

Bangla License Plate Detection Using YOLOv8: An Efficient Framework with a Custom Dataset

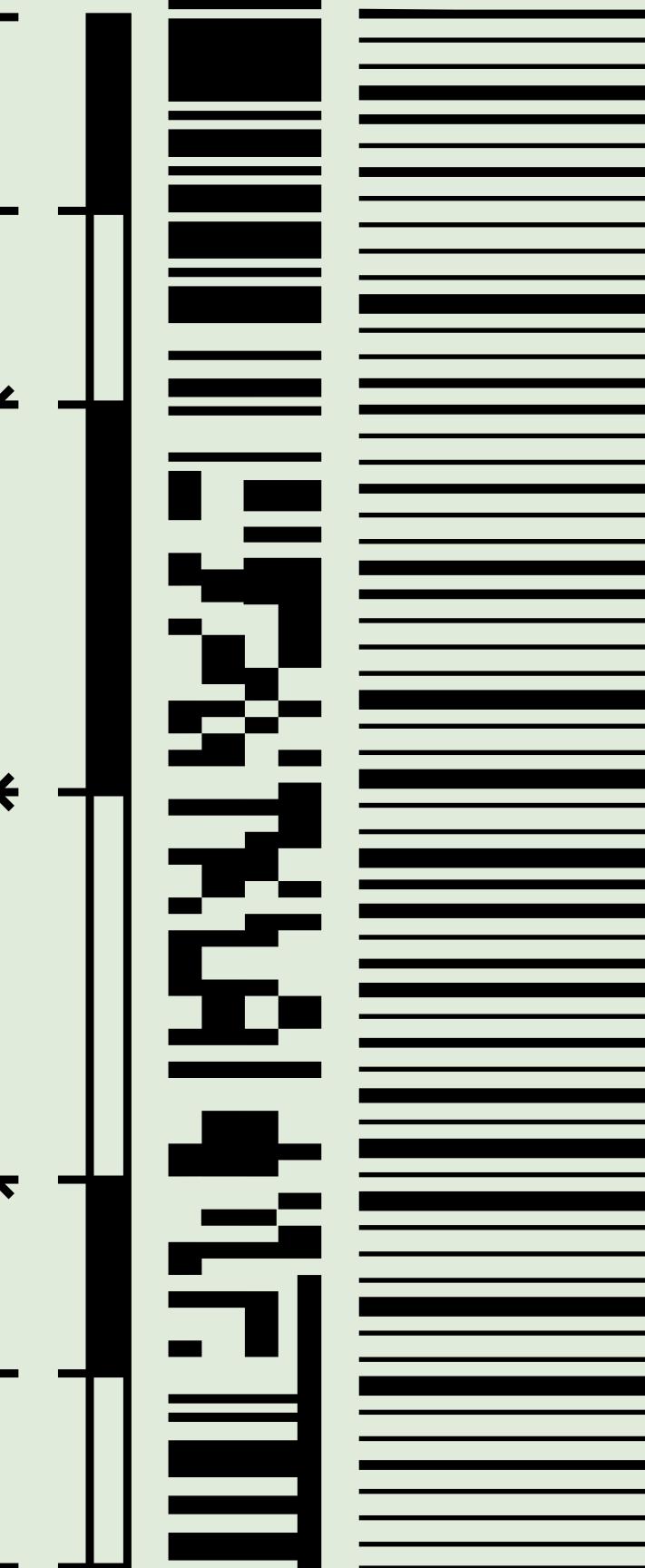
A project by

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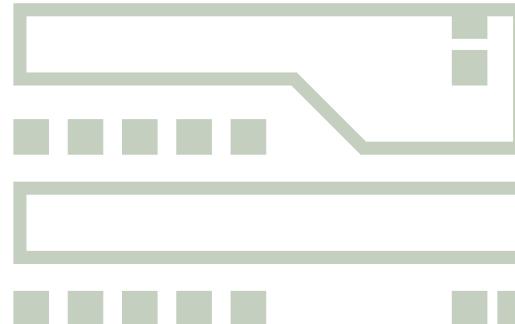


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Introduction to ALPD

Understanding the significance of Automatic License Plate Recognition in Bangladesh and the project goal utilizing YOLOv8 for accurate detection.



01.

ALPD enhances **traffic management** and law enforcement efficiency.

02.

It plays a crucial role in **improving road safety** across the country.

03.

The project aims to effectively recognize **Bangladeshi license plates** using YOLOv8 technology.

Objectives

01.

To prepare an optimized dataset of Bangladeshi license plates for effective training.

02.

To train a YOLOv8 model for accurate and efficient license plate detection.

03.

To evaluate and optimize model performance using metrics like mAP, precision, and recall.

Related Works

[1] Abdullah et al., 2018 – YOLO-Based Three-Stage Bangla LP Recognition

Shortcomings:

Only single-character recognition in first row.

Small dataset → Limited real-world variation.

YOLOv3 → Faster than older methods, but not optimized for edge deployment.

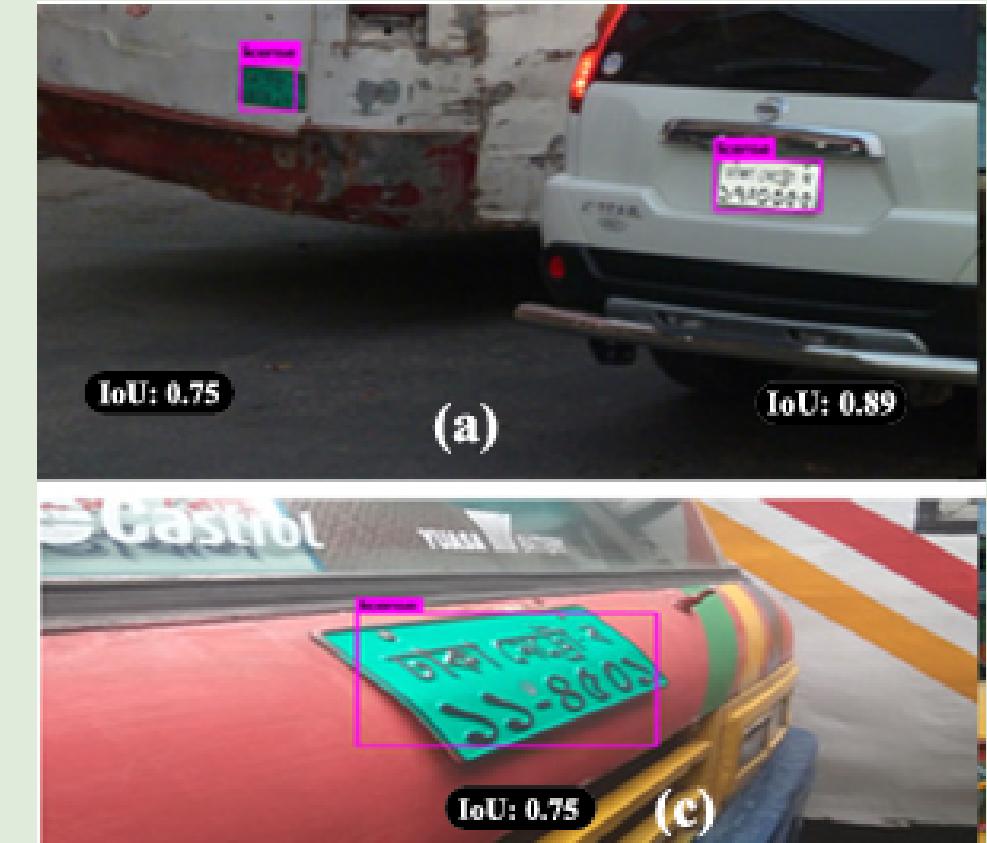


Figure 2 provides an overview of the performance of the YOLO-based Bangla license plate recognition framework.

Related Works

In [3], Ahmed et al., 2022, proposed a “Bangla License Plate Detection and Recognition System with YOLOv7 and Improved Custom OCR Engine.”

Shortcomings:

- Requires high-quality images for optimal segmentation.
- Performance decreases on tilted or rotated license plates.
- Real-time video-based detection not fully addressed.
- LoG-RSF segmentation can be computationally expensive for edge devices.



Fig. 3. Some of the detected license plate from the proposed work.

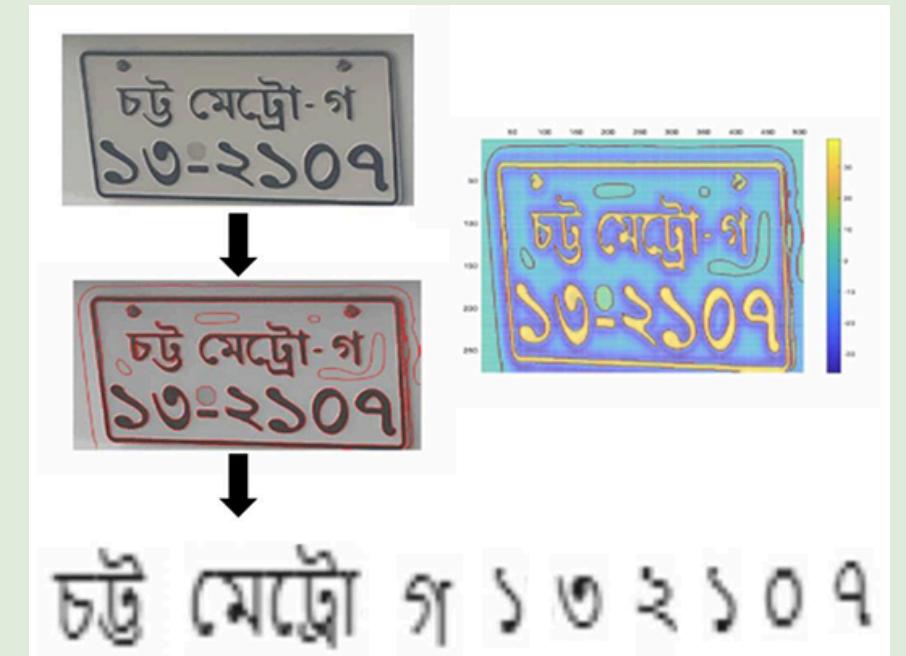


Fig. 4. LoG-RSF result.

Methodology Overview

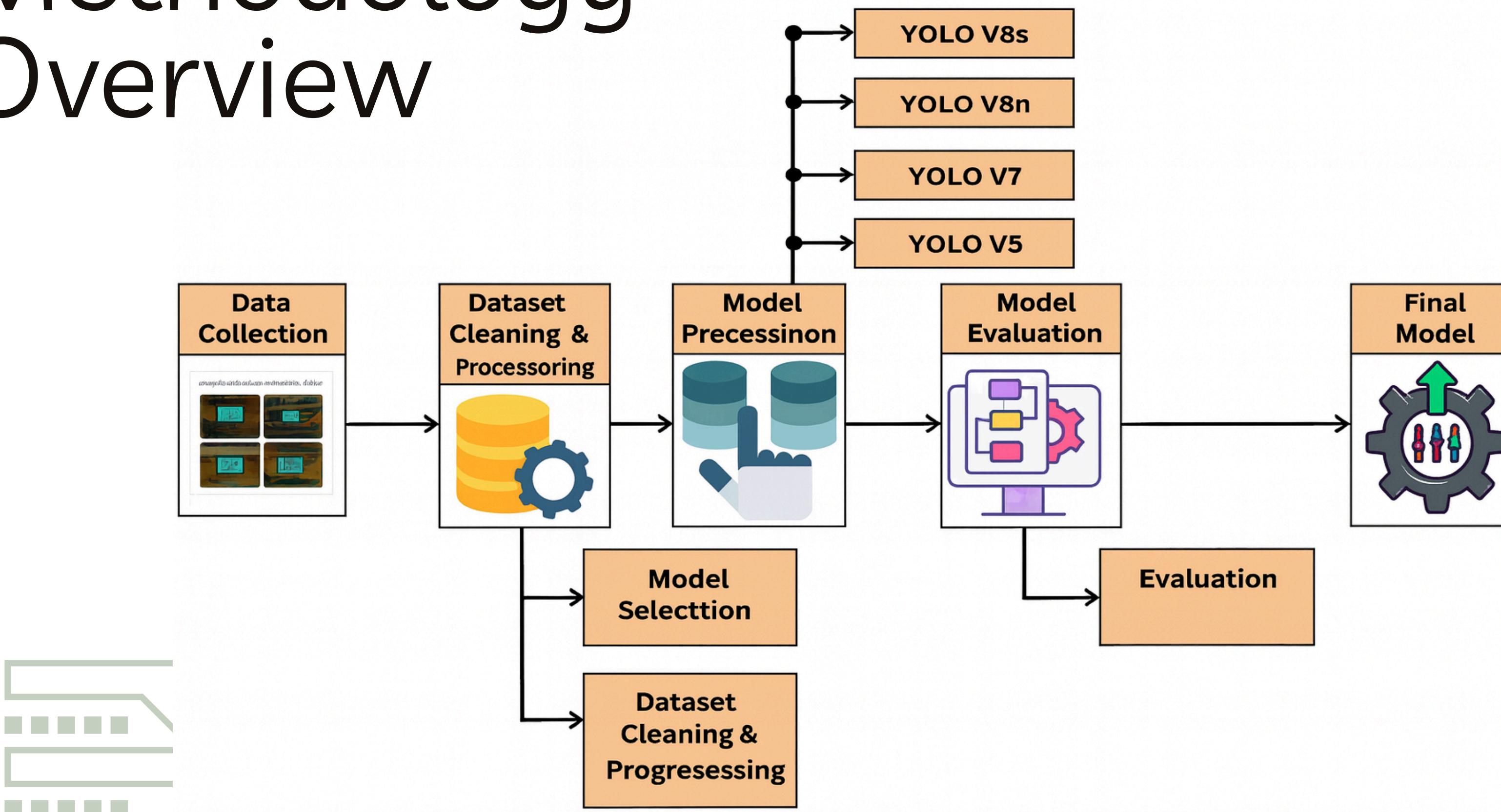


Fig. 5. Workflow of the YOLOv8-based Bangla license plate detection system

Dataset Details

01.

Roboflow was used to create our dataset.

02.

We defined **one class** specifically for Bangladeshi license plates.

03.

Data was split into training, validation, and test sets.

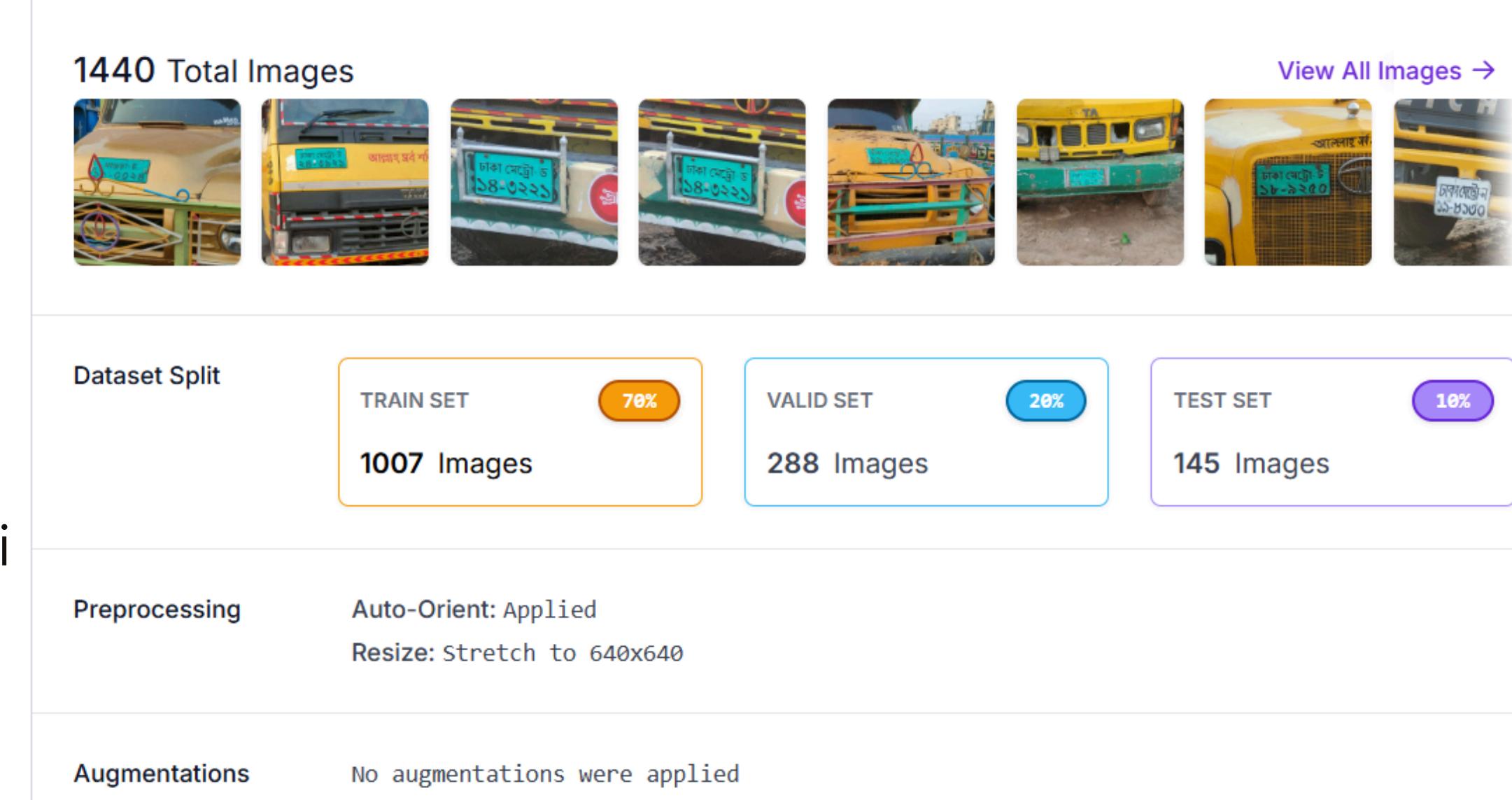
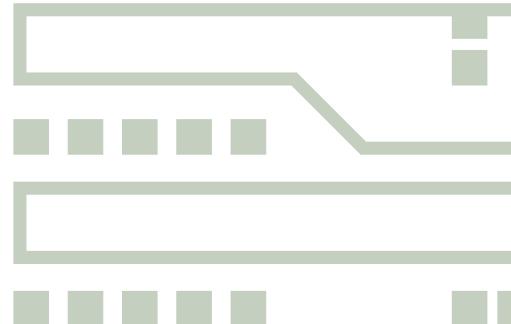


Fig. 6..Roboflow dataset [6]

Training Setup

This section outlines the tools and frameworks used for training the ALPR model effectively on Kaggle, focusing on key parameters and configurations.



01. Kaggle provides a robust platform for training models.
02. We utilized **YOLOv8** for accurate detection of license plates.
03. OpenCV and Roboflow were essential for preprocessing data.

Model Performance Comparison

Model	mAP50	Precision	Recall
YOLOv8s (Ours)	0.95	0.97	0.95
YOLOv8x	0.96	0.93	0.9
YOLOv7	0.94	0.92	0.89
YOLOv5	0.91	0.89	0.87
YOLOv3	0.89	0.87	0.85

Performance Visuals

This section presents visual representations of the **confusion matrix** and **loss curves** to evaluate the model's performance.

01.

The confusion matrix illustrates classification accuracy.

02.

Loss curves show model training effectiveness over time.

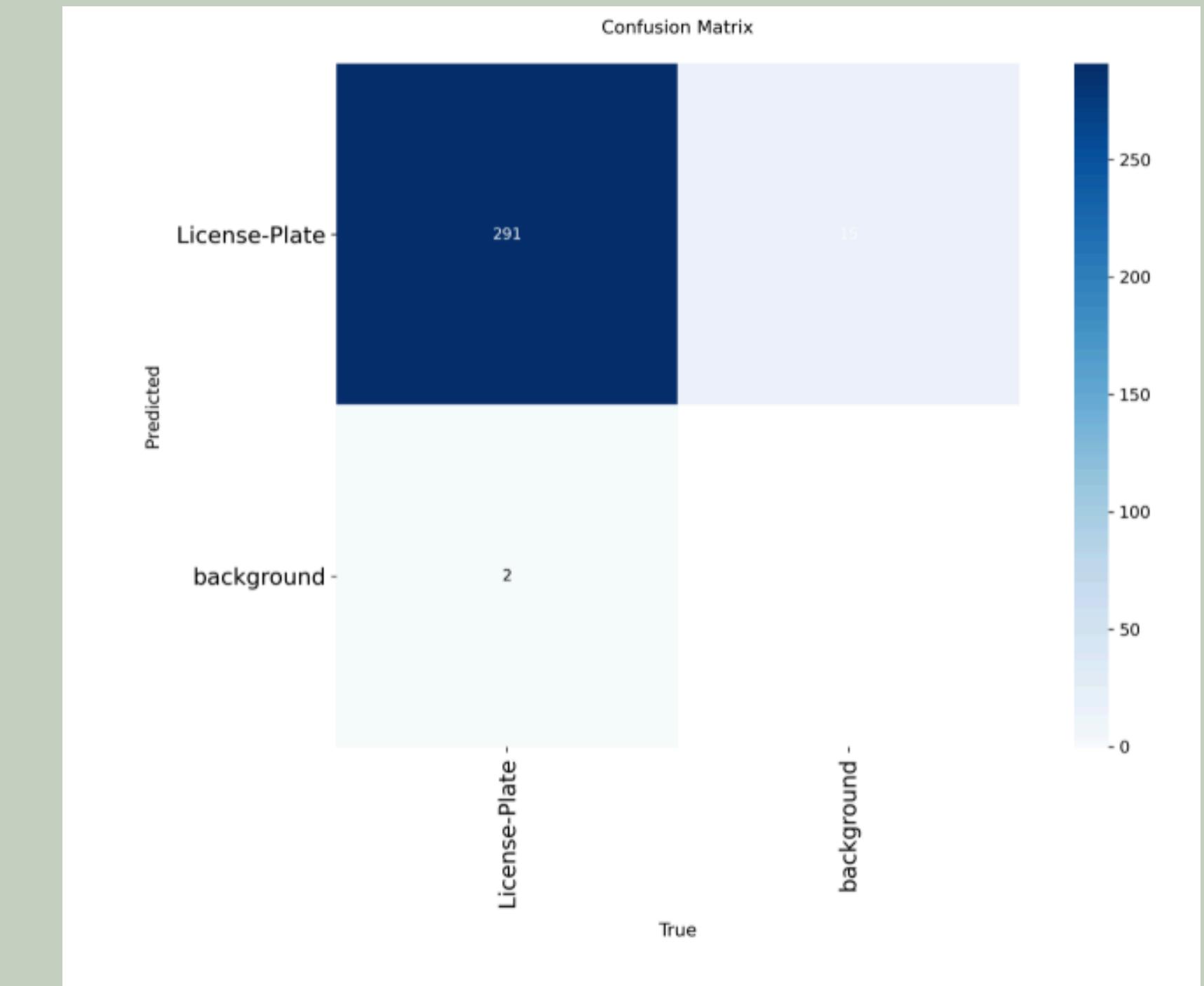


Fig. 6. Confusion Matrix of the trained YOLOv8 model.

Performance Visuals

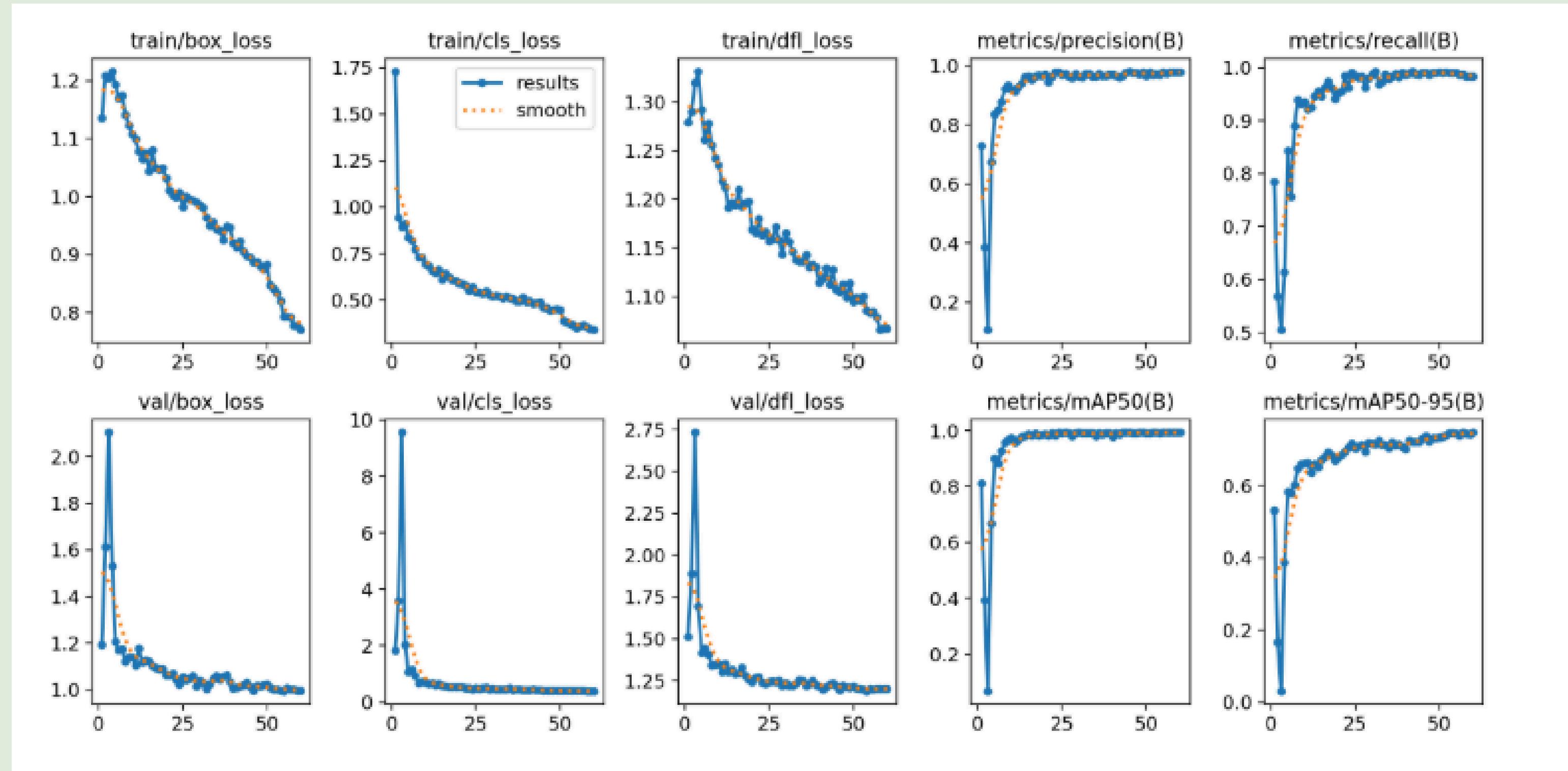


Fig. 7. YOLOv8 training and validation curves including Precision, Recall, mAP50, mAP50-95, and all loss components.

Batch Images



Fig. 8. Sample predicted results on the validation dataset

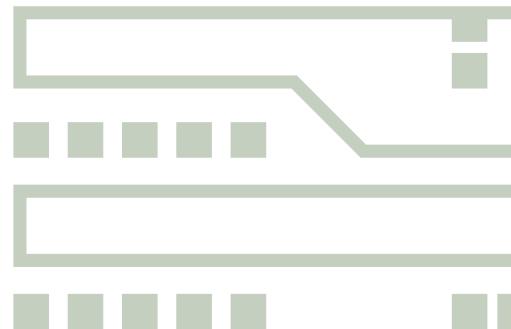
Results



Fig. 9. Sample predicted results

Project Achievements

Highlighting significant milestones reached in the project, demonstrating our progress and success in developing an ALPR system for Bangladesh.



01.

Successfully collected a diverse dataset for training.

02.

Achieved high accuracy in license plate detection.

03.

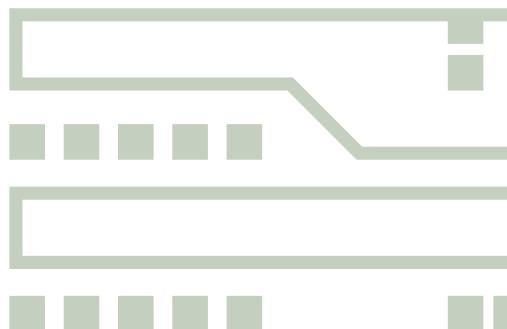
Developed a robust model using YOLOv8 technology.

Comparison with Related Works

References	Method / Model	Performance	Limitations	Our YOLOv8s Model
[1] Saha et al., 2024	YOLOv8x	mAP@50 = 0.96	Large model, slower inference time	Similar accuracy with a much lighter model
[2] Ismail & Ahamed, 2025	YOLOv8 + EasyOCR	Overall recognition = 94.8%	OCR dependent; detection not optimized	Strong plate detection pipeline; OCR can be added later
[3] Ahmed et al., 2022	YOLOv7 + Custom OCR	Detection ≈ 96%, Recognition ≈ 97%	Requires multiple YOLO models, heavy compute	YOLOv8s is lightweight and faster
[4] Ramit et al., 2024	YOLOv5 vs YOLOv7 vs YOLOv8	YOLOv8 mAP = 0.934	YOLOv5/YOLOv7 show lower performance	Our model improves accuracy to 0.95 mAP50
[5] Haque et al., 2022	ESRGAN + ALPR	OCR ≈ 91% on low-res images	Requires super-resolution preprocessing	YOLOv8s directly handles low-res cases
[6] Roboflow Dataset V2	Dataset used	–	–	Cleaned, validated, optimized training dataset

Future Work

Plans for integrating OCR, expanding the dataset, and deploying the system in real-world applications.



01.

Integrating OCR will enhance **text recognition accuracy**.

02.

Expanding the dataset will allow for better **model performance**.

03.

Deployment strategies will ensure **real-time functionality** and usability.

References

- [1]** U. Saha, I. U. Ahamed, and M. I. Hossain,
“YOLOv8 for Bangla License Plate Recognition: Advancing Real-Time Object Detection in Localized Contexts,” 2024.
- [2]** G. M. Ismail and I. Ahamed,
“YOLOv8-Based License Plate Recognition for Bangladeshi Vehicles,” 2025.
- [3]** S. U. Ahmed, F. B. F. Maisha, and M. H. E. Haider,
“Bangla License Plate Detection and Recognition System with YOLOv7 and Improved Custom OCR Engine,” ICERECT, 2022.
- [4]** S. S. Ramit et al.,
“Performance Evaluation of YOLO Models for Detecting Bangladeshi License Plates,” 15th ICCCNT, 2024.
- [5]** N. Haque, S. Islam, R. A. Tithy, and M. S. Uddin,
“Automatic Bangla License Plate Recognition System for Low-Resolution Images,” STI Conference, 2022.
- [6]** Roboflow Universe,
“Bangladeshi Vehicles License Plate Dataset — Version 2,” 2025.
Available: <https://universe.roboflow.com>



Thank You!



**Feel free to ask questions or
share your thoughts!**

