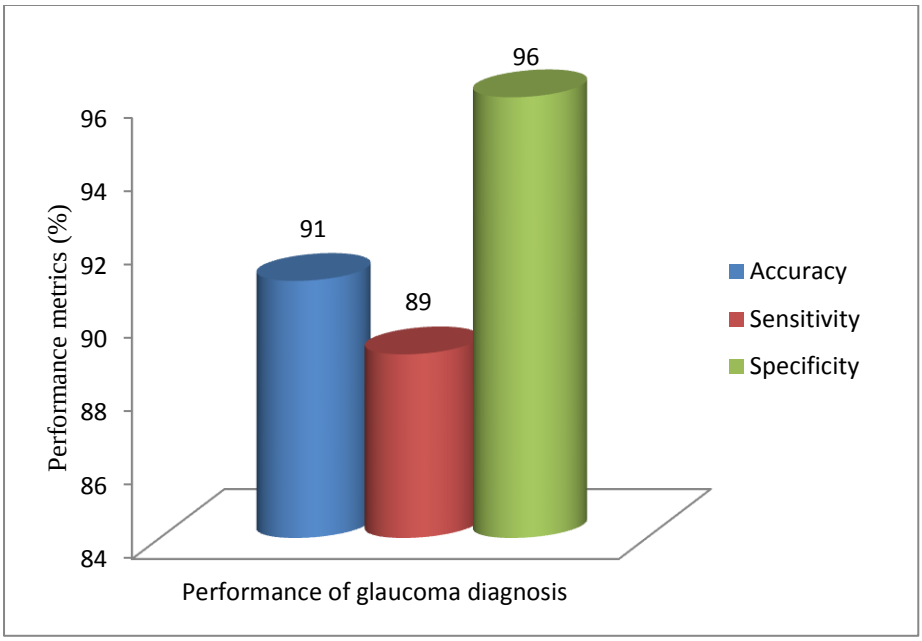


**Figure 4 Performance of proposed system**

It is apparent from the above figure that the method is accurate in classification of 91% and its sensitivity and specificity are 89% and 90% by using color channel separation and HMM classifier.

## Conclusion

A histogram matching algorithm for the diagnosis of glaucoma using different colour spaces is discussed. At first the red, green and blue channels are divided by colour spaces from the input fundus images. Then this separated green channelis given to HM for prediction. The system yields the classification accuracy of 91% and its sensitivity and specificity are 89% and 90%. The experimental findings are much higher classification accuracy by using color spaces and HM classifier.

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