Hand Gesture Recognition CMPN450 Project

May 14, 2023

Abstract

This project was made using tools learned in the Pattern Recognition course and used Static Hand Gesture Recognition for Sign Language Alphabets using Edge Oriented Histogram and Multi Class SVM papper as a reference for us.

Contents

1. Pipeline

1.1. Input Module: (returns a list of image paths)

- Uses PIL module to read images from the disk and exclude them if corrupted.
- Sort the files in increasing order of the file name (as integers).
- Split the dataset into training, validation, and testing sets (70%, 10%, 20%).

1.2. Preprocessing Module:

- Read the image using opencv, then resize it to 200x200 pixels.
- Convert the image to grayscale.
- Segment the hand from the background using a skin detection (HSV), thresholding technique (Binary + OTSU).
- Morphological operations (Erosion + Dilation) to remove noise.
- Canny edge detection to detect the edges of the hand (remove useless information).

1.3. Feature Extraction Module:

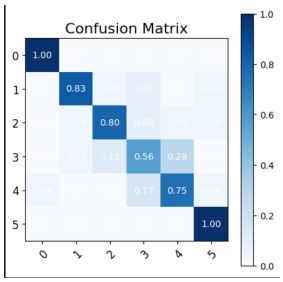
- Used Edge of Oriented Histograms (EOH) to extract features from the image.

1.4. Classification Module:

- Used RandomizedSearchCV to find the best hyperparameters for the classifier.
- Used SVC with the best hyperparameters.
- Tested with different classifiers.
  - KNN
  - Random Forest
  - Logistic Regression
  - ADABoost
  - 2-layer NN

1.5. Performance Analysis Module:

- Used confusion matrix to analyze the performance of the classifier.



- Used classification report to analyze the performance of the classifier (best accuracy= 82.7%).

1.6. Future Enhancements:

- Preprocessing: Use better methods to eliminate shadow (ML or DL).
- Classification: Use a CNN to extract features and classify the images.

2. Workload Distribution

2.1. Mai:

- Image preprocessing

2.2. Rana:

- Image preprocessing

2.3. Omar:

- Input utils, Feature Extraction

2.4. Youssef:

- Classification, Output Utils