Diabetic Retinopathy Detection using Automated Segmentation techniques

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ABSTRACT

This paper will contain a brief discussion about Diabetic Retinopathy. As the name indicates, it's a medical complication present in diabetic patients which affects the retina, which is an essential part of the eye. Diabetic Retinopathy acronymed as DR is a medical circumstance where the high glucose levels in the blood start affecting the blood vessels in the retina. In this paper will discuss the non-invasive technical method to detect diabetic retinopathy involving various algorithms in every phase of the process. The input fundus images are taken from STARE Database. The methodology conveyed in this paper involves contrast-limited adaptive histogram equalization for noise cancellation purposes and enhancing the base contrast of the image. By consistent distribution of gray values, it will improve the image and aids in bringing out the hidden components. The optimization stage consists of 2 steps and the first step involves Kirsch's template for the extraction of the blood vessels. The second step consists of the Fuzzy C-Means clustering primarily to find the coarse vessels present in the retina. Additionally, the Region-based active contour is used to remove the optic disc. As a result, The output Image will convey the Segmented retinal blood vessels. Furthermore, these segmented retinal blood vessels are given as the input to CNN classifiers in order to detect Diabetic Retinopathy.

INTRODUCTION

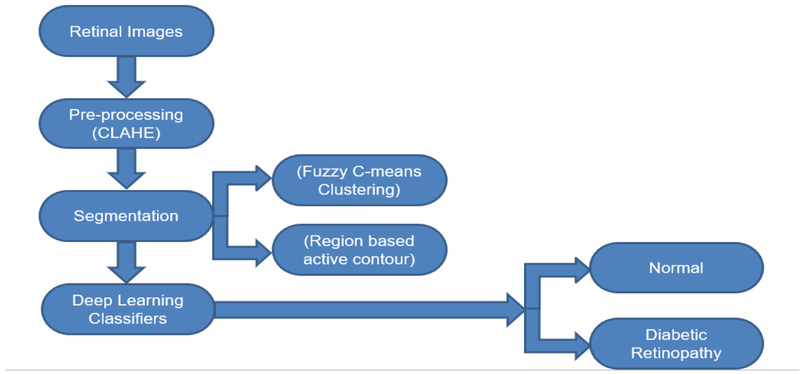
The world is evolving towards something new on a daily basis, leading to advancements in every sector be it technical, business or even the overall life style of human beings. Along with these advancements, an essential sector with regular advancements is the medical sector. There are researches, inventions and discoveries of new medical circumstances often. As a result, the medical world and advanced technology work hand-in-hand to resolve problems in an effective manner. The same way diabetes is a medical condition wherein the sugar levels present in the blood are higher than required.

Patients with diabetes commonly face other problems like foot ulcers, cardiovascular complications, gum diseases, fatigue, stroke, nerve damage, chest pain, vision complications. A common disease caused because of diabetes is diabetic retinopathy. It is a medical condition where the high sugar levels present in blood affects the eyes as well in various ways. And one such condition is Diabetic Retinopathy also known as DR. It is the medical condition wherein the high sugar levels present in the blood start affecting the blood vessels in the eyes causing severe complications. The most common issues that can possibly be faced by patients with Diabetic Retinopathy are blockage, or leakage in the vessels or even initiate the growth of new blood vessels in the Retina.

PROPOSED METHOD

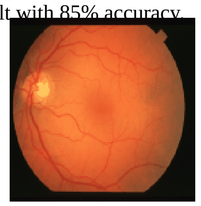
The process of detecting DR will first be started out by first acquiring the retinal fundus image from the STARE Database. STARE stands for Structural Analysis of the Retina. The pre-processing will be done through CLAHE (contrast-limited adaptive histogram equalization) algorithm. This particular algorithm is used to enhance the contrast level of the image and for noise cancellation features. As a result, the image is additionally enhanced so that the unseen features are also visible. Then the optimization stage takes place in two steps. The first one is the extraction of blood vessels from the retinal image through the Kirsch's Template. The second stage of optimization includes the involvement of Fuzzy-C Means clustering to specifically spot the coarse vessels present in the retina. Later the Region-based active contour is used to select the particular region based on a given threshold during the screening process. Now the output image will show the segmented retinal blood vessels which will be sent as an input image through the CNN classifier and this is where the presence of diabetic retinopathy is observed, reviewed and confirmed.

BLOCK DIAGRAM



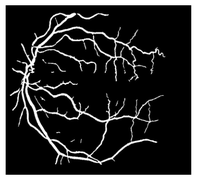
RESULTS AND DISCUSSION

The results of the proposed method are input images(fundus images) which were taken from the STARE database, further sent for pre-processing. The pre-processing will go through by using CLAHE which will increase the quality of the image by improving the contrast. Next we will get an segmented image as an output by sending the contrasted image for segmentation process by using the Fuzzy C-Means clustering and Region based active contour. The segmented output was given as an input to the CNN classifier to detect whether the image is affected with diabetic retinopathy or not. The CNN classifier gives the result with 85% accuracy.

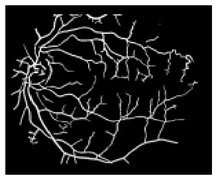


Fundus Image

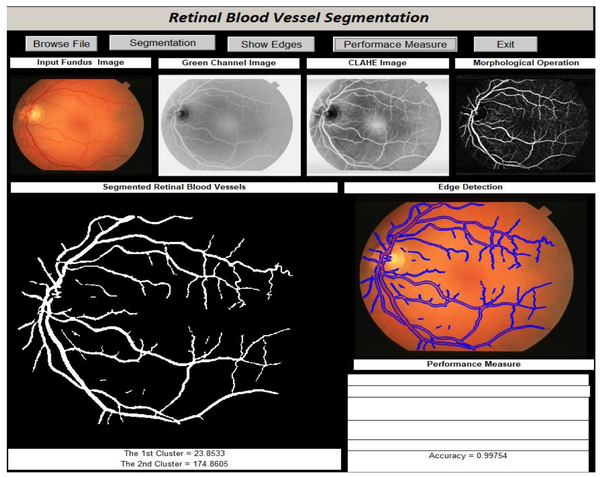
CLAHE Image



Segmented Image



Ground truth Image




```
import numpy as np
from keras.preprocessing import image
test_image = image.load_img('D:\design project\outputs\image.32.jpg', target_size = (256,256))
test_image = image.img_to_array(test_image)
test_image = np.expand_dims(test_image, axis = 0)
result = model.predict(test_image)
training_set.class_indices
if result[0][0] == 1:
 print("Affecting with Diabetes retinopathy")
else:
 print("Not Affecting with Diabetes retinopathy")
```

```
Not Affecting with Diabetes retinopathy
```

The fundus image which is shown in the above results is not affecting with Diabetic Retinopathy.

CONCLUSION

In order to determine the severity level of DR, it is critical to precisely identify the retinal blood vessels during the ophthalmological examination. Many algorithms aren't capable of differentiating the depigmented abnormal retinal images from the retinal blood vessels. The research findings have emerged from each of the STARE database's 88 photos. The results indicate that the proposed methodology consisting of Kirsch's template with FCM clustering accurately identifies all the blood vessels. There are no discontinuities between the minor vessels and they are also identified in this process. CLAHE minimizes the level of noise in depigmented retinal images. By examining the segmented vessel structure through the proposed method, it is evident that it is capable of minimizing the ophthalmologists' effort in analyzing the blood vessels of patients with DR. The proposed retinal blood vessels segmentation approaches can be used for datasets with similar attributes.

REFERENCES

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