Traffic Monitoring System using Computer Vision and Machine Learning

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Presented by:

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https://youtu.be/2-B28uaSZEY

Presentation Outline

- ❑ Introduction
- ❑ Problem Statement
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- ❑ Methodology
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Introduction

- ❑ Traditional traffic monitoring is manual, error-prone, and lacks real-time data.
- ❑ Develop a tool using video analysis and machine learning for automated traffic monitoring.
- ❑ Benefits:
  - ➢ Real-time data for dynamic traffic management.
  - ➢ Reduced errors compared to manual methods.
  - ➢ Improved traffic control and decision-making.

Problem Statement

- ❑ Manual traffic monitoring is labor-intensive and error-prone.
- ❑ Traditional methods cannot provide real-time data.
- ❑ We need a more accurate, efficient, and real-time traffic monitoring solution.

Research Objectives

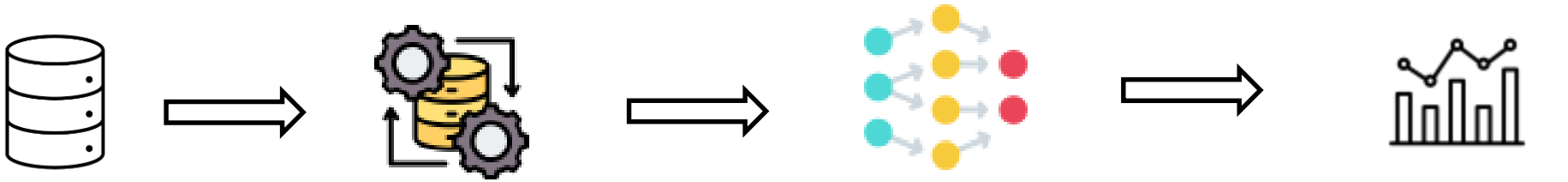
- Develop a system that utilizes video object detection and classification techniques to automatically identify and categorize features in traffic videos.
- Employ various machine learning models to analyze traffic conditions.
- Compare the performance of different machine learning models to determine the most effective approach.

Research Contributions

- The major contributions of the project were as follows:
  - Implemented the following Machine Learning models:

    Support Vector Machine (SVM), Random Forest, k-Nearest Neighbors (k-NN), and Logistic Regression
  - Built an Essembled models that combines Random Forest, k-NN, and Logistic Regression.

Methodology



Data Collection

Data Pre-processing

Model Building

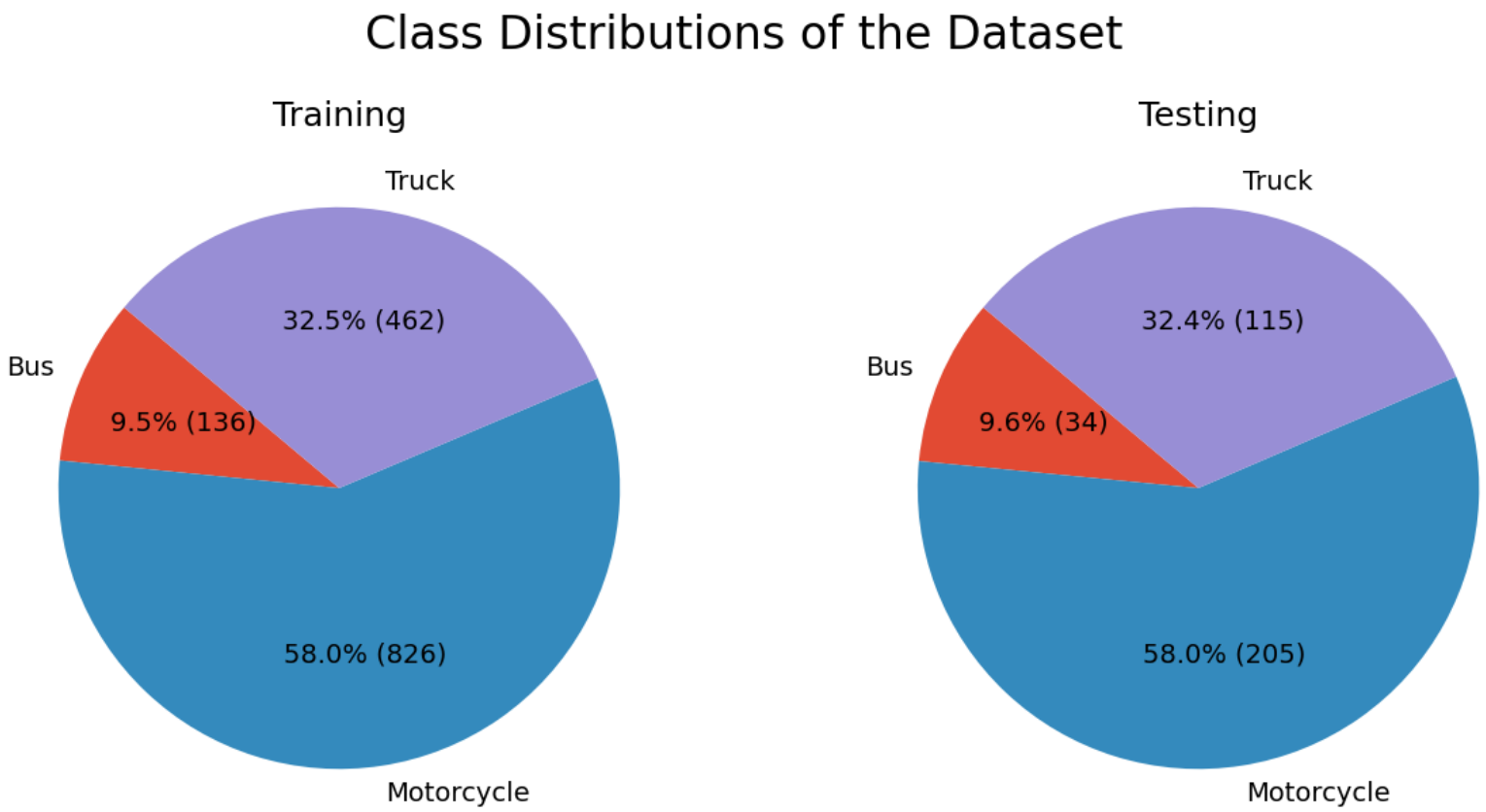
Model Evaluation

Traffic Video Preprocessing and Data Preparation

- ❑ Extracting video information (frame rate, size, etc.)
- ❑ Frame capture for image dataset creation
- ❑ Object annotation using bounding boxes and labels
- ❑ Feature extraction with color histograms
- ❑ Data splitting for training and testing

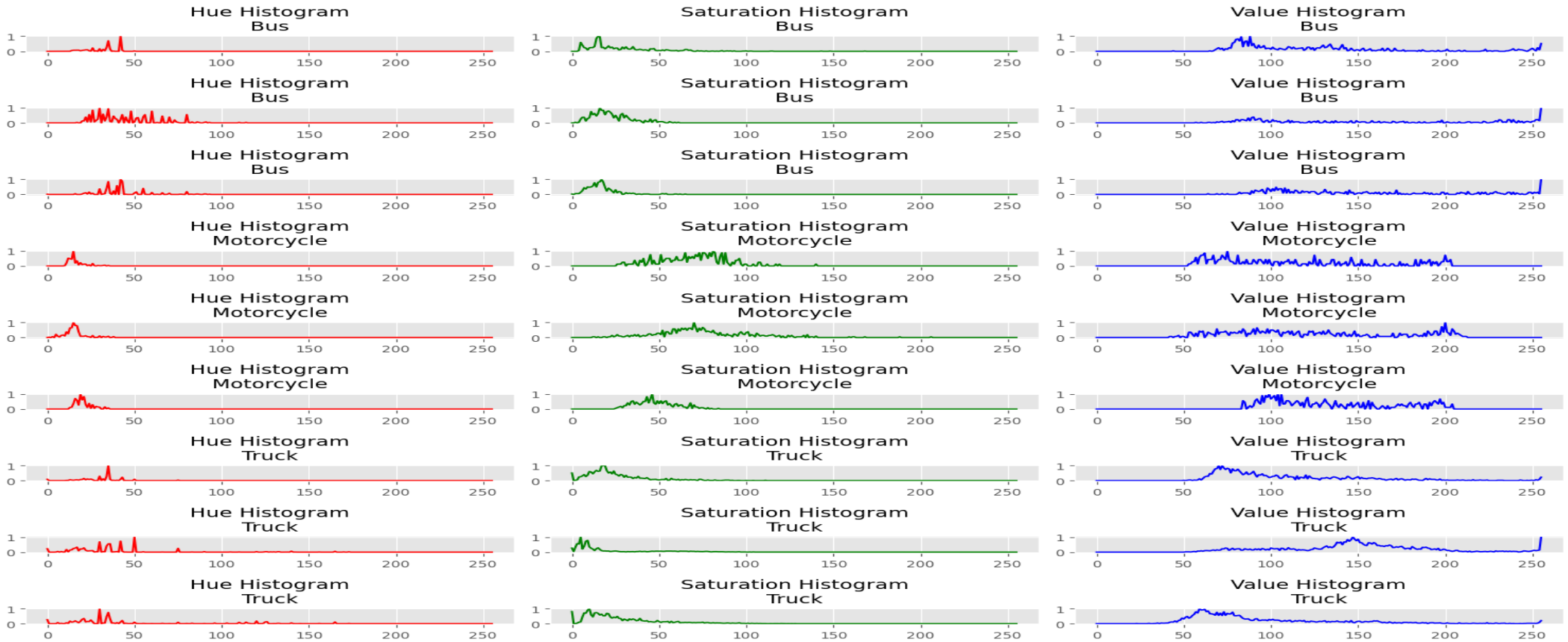
Traffic Video Preprocessing and Data Preparation cont..

- Data splitting for training and testing



Traffic Video Preprocessing and Data Preparation cont..

- Feature extraction with color histograms



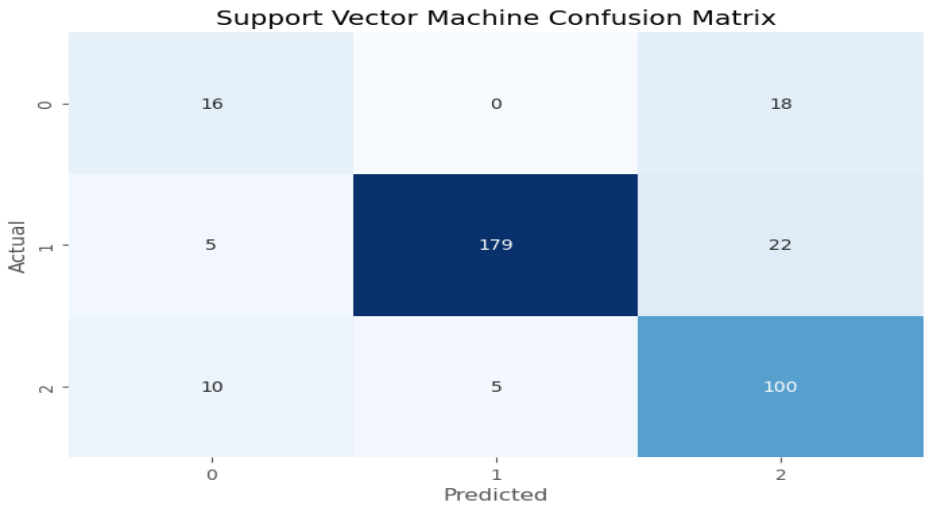
Machine Learning Model Training and Evaluation

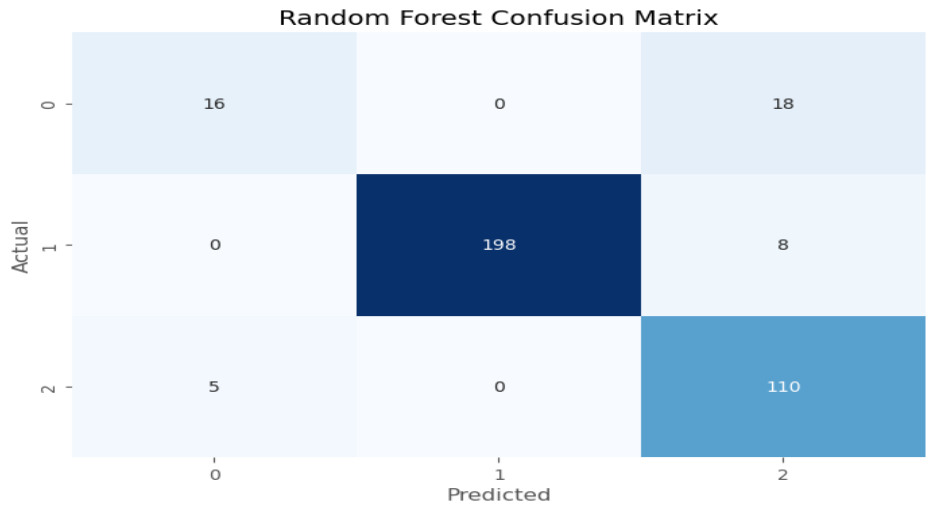
- Model selection: Support Vector Machine (SVM), Random Forest, k-Nearest Neighbors (k-NN), Logistic Regression, and an Essembled model
- Model training using the prepared training dataset
- Model evaluation using the testing dataset
- Performance metrics: Accuracy, F1-Score, Precision, Recall, and confusion matrix
- Comparison of model performance to identify the most effective approach

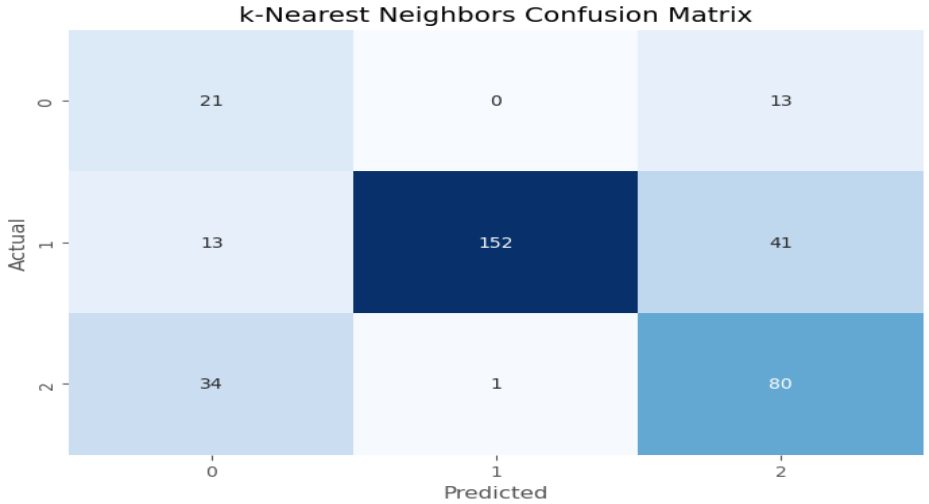
Results and Discussions

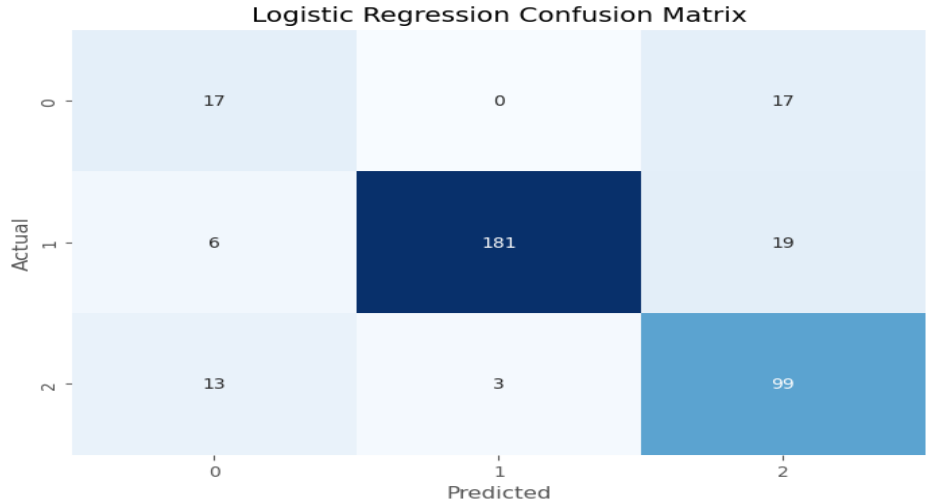
Model	Accuracy	Precision	Recall	F1-Score	AUC
Support Vector Machine	0.83	0.84	0.83	0.83	0.82
Random Forest	0.91	0.91	0.92	0.91	0.90
k-Nearest Neighbors	0.71	0.80	0.71	0.73	0.73
Logistic Regression	0.81	0.80	0.81	0.81	0.91
Ensemble Model	0.88	0.90	0.88	0.88	0.91

Results and Discussions – Cont'd









Conclusions

- Traditional traffic monitoring methods are labor-intensive and error-prone.
- This project explores using computer vision and machine learning for automatic traffic monitoring.

- **Thank you**

- **Github link**

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