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A Review on HOG Feature Extraction based LDA Classification on Medical Image Processing

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Abstract – *In this study, I have referred few papers on* Histogram of Oriented Gradients (*HOG) feature extraction and* Linear Discriminant Analysis(*LDA) classification. HOG is basically used for object detection where as LDA is one of the supervised classification. They have used these algorithms for different identification based on required part of the human body. So, here we would be seeing both these algorithms used individually or in combination with other algorithms to obtain required results. But here I will be surveying these papers by focusing on HOG & LDA, so that combining HOG with LDA after considering the strengths of both the algorithms, where in it would increase the accuracy of detection.*

Key Words*: *Machine Learning (ML), Histogram of Oriented Gradients(HOG), Linear Discriminant Analysis(LDA), early detection.

1. INTRODUCTION

In medical science, there are over 100s have been defined and each is classified by the type of cell that is initially affected. So, to detect minute issues, we need to train the system so that it could detect in early stages and the issues could be handled in better way, with all precautions. Early prediction and detection of any disease is better so that it could be treated well before and could avoid further complications. If the diseases are detected at an early stage, it can be cured effectively.

One of the main targets of computer vision is object detection and extracting and especially in medical field, all the minute details which are not visible to our naked eyes could be done using these algorithms. Detecting any fault/issue in images or in videos became an important step to bring in more high end machines.

So considering the algorithms Histogram of Oriented Gradient's (HOG) efficiency in object detection and extraction of the ROI. And using Linear Discriminant Analysis (LDA) for classifying

1.1 Histogram of Oriented Gradients (HOG)

The Histogram of Oriented Gradients (HOG) technique is employed to extract features of objects following a change within the intensity. Hence, following the distribution of these intensity gradients, the edges of objects are highlighted to permit for features to be extracted and for shapes to be discerned clearer.

After getting its shape, the object is then classified employing a machine-learning technique, like Linear Discriminant Analysis (LDA) the one considered for the research work.

There are 2 main geometric exists– 1. R-HOG(Rectangular)
2. C-HOG(Circular)

R-HOG blocks are usually square grids, has 3 parameters-

–the number of channels per cell histogram.
–the number of pixels per cell.
–the number of cells per block,

C-HOG has two forms a) With one single, central cell b) With an angular division of central cell. C-HOG blocks are described with four parameters:

– the quantity of angular and radial bins,
– the radius of the middle bin,
– the expansion factor for the radius of additional radial bins.

For improved accuracy, the local histograms can be contrast-normalized by calculating a measure of the intensity across a larger region of the image, called a block, and then using this value to normalize all cells within the block.

This normalization results in better invariance to changes in illumination or shadowing.

1.2 Linear Discriminant Analysis (LDA)

Linear Discriminant Analysis or Normal Discriminant Analysis may be a dimensional reduction technique that is majorly used for supervised classification problems.

It's used for modeling differences in groups i.e. separating two or more classes. it's wont to project the features in higher dimension space into a lower dimension space.

For example, we've got two classes and that we must be separated in an efficient manner. Classes can have multiple features. Using only one feature to classify them may lead to some overlapping as shown within the below figure. So, we are going to carry on increasing the number of features for correct classification.

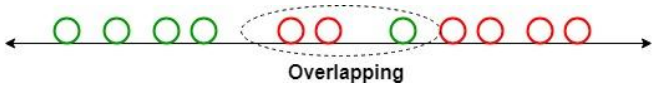

Fig -1: LDA

2. Literature Survey

In this paper[1] they have considered both HOG and Principal Component Analysis (PCA) for detection and tracking. Here, they have used HOG in detection stage since it is used as a feature extractor. The HOG's robust nature of changing local geometry of image but it has one disadvantage where its executive scanning approach over the region of interest. They used HOG to reduce the computational speed by determining region of interest and by using PCA to reduce the dimentionality of the HOG features. They have included optical flow tracking to omit the need of computations in every frame. This proposed method has seen efficiency in both detection and tracking.

In this work, the[2] authors have used an algorithm using the concatenation of HOG which detects the objects and the region of interest (ROI) and Grey Level Co-occurrence Matrix(GLCM) which extracts occurrence of certain grey levels for further identification of the features that is used for detection of malignant and benign tumors. To enhance the contrasts of region of interest they have used Contrast Limited Adaptive Histogram Equalization(CLAHE) HOG and GLCM combined. They have used various classifiers where in KNN (K-Nearest Neighbour) showed better accuracy.

The authors of paper [3] have given a study on detection of Glaucoma by using Histogram of Oriented Gradients (HOG) Feature extraction along with SVM classification of retinal fundus image with the extraction of blood vessels using Gabor filter which is used in extracting the feature ie, blood vessels that has improved the accuracy of the classifier.

In this paper [4] the authors have used Principal Component Analysis (PCA) combined with Linear Discriminant Analysis (LDA) for gender recognition from human facial images. Here, they have used this method which has the accuracy outcome of 84.16% , along with combined one using of masking face that helps in obtaining better accuracy of 89.7%.

In this paper [5], the authors have used Artificial Neural Network(ANN) by using Histogram of Oriented Gradients (HOG) features and Linear Discriminant Analysis(LDA) for the detectionof type of cancer cells present in the infected stomach cancer images. The features for benign and malignant one have been obtained using HOG and the dimentionality of these images are reduced using LDA and later classified using ANN. This is done by considering few images to train the system , to better its accuracy.to 88.9%.

3. CONCLUSION

Here in this paper, I have done a survey on the papers that are related to the algorithms HOG, LDA, PCA. I have understood about the usage of algorithms and the way these can be used in various other image processing. The merits of using these major algorithms in a combined way would obtain better accuracy in the results. Also about using the algorithms to improve our medical image processing..

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