Pattern Recognition project

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Literature review

Gender Classification from handwriting is still considered to be challenging due to homogeneous vision comparing male and female handwritten documents. First paper presents a new method based on Cloud of Line Distribution (COLD) and Hinge feature for distinguishing the gender from handwriting. The SVM classifier combination decides the assigned class based on the maximum of the two decisions values resulting from COLD and Hinge feature.

Another approach, in gender recognition, where local features were preferred to global ones, The Histogram Oriented Gradient (HOG) and the Local Binary Pattern (LBP) and grid features were used. In addition to a feature resulting from a segmentation-based fractal texture analysis (SFTA) and features extracted from gray level co-occurrence matrices (GLCM).

COLD feature

The COLD feature is inspired by the shape context descriptor, with respect to the extracted information into a log-polar histogram, which is more sensitive to regions of nearby the center than to those farther away. The feature extracts unique shapes handwritten text components by analyzing the relationship between dominant points; such as straight, angle-oriented features and curvature over contours of handwritten text components.

Hinge feature

The Hinge feature is the probability distribution of orientations of two legs of the obtained “hinge” based on edges or contours together attached at a current pixel.

There are two parameters in the Hinge feature: the number of angle bins p and the leg length r.

Among the different discriminating attributes of male and female writings, some papers focus on the slant/orientation, roundedness/curvature, neatness/legibility.

The orientation (slant) and curvature information in the writing is extracted by computing a set of features from contours of writing. The contour representation is chosen based on the hypothesis that the shape of characters in a writing can be encapsulated by its contours. Working on contours also eliminates the writing instrument sensitivity while conserving the shape of the characters. But in our project, we didn’t use these features.

Detailed description of your system

Project Pipeline

We started doing preprocessing to crop the text area from the image after preprocessing is done, we implemented COLD and Hinge features and the credit of implementing them goes to GitHub repository which helps us a lot.

After implementing these two features we train the model with COLD feature then Hinge features individually. Then we used SVM for classification and we notice that the accuracy of COLD features is low about 64% but the accuracy of Hinge feature is high about 83%.

After that we extract LBP features and used it to train the model individually also with SVM and we get accuracy about 74%.

Then we extract GLCM features and used it to train the model individually also with SVM and we get accuracy about 70%.

Preprocessing Module

In this module we want to crop the text area in dataset so we apply dilation to make the text area region and make text close to some rectangles.

Then we use a function to get all contours in image then we find the biggest contour. Due to the dimensions of the biggest contour, we crop the image.

Feature Extraction/Selection Module

We used 5 features:

1- COLD feature
2- Hinge feature
3- GLCM feature
4- HOG feature
5- LBP feature

We train the model with each feature individually and compute the accuracy, we found that Hinge feature get the best accuracy then LBP and GLCM then COLD and HOG features.

We changed each function parameters to get the best accuracy using it. For example, for LBP we changed the radius and n_point until we get the best accuracy with LBP.

Feature	Accuracy
1- COLD feature	64%
2- Hinge feature	86%
3- GLCM feature	70%
4- LBP feature	74%
5- HOG feature	62% with overfitting

Model Selection/Training Module

We have 5 features now. We try to train the model by each feature individually then we used sequential forward selection (SFS) but we notice that Hinge feature was the best accuracy. But when the select Hinge with any other feature, the accuracy decreases.

So, we choose Hinge feature only to train our model. Hinge feature is a vector of 420 element for each image we extract these 420 features from each image and train the model with these features.

Performance Analysis Module

Here we resd the test images then applying a preprocessing and feature extraction on it and then appling a standered scaler on these features (the same scaler used in training the training data) and then predict its calss with our trained svm model and after that we write the results in the results.txt file and the time that each image takes from the start of the pipeline till the prediction module in the times.txt.

Enhancements and Future work

We hope to generate more features with reasonable performance that can be used with the hinge to get even better results.

Work Load Distribution

Mostafa Ahmed Sobhy Ahmed	- HOG - LBP - GLCM
Mostafa Magdy Abdelrahman	- COLD - HINGE - Splitting data
Mohamed Nabawi	- Preprocessing - Classification (SVM)
Michael Aziz Fahim	- Classification (SVM) - Generate result and time files