Face Recognition using Traditional Classifiers

Shreekar Mane[1] Tavishi Srivastava[1] Debadatta Sahoo[1] Mayank Agarwal[1]
Dhruv Mishra[1]

[1]Indian Institute of Technology, Jodhpur
{b23cs1069, b23cs1101, b23cm1013, b23cm1052, b23cs1090}@iitj.ac.in

Abstract

Face recognition is a crucial task in computer vision, widely used in security systems and identity verification. This study evaluates the effectiveness of various machine learning techniques, including Decision Trees, K-Nearest Neighbors (KNN), Support Vector Machine (SVM) and Clustering, in face identification using different types of processed data. We extract features from images utilizing Convolutional Neural Networks (CNN) with ResNet, Histogram of Oriented Gradients (HoG), and Local Binary Patterns (LBP) to enhance recognition accuracy. Additionally, Linear Discriminant Analysis (LDA) is applied to reduce dimensionality and improve feature separability. Our research systematically analyzes the accuracy and computational efficiency of these techniques on processed datasets. The findings indicate that while Decision Trees remain simple, they perform competitively with well-processed facial features. Similarly SVM, KNN and Clustering provide valuable insights into face identification, showcasing the advantages and trade-offs of different approaches. These results suggest that traditional machine learning techniques can serve as efficient and scalable solutions for face recognition applications.

Keywords: Face Recognition, Machine Learning, Decision Trees, KNN, Clustering, SVM

Contents

1 Introduction

This section introduces the problem, major findings, and the structure of the report.

1.1 Citing Papers

This is how you cite [1]. Please keep all bib entries in `ref.bib`.

1.2 Figures

All figures should be placed in the `figs` directory.

2 Approaches Tried

This section describes various approaches that were tried in the implementation of the Decision Tree model for face recognition.

2.1 Decision Tree

2.1.1 With CNN features

The Decision Tree model was applied using features extracted from images utilizing Convolutional Neural Networks (CNN). The model was trained with a maximum depth of 6. The results were as follows:

- **Test Accuracy:** 0.75
- **Train Accuracy:** 0.99

The high training accuracy indicates that the model fits the training data well, while the test accuracy suggests a reasonable generalization to unseen data.

2.1.2 With LBP Features

Another approach involved using features extracted through Local Binary Patterns (LBP). The Decision Tree model was trained with a maximum depth of 3. The results were:

- **Test Accuracy:** 0.47
- **Train Accuracy:** 0.65

The lower accuracy in both training and testing phases suggests that LBP features may not be as effective for this task compared to CNN features.

These experiments highlight the impact of feature extraction techniques on the performance of Decision Tree models in face recognition tasks.

3 Experiments and Results

This section provides details about the dataset, experimental setup, and result comparisons. Additionally, graphs illustrating the relationship between tree depth and accuracies are included.

3.1 Dataset and Experimental Setup

3.1.1 Dataset

The dataset used for this study consists of facial images processed using various feature extraction techniques, including CNN, HoG, and LBP. For this experiment, CNN and LBP extracted data were utilized. A filter was applied to select individuals with more than 80 images, resulting in a subset of 5 different persons, each with over 80 images. Linear Discriminant Analysis (LDA) was then applied to reduce dimensionality and improve feature separability.

3.1.2 Experimental Setup

The experiments were conducted using Decision Tree models with varying depths to assess their impact on accuracy. Feature extraction was performed using CNN and LBP, and Linear Discriminant Analysis (LDA) was applied for dimensionality reduction.

3.2 Results and Analysis

3.2.1 Decision Tree with CNN Features

- **Test Accuracy:** 0.75
- **Train Accuracy:** 0.99

The high training accuracy indicates that the model fits the training data well, while the test accuracy suggests a reasonable generalization to unseen data.

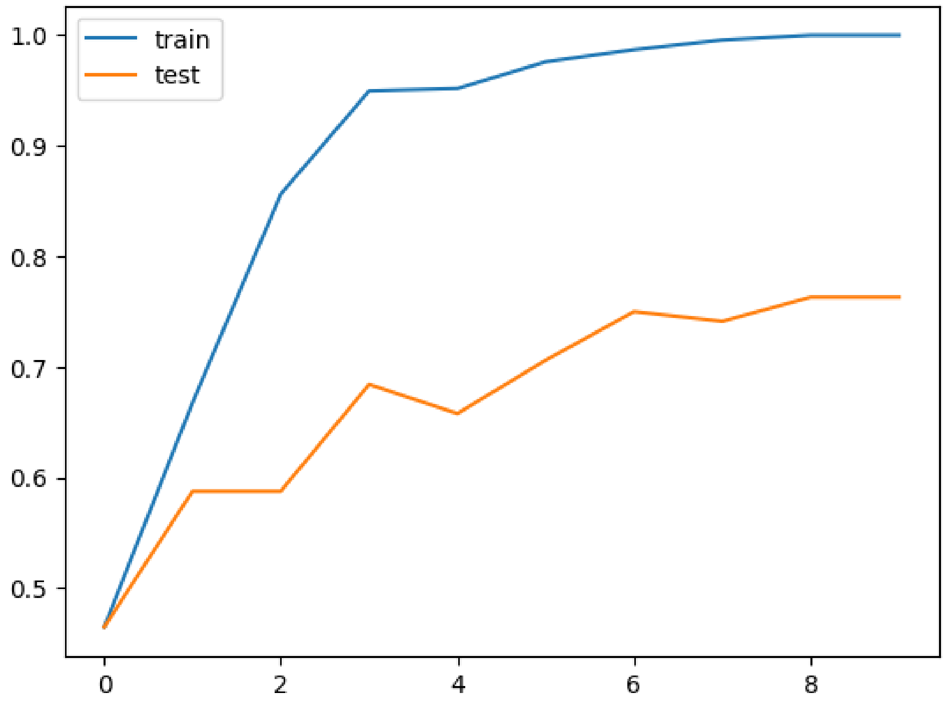

Figure 1: Depth vs. Accuracy for CNN Features

3.2.2 Decision Tree with LBP Features

- **Test Accuracy:** 0.47
- **Train Accuracy:** 0.65

The lower accuracy in both training and testing phases suggests that LBP features may not be as effective for this task compared to CNN features.

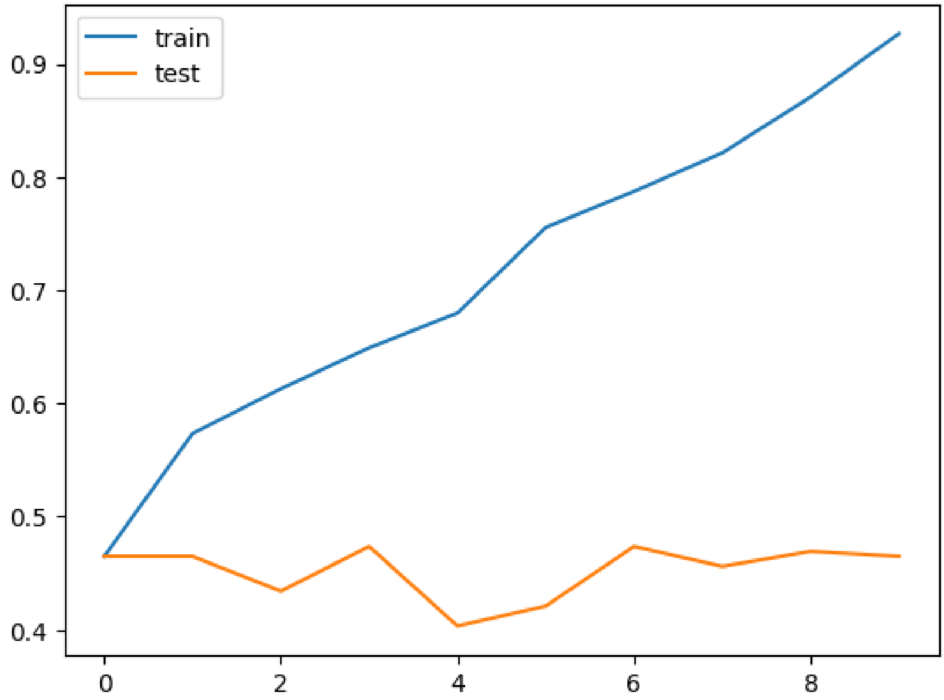

Figure 2: Depth vs. Accuracy for LBP Features

These graphs demonstrate how the choice of tree depth affects the model's performance, providing insights into the trade-offs between complexity and accuracy.

4 Summary

This section summarizes the project findings and conclusions.

References

[1] Prajwal Gatti, Kshitij Gopal Parikh, Dhriti Prasanna Paul, Manish Gupta, and Anand Mishra. Composite sketch+text queries for retrieving objects with elusive names and complex interactions. In *AAAI*, 2024.

A Contribution of Each Member

1. Shreekar Mane: Implemented data preprocessing for CNN features, Implemented Decision Tree model and prepared the project page.
2. Tavishi Srivastava: Implemented data preprocessing and KNN.
3. Debadatta Sahoo:
4. Mayank Agarwal:
5. Dhruv Mishra: