Object Detector - README

Project Information

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Semester: Spring 2025
Subject: PRCV
Compiler and OS: Visual Studio on Windows 11

Project Overview

This project is a simple object detector that utilizes OpenCV to capture video from a camera, process the frames, and classify objects based on extracted features. The program allows real-time object detection and classification using Hu Moments and other geometric features.

Features

- Captures video from a camera.
- Performs image preprocessing and region detection.
- Extracts features like aspect ratio, filled percentage, Hu Moments, and orientation.
- Classifies objects using a nearest-neighbor approach.
- Displays the processed frames with bounding boxes and classification labels.
- Supports training mode to collect new feature data.
- Logs debugging information to a text file.
- Computes and displays a confusion matrix for performance evaluation.

Requirements

- OpenCV (4.x recommended)
- C++ compiler (Visual Studio on Windows 11 recommended)
- Basic knowledge of C++ and image processing concepts

Installation and Usage

1. Clone or download the project repository.
2. Ensure OpenCV is installed and properly configured in Visual Studio.
3. Compile and run the program.
4. Use the following key commands:
    - **'n'**: For normal classification mode
    - **'k'**: For KNN classification mode

- **'q'**: Quit the program.
- **'s'**: Save the current frame and extracted features.
- **'t'**: Toggle between training and testing mode.

Debugging and Logging

- The program logs feature extraction and classification steps in debug_log.txt.
- If classification is not working correctly, check:
  - The features.txt file to ensure feature data is being stored properly.
  - The debugging logs for errors or unexpected values in extracted features.

Confusion Matrix

The program maintains a **5x5 confusion matrix** to evaluate classification performance. The matrix updates dynamically based on predicted and actual class labels.

File Structure

Submission_Files/

```
| -- Code FIles/
|    | -- objectDetector.cpp      # Main source file containing the program logic
|    | -- filters.cpp     # Image processing functions
|    | --confusionMatrix.cpp          # Code for Confusion matrix creation
|    | -- filters.h        # Filter header file
| -- Result_Images/
|    | -- IMAGES       # Images of the working system and task resquirements
| -- Working_Video   # Video of the working system
| -- features.txt    # Stores extracted feature vectors for classification
| -- debug_log.txt   # Logs debugging information for troubleshooting
| -- README.md        # Project documentation
| -- PRCV_Project_3_Report        # Project Report
```

Acknowledgments

This project was developed as part of the PRCV course in Spring 2025 at Northeastern University.