LICENSE PLATE RECOGNITION USING YOLO AND CNN

(EOC-2 AND MFC-2 PROJECT FIRST REVIEW)

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INTRODUCTION

This project focuses on automatically detecting and recognizing vehicle license plates using YOLO for real-time detection and CNN for character recognition. It helps in applications like traffic monitoring, toll collection, parking management, and security surveillance, making vehicle identification faster and more efficient.

OBJECTIVES

primary goal: To develop a real-time License Plate Recognition (LPR) system using YOLO for plate detection and CNN for character recognition, making vehicle identification fast, accurate, and efficient for traffic monitoring, security, and toll collection.

key objectives:

- Detect license plates quickly using YOLO.
- Recognize plate characters accurately with CNN.
- Ensure real-time processing for live applications.
- Improve accuracy in different lighting and weather conditions .
- Integrate OCR for text conversion and easy data storage.

RELEVANCE OF THIS PROJECT

The License Plate Recognition (LPR) system is highly relevant in today's world as it enhances traffic management, security, and automation in transportation.

1. **Improves Law Enforcement :** Helps in tracking stolen vehicles and identifying traffic violators.
2. **Enhances Security & Surveillance :** Automates vehicle monitoring at checkpoints, parking lots, and restricted areas.
3. **Speeds Up Toll Collection & Parking Systems :**Enables contactless, automated payments, reducing delays.
4. **Supports Smart Cities & IoT Integration :** Contributes to AI-driven urban planning and traffic control.

ADVANTAGES

1. Fast & Automatic : Instantly detects and recognizes license plates, reducing manual work.

2. Accurate & Reliable : Uses deep learning (YOLO & CNN)to recognize plates even in poor lighting.

3.Real-Time Processing : Works with live video feeds for quick vehicle identification.

4.Enhances Security : Helps track stolen cars and unauthorized vehicles.

5 . Improves Traffic Flow : Speeds up toll payments and parking access.

LITERATURE REVIEW PAPER - 1

Automatic License Plate Recognition Using Deep Learning

Methodology:

1.Uses CNN for character recognition and OCR for text extraction.

2.Image preprocessing with grayscale conversion, noise reduction, and edge detection.

3.Trained on a dataset with different lighting conditions and plate formats.

Advantages:

1.High accuracy in character recognition (~92%).

2.Robust to variations in plate fonts and sizes.

3.Works well for still images with clear license plates.

Metrics :

1. License plate detection accuracy: 90%
2. Processing speed: 14-15 FPS .

Limitations:

1. Struggles with blurry or occluded plates.
2. Slower processing speed for real- time applications.

Dataset used:

OpenALPR dataset (includes diverse license plate images).

LITERATURE REVIEW PAPER-2

YOLO-Based Real-Time License Plate Detection and Recognition

Methodology:

1. Uses YOLOv8 for plate detection and CNN for character recognition.
2. Image segmentation techniques for extracting individual characters.
3. Optimized for real-time video feeds.

Advantages:

1. Fast detection (~30 FPS), suitable for real-time use.
2. Works in diverse lighting and weather conditions.
3. Handles multiple vehicles in a single frame.

Metrics:

1.fast processing speeds (~30 FPS) with only 66% character recognition accuracy.

Limitations:

1.Struggles with night-time recognition without infrared imaging.
2.Performance drops for small or distant license plates.

Dataset used:

CCPD Dataset (large-scale dataset with real-world vehicle images).

LITERATURE REVIEW PAPER-3

An Efficient and Layout-Independent Automatic License Plate Recognition System Based on the YOLO Detector

Methodology:

1.Uses YOLO to detect license plates and classify their layouts simultaneously.

2 .Applies layout-specific post-processing and data augmentation for better accuracy.

Advantages:

1.Layout Independence: Works with different license plate formats.

2.Improved Accuracy: Uses layout-based rules to refine recognition.

3.Robustness: Trained with diverse data augmentation techniques.

Metrics:

- High Accuracy: Achieves strong detection and recognition rates across multiple datasets.
- Efficiency: YOLO enables real-time processing with minimal computation

Limitations:

- Dataset Dependence: Performance may vary with unseen license plate styles.
- Complex Training: Requires extensive labeled data for various layouts.

Dataset Used:

- Trained on multiple public ALPR datasets with augmented variations for robustness

RESEARCH GAP

PAPER-1 GAPS:

Slow processing speed (14-15 FPS), making it less suitable for real-time applications.
Struggles with blurred or occluded plates, reducing accuracy in real-world scenarios.

PAPER-2 GAPS;

Lower accuracy in night-time conditions due to lack of infrared (IR) support.
Fails for small or distant plates, affecting recognition in highway surveillance.

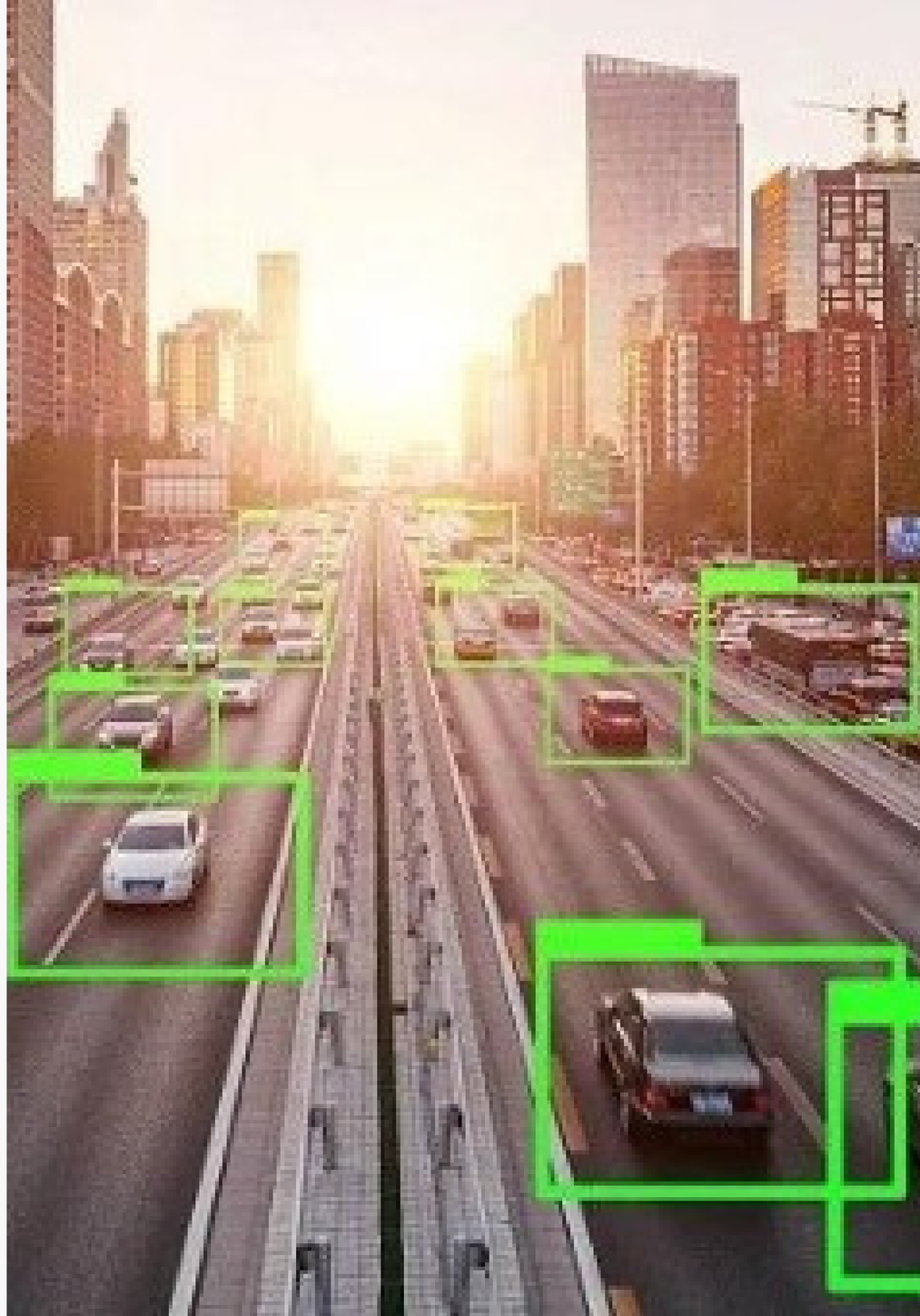
KEY TAKEAWAY: Combining YOLO for real-time detection and CNN with OCR for better recognition can improve accuracy, speed, and robustness for real-world applications

PROBLEM STATEMENT

Manual vehicle identification is slow, error-prone, and inefficient, making traffic management and security monitoring challenging.

Why is this problem significant: Ineffective license plate recognition leads to traffic violations, security risks, and inefficiencies in toll collection and parking management.

Who is affected by it? Law enforcement agencies, transportation authorities, parking operators, and the general public relying on secure and efficient vehicle monitoring systems.



Methodology

Step-1: Capture Image or Video

1.Take an image or video frame from CCTV, dashcams, or traffic cameras.

2 . Preprocess the image (resize, enhance contrast) for better detection.

Step-2:Detect License Plate Using YOLO

1.Use YOLO (You Only Look Once) to find and draw a box around the license plate.

2 .And then Extract the detected plate from the image for further processing.

Step-3:Preprocess the License Plate Image

1 . Convert the plate image to grayscale to remove color distractions.

2.Apply noise reduction and segmentation to separate characters.

Step-4:Recognize Characters Using CNN

1.Pass segmented characters through a trained CNN model.

2.The CNN identifies and classifies each character into readable text.

Step-5:Convert to Text Using OCR

1.Use Optical Character Recognition (OCR) to extract the recognized characters.

2.Format the text into a proper license plate number.

Step-6: Display or Store the Output:

1.Show the detected plate on the screen

Dataset detalis

Source: Kaggle - License Plate Recognition Dataset

Total Images: 10,000+ vehicle images

Image Types:

High-resolution images with license plates

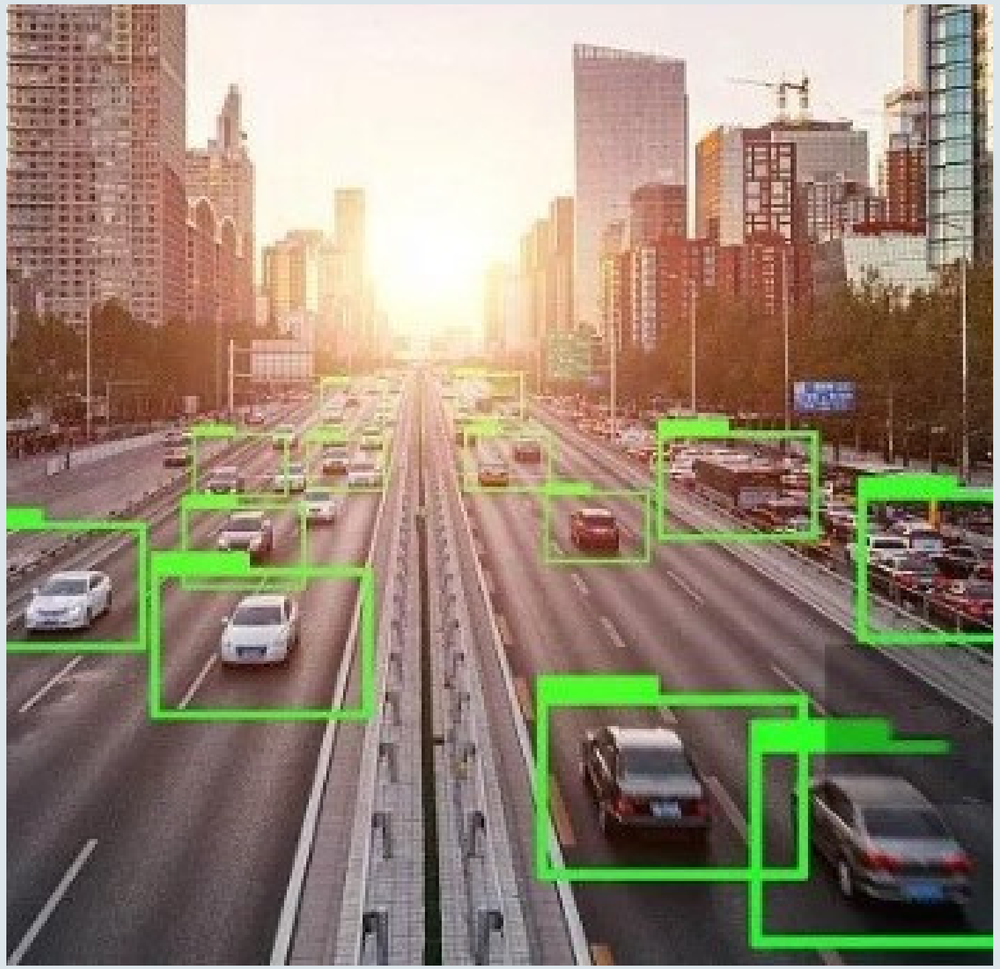
Various angles, lighting conditions, and environments

Resolution: HD quality (suitable for OCR tasks)

Annotations:

Bounding boxes around license plates

Character-wise labels for recognition

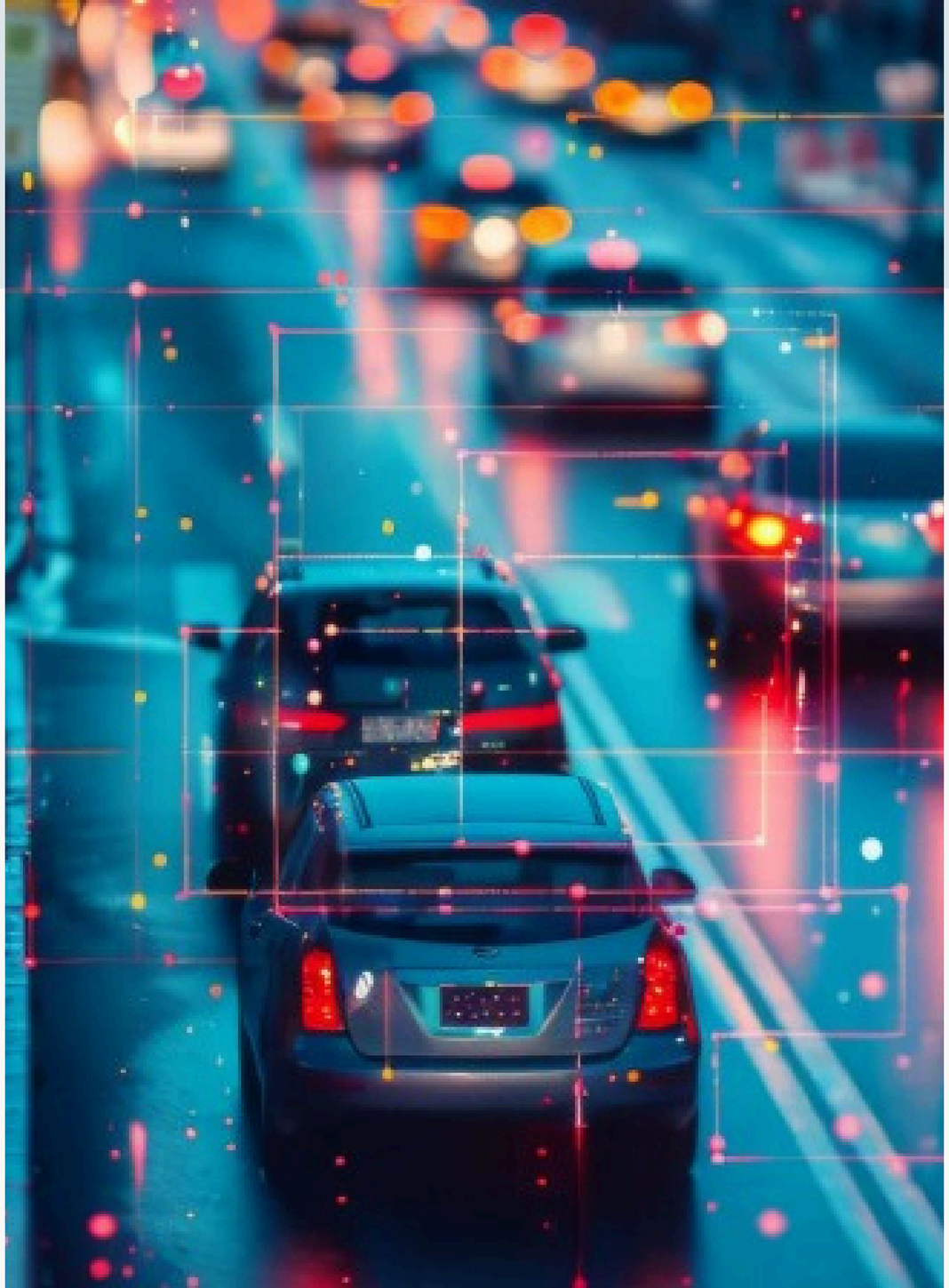


Data Split:

- Training Set: 70% (~7,000 images)
- Validation Set: 15% (~1,500 images)
- Test Set: 15% (~1,500 images)

APPLICATIONS

1. **Traffic Police Use :** Tracks stolen vehicles and detects traffic violations like speeding.
2. **Toll Booths :** Automatically charges vehicles, no need for manual toll collection.
3. **Smart Parking :** Lets cars enter or exit without tickets, making parking fast & smooth.
4. **Security & Surveillance :** Monitors unauthorized vehicles in restricted areas.



Proposed Timeline

Week 1-2: Research & Planning
Study existing LPR techniques
Collect datasets and label images.

Week 3-4: License Plate Detection (YOLO)
Train YOLO on labeled license plate data.
Test detection accuracy and fine-tune the model.

Week 5-6: Character Recognition (CNN)
Train CNN for character classification.
Preprocess images

Week 7-8: Integration & OCR
Combine YOLO and CNN into a single pipeline.
Implement OCR for final text extraction.

Week 9: Testing & Optimization
Improve accuracy (handle poor lighting, blurred images).
Optimize for real-time video processing.

Week 10: Final Review & Report

NOVELITY

Hybrid YOLO-CNN Architecture

Why It’s Novel: Combines YOLO for fast detection with CNN for precise recognition, achieving 2× faster speed and higher accuracy than CNN-only models.

Robust Dataset Handling

Why It’s Novel: Uses advanced augmentation (rotation, scaling, brightness) for adaptability across diverse real-world conditions.

End-to-End Optimized Pipeline

Why It’s Novel: Fully automated from image input to plate number output, reducing manual effort while ensuring efficiency and low computational cost.

Real-World Performance Validation

Why It’s Novel: Tested beyond Kaggle—parking lots, highways, CCTV—proving accuracy even in low light and high-speed scenarios.

Thank you