RETINAL IMAGE ANALYSIS FOR DETECTION OF DIABETIC RETINOPATHY

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Abstract – *Diabetic Retinopathy (DR) is a complication of diabetes that can lead to blindness if not readily discovered. Automated screening algorithms have the potential to improve identification of patients who need further medical attention. However, the identification of lesions must be accurate to be useful for clinical application. Diabetic Retinopathy (DR) is the primary cause of visual loss in case of diabetic patients. It is mainly caused by the changes in the blood vessels of the retina even though manual screening is available but they are very much time consuming and inefficient. Therefore for automatic detection of these changes and prevention of vision loss, color retinal image is an important tool used by the ophthalmologist.*

BoVW allows to bypass the need for pre- and post-processing of the retino-graphic images, as well as the need of specific ad hoc techniques for identification of each type of lesion. The results demonstrate that the BoVW classification approach can identify different lesions within an image without having to utilize different algorithms for each lesion reducing processing time and providing a more flexible diagnostic.

1. INTRODUCTION

Diabetic retinopathy is a diabetes complication that occurs in people who have diabetes. It causes progressive damage to the retina, the light-sensitive lining at the back of the eye Commonest cause of blindness in the population of working age in developed countries. Many research groups in different universities are pursuing work to develop automated DR detectors to decrease the cost and burden on ophthalmologists. Each year in the United States, diabetic retinopathy accounts for 12% of all new cases of blindness. It is also the leading cause of blindness for people aged 20 to 64 years.

1.1 Pathological Signs of DR

Micro aneurysm (MAs):Small pouches which appear as red dots

Exudates: Yellow lipids caused by the damage of blood vessels and appear as a bright yellow lesion

Hemorrhages: Big blood clot caused by ischemia in the retina.
Cotton wool spots : Caused by damage to nerve fibers in the retina and appear as fluffy white or yellow

2. Related Work

This paper is inspired by work done by Bikramjot Hanzra on Bag-of-words using Open CV and sklearn.[1]
Most of the published work depends on classical image processing methods and focuses on detecting individual DR lesions such as MA's, exudates and cotton wool spots.
Pires et al. applied the BoVW for lesion classification of retinal image. The authors used different feature extraction method .Thet found best result is obtained by using Speeded Up Robust Features(SURF).

3. Proposed work

3.1 Dataset

The dataset used for the experiment is Graded Messidor Database which contains images of 1440×960 in .tif type and were arranged in two ways for training and testing purpose. Each folder contains Referral an non-referral images.

3.2 Procedure

The first step is to create feature extraction and key point detector objects using Scale invariant feature transform(SIFT).Then store all descriptors in array and performing k-means clustering. To find the class of images same procedures is repeated and performed the predictions.

cv2.xfeatures2d.SIFT_create()

Featue extraction is done by using the cv2 library applying proper contrast threshold ,sigma and edge threshold. The contrast threshold used to filter out weak features in semi-uniform region. The larger the threshold, the less features are produced by detector. The edge threshold used to filter out edge-like features. Sigma of the Gaussian applied to the input image at the octave.

k-means clustering

Performed the k-means clustering on descriptors which are stored in numpy array. The number of iterations used are 100.

Calculating the histogram of features and training Linear SVM

Histogram of features is calculated for the predictions of the classes and linear SVM is used for classification.

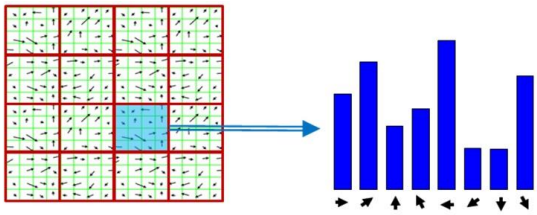

Fig-1: Divide the feature region into 16 square sub regions. Bin each region into an 8-direction histogram

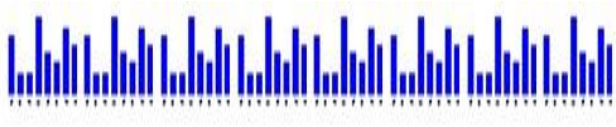

Fig 2: Concatenate the 16 histograms together to get the final 128-element SIFT descriptor

Linear SVM

A linear classifier has the form : $W^TX + b$ where, W is the normal to the line, and b the bias ,W is known as the weight vector.

Working flow for training and testing

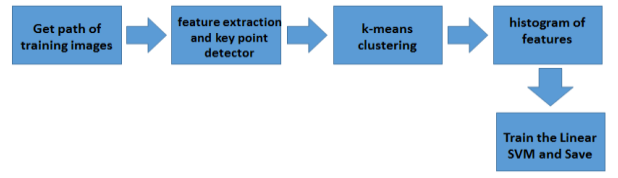

Fig-1 Training Graded Messidor Dataset Images

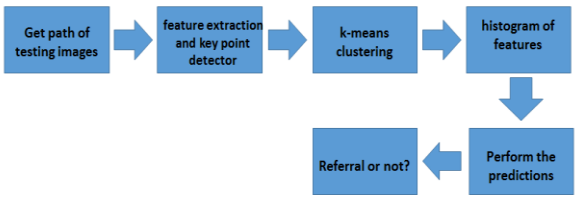

Fig-2: Testing Graded Messidor Dataset Images

4. RESULTS

For training and testing we used 847 and 375 images.

Fig-3 Input image1 Output Image1

Fig-2 Input image2 Output Image2

5. Conclusion

Bag-of-visual-word is an effective image representation in the classification task. Referral or no-referral Images classified successfully. We created user interface using HTML to do task.

6. REFERENCES

[1] https://github.com/bikz05/bag-of-words

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[4] A Osareh, M Mirmehdi, B Thomas, R Markham, "Automated identification of diabetic retinal exudates in digital color images," Br J Ophthalmol 2003;87:1220–1223.

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[7] Object Classification and Recognition using Bag-of-Words (BoW) Model Nursabillilah Mohd AliI, Mohd Safirin Karis3, Mariam Md Ghazall, MohdShahrieel Mohd Arai