Project 4: Car Plate Recognition and Reconstruction with Deep Learning

Abstract: Automatic car plate recognition is a crucial task in the field of computer vision with wide-ranging applications in intelligent transportation systems, traffic monitoring, law enforcement, and access control. The goal is to accurately recognize and reconstruct vehicle license plates from images or video streams, often captured under challenging real-world conditions such as varying lighting, occlusions, motion blur, and diverse plate formats. Deep learning models, particularly convolutional neural networks, have significantly advanced the performance and reliability of car plate recognition. This project aims to explore and implement deep learning-based approaches for license plate recognition, emphasizing practical challenges and the impact of robust solutions in modern urban infrastructure and mobility management.

Dataset: **Dataset:** CCPD [2]

Task: The objective of this project is to design and implement a deep learning-based system for license plate recognition, following the methodology outlined in [1]. The proposed solution is structured as a two-stage pipeline, leveraging the strengths of different neural network architectures to address the distinct subtasks involved in the recognition process. In the first stage, a YOLOv5 model is employed for license plate detection, allowing for fast and accurate localization of the plate region within vehicle images, even under challenging environmental conditions. In the second stage, the cropped plate region is passed to a specialized recognition model based on the PDLPR architecture. This model is responsible for decoding the sequence of alphanumeric characters on the plate, effectively treating the task as a sequence prediction problem. The integration of these two components aims to deliver a robust and efficient system for plates recognition and reconstruction suitable for deployment in real-world scenarios.

Main objectives:

- *Baseline implementation, training and evaluation:* Implement a simple baseline, train and evaluate it with the metrics used in [1].
- *YOLOv5 and PDLPR model implementation and evaluation:* Implement the proposed model in [1], composed by the YOLOv5 and PDLPR models, and evaluate it.
- *Comparison with the baseline:* Compare the performance of the proposed model with the baseline, underlining why the proposed model is working better or not on recognizing and recostructing the car plates.

References:

1. Tao, L., Hong, S., Lin, Y., Chen, Y., He, P. and Tie, Z. (2024). A Real-Time License Plate Detection and Recognition Model in Unconstrained Scenarios. Sensors, 24(9), 2791
2. Xu, Z.; Yang, W.; Meng, A.; Lu, N.; Huang, H.; Ying, C.; Huang, L. Towards end-to-end license plate detection and recognition: A large dataset and baseline. In Proceedings of the European Conference on Computer Vision (ECCV), Munich, Germany, 8–14 September 2018.
3. R. K. Prajapati, Y. Bhardwaj, R. K. Jain and D. Kamal Kant Hiran, "A Review Paper on Automatic Number Plate Recognition using Machine Learning : An In-Depth Analysis of Machine Learning Techniques in Automatic Number Plate Recognition: Opportunities and Limitations," 2023 International Conference on Computational Intelligence, Communication Technology and Networking (CICTN), Ghaziabad, India, 2023, pp. 527-532