Face-Mask Detection and Classification

CSCI 353

Shania Dhani
Michelle Lucero
Xuejin Gao

HUNTER
The City University of New York

Introduction

Motivation: According to the World Health Organization, one of the best protective measures is wearing a mask to combat COVID-19. But it's effectiveness is reliant on how one is wearing them.

Problem Definition: Create machine learning models that can differentiate between a person wearing a mask correctly, incorrectly, and not wearing a mask at all

Approach: We will be building our own models and compare their performances to our baseline research paper's results. Also will be testing for biases in our dataset and models

Datasets

We combined 2 different datasets from Kaggle and images from github user cabani together to form a three class classification. With over 17,000 images and additional images for people of color and people who are white

https://www.kaggle.com/ashishjangra27/face-mask-12k-images-dataset?

https://github.com/cabani/MaskedFace-Net

Approaches

KNN
We created the KNN model using the optimal parameters of n_neighbors =2, weights=distance, and distance=Manhattan distance, which was discovered during hyperparameter tuning. Dimensionality Reduction was used to remove unnecessary features.

Decision Tree
We created the Decision Trees model using the optimal parameters for max_depth= 10, and max_features=1138, which were discovered during hyper parameter tuning. Dimensionality reduction was explored

SVM
Used 50% of the dataset to train the SVM model. The optimal parameters were kernel = RBF, decision_func_shape = ovr.

Naive Bayes
Used GaussianNB and MultinomialNB, along with hyperparameter tuning for an optimal image classification task.

CNN Model:
We created our own CNN model using Tensorflow and Keras. Built using 3 convolution and 3 max-pooling layers followed by some drop out layers to make our model less prone to overfitting.

Evaluation Method:
- The Accuracy, Recall, and F1 score metrics
- Comparing our performance to research paper's result
- Bias test with datasets of people of color and whites

Results

KNN
The optimal parameters resulted in 86.7% accuracy, and performed lower when dimensionality reduction techniques were included.

Decision Tree
The optimal parameters resulted in 84% accuracy, and performed lower when dimensionality reduction techniques were included.

SVM
Reached an accuracy of ~93% with our testing dataset.

Naive Bayes
Because of naive bayes assumption and how much pixels correlate with each other, it performed with ~68% for multinomial and ~77% for Gaussian.

CNN:
Best performing: Reached an accuracy of ~98% with our testing data.

Conclusions

In conclusion our best performing model was CNN, achieving 98% testing accuracy. Models that were comparable to our baseline paper underperformed. In regards to our POC and W datasets, all models also underperformed dramatically, with an emphasis on poorer results for the W dataset