UNIVERSITY OF INORMATION TECHNOLOY AND SCIENCES

(UITS)

Lab Report

Course Title : Machine Learning Lab

Course Code : CSE432

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Introduction

This project aims to build a system to identify different types of vehicles from images using machine learning. We used two methods:

1. A traditional method with **Histogram of Oriented Gradients (HOG)** for feature extraction and **Support Vector Machine (SVM)** for classification.
2. A modern method using **Convolutional Neural Networks (CNN)** for deep learning.

The goal is to compare these two methods and understand their strengths and weaknesses in classifying vehicles from images.

Dataset Description

The project used a dataset called "Vehicle Type Recognition" from Kaggle. It has images of various vehicle types organized into folders for each category.

Here's an overview of the dataset:

- **Classes:** Cars, buses, motorcycles, trucks, etc.
- **Image Size:** All images resized to 64x64 pixels for consistency.
- **Normalization:** Image pixel values were scaled between 0 and 1 for deep learning.
- **Train/Test Split:** 80% of the images were used for training, and 20% were used for testing.

Methodology

1. Traditional Method: HOG + SVM

- **Feature Extraction:**
  HOG was used to extract features like shapes and edges. Images were converted to grayscale before extracting features.

- **Classification:**
  The extracted features were fed into an SVM with a linear kernel to classify the images.

2. Deep Learning Method: CNN

- **Model Design:**
  - The CNN model included layers for convolution, max-pooling, and a dense layer.
  - Dropout was added to avoid overfitting.

- **Training:**
  - The model used the Adam optimizer and categorical cross-entropy loss.
  - It was trained for 10 epochs with a batch size of 32.
- **Evaluation:**
  - Training and testing accuracy and loss were calculated.
  - Performance was visualized using accuracy and loss graphs.

<u>Results and Discussion</u>

- **HOG & SVM Method:**
  - Accuracy was average, especially for vehicles with small differences between classes.
  - It used less computing power and was easier to understand.
  - Needed manual feature engineering, which wasn't very effective for complex data.
- **CNN Method:**
  - It performed better than SVM with higher accuracy and better generalization.
  - Learned features directly from the image data, making it good for complex patterns.

- Needed more computing power and a larger dataset to work well.

Conclusion

This project shows that modern deep learning (like CNNs) is better for image classification than traditional machine learning methods (like HOG + SVM). The traditional method is simpler and easier to understand but doesn't handle complex image data well. CNNs, on the other hand, are powerful for handling complex patterns and give better results but require more resources.