Image Recognition of Clothes

Abstract

In this report, we analyze the task of image recognition in the context of identifying different types of clothing items. The objective is to build machine learning models that can accurately classify images of clothes into distinct categories, such as shirts, trousers, dresses, and shoes. The methodology involved pre-processing steps, dimensionality reduction, and the implementation of various machine learning algorithms such as Logistic Regression, Support Vector Machines (SVM), and Random Forest.

Introduction

Image recognition is one of the fundamental tasks in computer vision, with applications spanning from security and surveillance to e-commerce. For the specific case of clothing items, accurate image recognition can be highly valuable, for instance, in the development of recommendation systems for fashion retail. The challenge lies in the high variability of clothes (in terms of colors, shapes, patterns, and styles) and the need to process high-dimensional image data.

Data

The dataset consists of grayscale images of different types of clothes. Each image is represented as a 2-dimensional array with pixel intensities ranging from 0 (white) to 255 (black). The dataset was divided into a training set for model building and a test set for model evaluation.

Methodology

Preprocessing

First, we reshaped the images from 2-dimensional arrays to 1-dimensional arrays, i.e., each image was transformed into a vector of pixel intensities. We also normalized the pixel intensities to be in the range [0,1] by dividing them by 255.

Dimensionality Reduction

We applied Principal Component Analysis (PCA) to reduce the dimensionality of the dataset. PCA works by transforming the original set of variables into a new set of uncorrelated variables (principal components) that retain most of the variance in the dataset. We scaled our data between 0 and 1 before applying PCA. The number of components was chosen such that 95% of the variance in the data was retained.

Model Training and Evaluation

We trained and evaluated three types of models: Logistic Regression, Support Vector Machines (SVM), and Random Forest.

Logistic Regression

Logistic regression is a statistical model used for binary classification tasks, but it can be extended to multiclass classification via the one-vs-rest scheme. We used the 'liblinear' solver and evaluated the model's performance by computing the accuracy score on the training and test sets. The performance of the model was visualized using a confusion matrix and a classification report, which provides precision, recall, and F1-score for each class.

Support Vector Machines (SVM)

SVM is a powerful classifier that finds the hyperplane in a transformed feature space that separates the data into different classes with the maximum margin. We used the 'rbf' (Radial Basis Function) kernel, which allows for non-linear classification. We performed a grid search combined with cross-validation to tune the hyperparameters of the SVC.

Random Forest

Random Forest is an ensemble learning method that constructs multiple decision trees and outputs the mode of the classes as the final prediction. We used 100 decision trees and evaluated the model's performance using accuracy, confusion matrix, and a classification report.

Conclusion

In conclusion, we have shown how image recognition can be applied to classify images of clothes using machine learning models. Each model has its own strengths and trade-offs, and their performances can vary depending on the specific characteristics of the

	dataset. The preprocessing and dimensionality reduction steps were crucial in managing the high-dimensionality of image data and improving the computational efficiency of the models. Further work can explore other types of models and feature extraction methods, as well as ways to deal with class imbalance and improve the models' robustness to variations in the images.