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CSC 327: Artificial Intelligence

Semester Project Report
Automatic License Plate Recognition

BSCS 6-B

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Abstract

Automatic License Plate Recognition (ALPR) systems have become integral tools with wide-ranging applications in law enforcement, parking management, and traffic surveillance. This project represents a concerted effort to enhance ALPR capabilities by leveraging the advanced YOLOv8 (You Only Look Once version 8) model for License Plate Detection. Subsequently, we integrate EasyOCR to extract text information from the detected license plates. This strategic combination aims to harness the speed and precision of YOLOv8 alongside the text extraction proficiency of EasyOCR, with the ultimate goal of crafting a streamlined ALPR system. This system is designed to recognize license plates efficiently and accurately in diverse real-world scenarios, addressing the existing challenges associated with traditional ALPR methodologies.

Objective

The primary objective of this project is to implement a comprehensive ALPR system that utilizes YOLOv8 for License Plate Detection and EasyOCR for text extraction from the detected license plate. Key goals include:

1. Implement YOLOv8 for robust and efficient License Plate Detection.
2. Train the model on a curated dataset to ensure adaptability to diverse license plate formats and challenging scenarios.
3. Integrate EasyOCR to extract text information from the detected license plates.

Project Scope

This project revolves around the development and refinement of an Automatic License Plate Recognition (ALPR) system. Leveraging the capabilities of YOLOv8 and EasyOCR technologies, our aim is to overcome the challenges inherent in traditional ALPR systems. Specifically, we concentrate on achieving accurate license plate detection and efficient text extraction from diverse images.

The overarching scope of this initiative extends to seamlessly integrating these technologies into a well-coordinated system. The envisioned outcome is a streamlined ALPR system with the ability to perform real-time recognition in varied environments. Despite the substantial progress evident in the current implementation, the ongoing focus of our work involves exploring potential refinements and optimizations. Our objective is to elevate the system's accuracy and adaptability, ensuring its effectiveness across a wide spectrum of real-world scenarios.

Methodology

- **YOLOv8 License Plate Detection:**
    1. **Utilization of YOLOv8 Architecture:**
       To achieve precise and rapid license plate detection, we employ the YOLOv8 architecture. This choice is based on the recognized efficiency of YOLOv8 in object detection tasks.
    2. **Training on Diverse Dataset:**
       The YOLOv8 model undergoes training on a meticulously curated dataset that covers a spectrum of scenarios, including various license plate formats and lighting conditions. This intentional diversity in training ensures the adaptability of the model to real-world situations.

3. **Data Preprocessing for Uniformity:**
   As an integral part of the training process, we apply data preprocessing techniques such as image padding and resizing. This step is crucial in achieving uniformity in image dimensions, contributing significantly to a more robust training process.

- **EasyOCR Text Extraction:**
  1. **Implementation of EasyOCR:**
     We integrate EasyOCR into the system to execute text extraction from the license plates identified by the YOLOv8 model. Leveraging EasyOCR's optical character recognition capabilities, we aim to retrieve accurate textual information.
- **Integration of YOLOv8 and EasyOCR:**
  1. **Combining Results:**
     The integration process involves seamlessly combining the results obtained from YOLOv8's license plate detection and EasyOCR's text extraction. This strategic combination is designed to provide comprehensive information about each license plate, including the alphanumeric characters present.
  2. **Ensuring Systematic Integration:**
     A special focus is placed on the integration process to guarantee the seamless operation of the overall ALPR system. The collaboration between YOLOv8 and EasyOCR is meticulously orchestrated to optimize both efficiency and accuracy.

This comprehensive methodology, covering YOLOv8 license plate detection, EasyOCR text extraction, and systematic integration, is reinforced by preprocessing steps addressing variations in image dimensions. This holistic approach is aimed at creating an ALPR system that not only excels in accuracy but also demonstrates efficiency across diverse real-world scenarios.

Results

While the implementation of YOLOv8 for License Plate Detection has shown promising advancements in both accuracy and speed, it's important to note that, due to time constraints and a limited dataset, there is still room for further improvement. The preprocessing and training modules have been successfully completed, and EasyOCR integration is in place. However, acknowledging that the accuracy is yet to reach its full potential, there is a need for the model to undergo training on larger and more diverse datasets. Despite these considerations, given the available resources, the model demonstrates commendable performance. The ongoing efforts in preprocessing and training lay a foundation for future enhancements, ensuring that the system evolves to meet the desired accuracy standards.

Conclusion

Concluding this semester's project, it has been an engaging and challenging journey. Undertaking a project of this nature, which was relatively new to us, presented various challenges and a significant learning curve. Throughout the process, We grappled with different issues and complexities, but each obstacle became an opportunity to delve deeper into the intricacies of the project.

The exploration of various functions and methods across a spectrum of libraries, including neural nets, YOLOv8, EasyOCR, cv2, and matplotlib.pyplot, has enriched my understanding of these technologies. The application of diverse Image Analysis techniques and data preprocessing methods has been a pivotal aspect of the project, providing practical insights into the nuances of handling real-world data.

Despite the hurdles faced, the project has provided valuable lessons in problem-solving, coding practices, and the intricacies of working with cutting-edge technologies. As the project unfolded, we not only gained proficiency in the specific tools and techniques employed but also developed a deeper appreciation for the complexities and potential applications of License Plate Detection systems.

While the current state of the project marks a significant achievement, recognizing that this is part of an ongoing learning process opens avenues for future refinements and optimizations. As I reflect on this journey, I am more equipped with the skills and knowledge necessary for tackling intricate projects in the field of image processing and artificial intelligence.