Isadora Oliveira Grasel

Dr. Tempestt Neal

Mobile Biometrics

October 3, 2024

Implementing Machine Learning for Face Recognition

INTRODUCTION

The field of Mobile Biometrics is supported by multiple machine learning algorithms and distance measurements. The goal of this assignment was to implement machine learning techniques for face recognition using the provided facial landmark datasets: the Caltech Faces Dataset and the Specs on Faces (SoF) Dataset. These datasets contain facial landmark coordinates that describe key points on the face, such as the eyes, nose, and mouth. The objective of the assignment was to explore different classifiers and modify feature representations to improve the authentication accuracy of the system, aiming for a minimum accuracy of 80%. To achieve this, various machine learning models and techniques were tested using the scikit-learn library.

CLASSIFIER EXPLORATION

At this stage, I focused on researching and testing how different algorithms and feature representations usually performed to narrow down my exploration to the ones with higher chances of resulting in at least 80% accuracy. Here I noticed that the algorithm that performed best (at least with the first set up of Euclidean distance) was SVM, which achieved above 80% for both data sets. KNN performed a bit better than Decision Trees, but neither of them achieved at least 80% accuracy in my tests. I believe SVM is the better option in this case because it assumes that the data is separable, even if not linear.

CLASSIFIER PARAMETER TUNING

I was able to get 82% accuracy in 68-Caltech by using SVM with a linear kernel and balanced class weight. However, for 68-SoF I had to change the kernel to rbf (Radial Basis Function or Gaussian kernel), achieving 82% accuracy as well. This showed me how SVM is highly versatile and also gave me insight on the difference between both datasets, mainly how SoF has non-linear data.

FEATURE REPRESENTATION MODIFICATION

Next, I explored using a different distance standard: Manhattan distance. I tested it with 68-Caltech and SVM with linear kernel and balanced class weight, and the accuracy was 82% as well. Since the accuracy was the same, I believe that the dataset has a uniform distribution and is linearly separable. However, when I tried Manhattan distance with 68-SoF, the accuracy was significantly lower, solidifying my conclusion that SoF has non-linear data.

CONCLUSION

My main conclusions on this assignment were that SVM is a great machine learning algorithm for facial landmark datasets, but it requires different tuning when working with separate datasets. Therefore, even when using a versatile algorithm, it's essential to know how your dataset is distributed and the overall behavior of the data in it.