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COMPARATIVE ANALYSIS OF LOCAL BINARY & NON BINARY DESCRIPTORS FOR GENDER CLASSIFICATION

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ABSTRACT

Gender is one amongst the foremost components within the interaction between individuals. Generally, in face acknowledgment systems, local descriptors are broadly used as feature descriptors, as they offer more strong leads in changing conditions of the image like lights & shades, pose etc. In this paper, I try to predict the gender of image datasets by analyzing their features using various three feature descriptors: Local Binary Pattern (LBP), Local Directional Pattern (LDP), and Histogram Oriented Gradients (HOG). Support Vector Machine (SVM) is used to classify gender and includes three kernel functions. To accomplish the comparison, dataset which is pre-processed is given as input to the SVM classifier from three descriptors and its accuracy is found from the observed results. The results that obtained for LBP, LDP and HOG are summarized as an accuracy table, which indicated that the combination of HOG & SVM linear kernel function showed the best performance on the data with an average accuracy of 98.05 percentage.

Keywords: Gender Classification, Feature Extraction, LBP, LDP, HOG.

I. INTRODUCTION

In Image processing, Feature extraction can be considered to be a part of a dimensionality reduction process, in which, an initial set of the raw data is reduced to more manageable groups. During this process relevant features are extracted from objects to produce feature vectors. These feature vectors are easy to process, but still able to describe the actual data set with the same accuracy and originality Feature representation methods are of two types: Local descriptors and Global descriptors, where Global Feature Descriptor (GFD) takes the whole image to induce its representation, but in the case of Local Feature descriptor (LFD), the sub features are created from a single face image. This method can be used to reduce the number of resources required for processing the data without any of the important information being lost or decreased. Image classification forms basis for many other computer vision tasks such as object recognition, image segmentation and object detection. The application of classifying images into one of several predefined classes is called image classification. Though the task of classifying images is easy for human beings, it is very difficult for an automated system.

The problem definition of this project is to monitor, compare and analyze the image training process with different feature descriptors such as Local Binary Pattern (LBP), Local Directional Pattern (LDP) and Histogram of Oriented Gradients (HOG) under the same classification algorithm to provide insights regarding the efficiency and accuracy of them. MATLAB is the programming platform used to develop algorithms and create models. Also, an additional package Simulink adds graphical multi-domain simulation and model-based design for dynamic systems. The LBP, LDP and HOG algorithms are implemented using MATLAB.

II. METHODOLOGY

The overall implementation workflow involves Data Collection, Data Pre-processing, training the model and testing the model. The whole set of input data is grouped into a collection of training and testing. The LBP, LDP and HOG features are extracted at the beginning to show and make comparisons of the performance of the algorithms being considered. Then three different Kernel functions of SVM are used to conduct the classification of the test images examined. The output of these descriptors is evaluated on the classifier and accuracy is measured on each descriptor. The basic steps of implementation are listed below:-

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1. Image Pre-processing

The dataset images need to be pre-processed before performing the feature extraction. Pre-processing is done to convert images into a format that is easily distinguishable by the system for improved efficiency in Feature Extraction. The pre-processing is done by setting the different image parameters of the dataset.

2. Feature Extraction

Feature extraction is a technology using which raw image data with a specified dimension is reduced in size which thus improves the overall efficiency and effectiveness in processing and consequently reducing the image complexity. The three feature descriptors used for comparison are:-

a) Local Binary Pattern (LBP)

b) Local Directional Pattern (LDP)

c) Histogram of Oriented Gradients (HOG)

3. Image Classification

SVM is used for the classification of gender based on the extracted features for testing and training. SVMs work out a generic mechanism which uses a kernel function to fit the surface of a hyper plane to the input data. SVMs work out a generic mechanism which uses a kernel function to fit the surface of a hyper plane to the input data. Kernel function helps transform data into a higher dimension which has a clear hyper plane. The kernel functions used for the classification are Linear, Polynomial and Radial Basis function.

III. MODELING AND ANALYSIS

Image classification can be done using both supervised classification algorithms and unsupervised classification algorithms. Supervised classification uses training data along with human intervention whereas in unsupervised classification human intervention is not required as it is fully computer operated. The supervised classification has two phases namely training phase and classification phase. In training phase, the classifier is given information about classes. In classification phase it uses the information that is passed out by the training phase and classifies the image into one among the existing predefined classes. In this project, we use supervised classification and thus involve training and testing phases. In both phases the dataset is pre-processed to carry out feature extraction using the three feature descriptors namely LBP, LDP and HOG. After the features are extracted from the image, classification algorithm is executed using the extracted features to gain insights on the accuracy of classification. 70% of the dataset is considered for training and the remaining 30% of the dataset for testing.

The dataset had a total of 60 images with two folders namely Male and Female which contains facial images of male and female respectively. Initially the image needs to be pre-processed. During pre-processing, we convert the format of the image to get more distinct images for the next step. The preprocessed images are used for one of the three feature descriptors LBP, LDP or Hog to produce their respective feature vectors. The feature vectors are then used for training and testing functions of the SVM classifier. For training, the features, and the two classes (male/female) are provided as parameters to the training function of SVM. The testing function of SVM takes the output of the training function and the testing dataset as parameters, in order to classify the testing dataset into the two classes as either male or female. The output of the testing function is compared with the expected output to evaluate the accuracy and tabulate the results. These steps are repeated for all the three feature descriptors and each feature descriptor is used to perform image classification using three of the kernel functions of SVM classifiers: Linear, Polynomial and RBF.

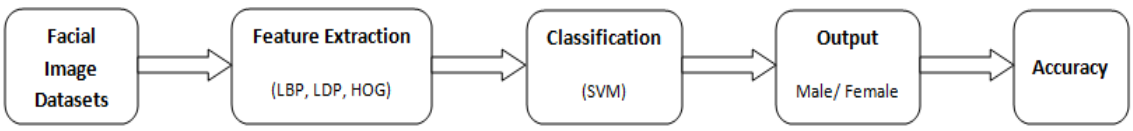

Figure 1: Overall Work Flow of Implementation

IV. RESULTS AND DISCUSSION

The results recorded during the image classification testing phase are provided in this section. The results are in terms of accuracy as a measure of classification. The above mentioned parameter has been measured for all

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three feature descriptors which are LBP, LDP and HOG. The final accuracy value is the percentage value which is obtained at the end of classification phase of each feature descriptor. The final value is the average value obtained from all the accuracy values of 20 observations. This value is significant because it represents the accuracy or in other words rate of successful classification by the resulting model for each feature descriptor. There were a total of 20 observations for each feature descriptor. Each of these observations includes all the three kernel functions: linear, polynomial and RBF. All the 20 observations are recorded and tabulated to determine the average accuracy of that particular feature descriptor for all the three kernel functions.

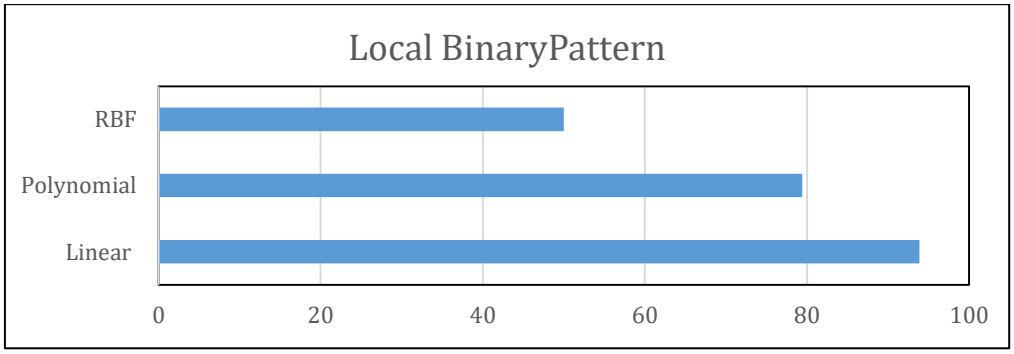

Figure 2: LBP Average Accuracy Graph

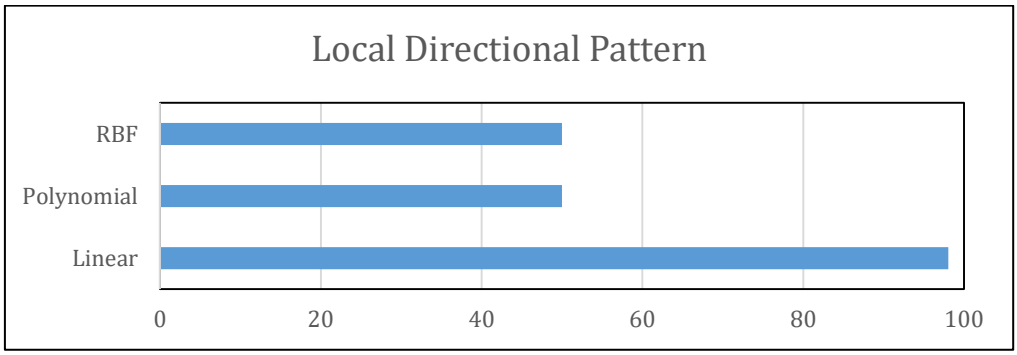

Figure 3: LDP Average Accuracy Graph

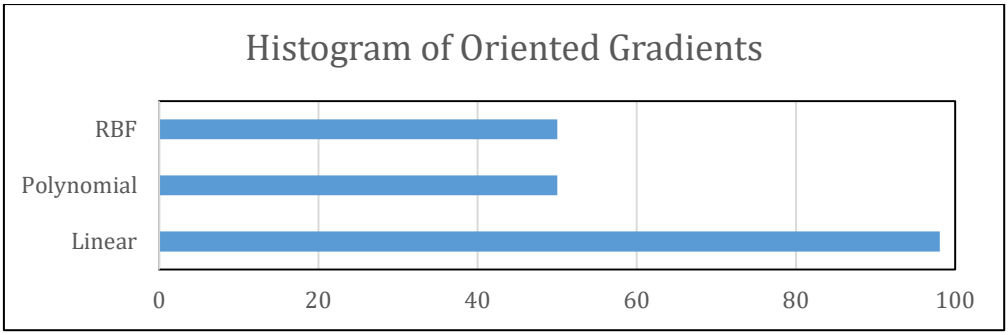

Figure 4: HOG Average Accuracy Graph

Table 1. Summarized Accuracy table

Descriptors	SVM		
	Linear	Polynomial	RBF
LBP	93.885	79.435	50
LDP	95.55	73.6	50
HOG	98.05	50	50

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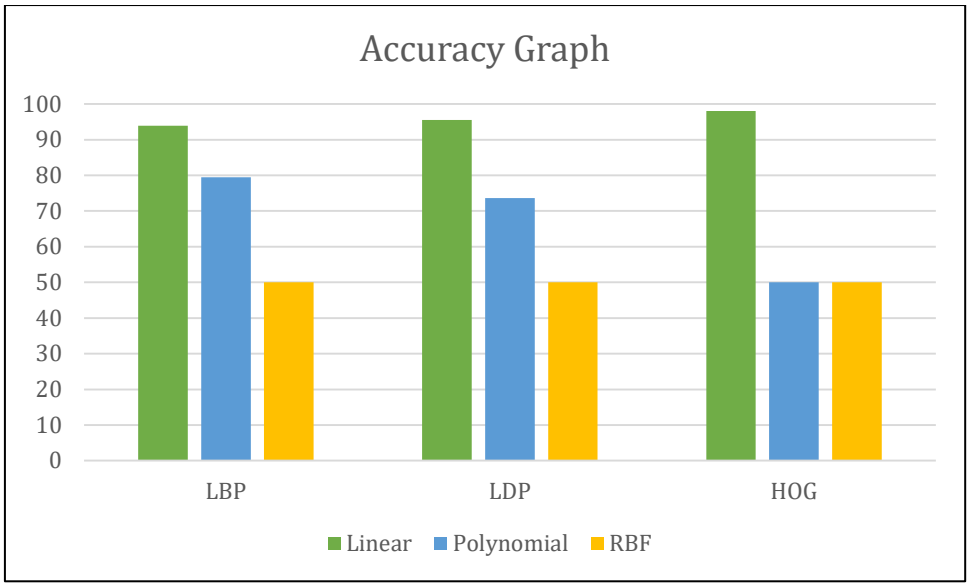

Figure 5: Summarised Accuracy Graph

V. CONCLUSION

In this paper, I tried to predict the gender of image datasets by analyzing their features using various three feature descriptors: Local Binary Pattern (LBP), Local Directional Pattern (LDP), and Histogram Oriented Gradients (HOG). Support Vector Machine (SVM) is used to classify gender and includes three kernel functions. To accomplish the comparison, dataset which is preprocessed is given as input to the SVM classifier from three descriptors and its accuracy is found from the observed results. The objective of this project was to analyze and compare the three different feature descriptors in terms of their accuracy. The expected results of this project were to find a clear-cut line in between the feature descriptors on the basis of their accuracy. In most of the researches it was found that HOG gave the best result and the same was observed in this project. In terms of accuracy, the HOG scored the highest with percentage 98.50% when combined with linear kernel function. LDP produced a result of 95.55%, slightly greater than LBP which had a score of 93.885, both when combined with linear kernel function which indicated that the combination of HOG & SVM linear kernel function showed the best performance on the data. When comparing the kernel functions Linear kernel function turned out to be the most accurate, followed by Polynomial and RBF functions respectively. The overall accuracy levels clearly shows that the most inaccurate and underperformed feature descriptor was all of them when combined with the RBF kernel function with only an accuracy of 50%. It is also noticeable that RBF function maintained a consistent 50% classification accuracy with all the feature descriptors meaning that half of the prediction with RBF was always inaccurate.

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