

Individual Term Project:
Generating Route Panorama
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Abstract

The "Route Panorama" project aims to generate panoramic views from front-facing dashcam footage captured during road journeys. Inspired by Jiang Yu Zheng and Saburo Tsuji's 1990 work on panoramic views, this project focuses on a specific type of panorama known as 'route panorama.' Leveraging Python and OpenCV, the video footage is processed by extracting individual frames. Subsequently, each frame is sliced to isolate views from the left and right sides of the car. The resulting slivers are then looped over time to create a dynamic route panorama. This documentation outlines the implementation details, showcasing the use of computer vision techniques for video processing and panoramic image generation.

Keywords: Panorama, route panorama, multimedia, video processing, image processing, computer vision, python, jupyter, jupyter notebook, matplotlib, cv2, pyplot, computer science

Introduction

In the pursuit of creating panoramic views, this project successfully crafts ten distinctive "Route Panoramas." Five panoramas showcase the view from the left side of the car, while an additional set of five captures the view on the right.

The project uses strategic video manipulation, achieved through Python and OpenCV. Vertical and horizontal cuts are employed, focusing on selectively capturing the dynamic surroundings adjacent to the car window. Vertical cuts delineate the left and right views, offering a comprehensive view of the scene over time. Simultaneously, horizontal cuts add sophistication, capturing the moving landscape with precision.

In subsequent sections, this documentation delves into the methodology, showcasing technical expertise in Python and OpenCV. These panoramas invite viewers to engage with the dynamic visual narrative of a road journey in a fresh and captivating way.

Methods

Folder M5, assigned by Professor Zheng, contained five MP4 files, each approximately one minute in duration. The dataset can be accessed through [this](#) link. Employing Jupyter Notebook and OpenCV in Python, the following methodology was employed to process the video files and generate Route Panoramas.

1. Video Processing:

The MP4 files were read using Jupyter Notebook and OpenCV in Python. Each file represented a distinct journey captured by a front-facing dashcam.

2. Frame Extraction:

The video files were dissected into individual frames. This process served as the foundational step for subsequent panoramic image creation.

3. Spatial Refinement:

To streamline the panorama creation process and eliminate static variables such as the dashboard, the frames were strategically cut to showcase only the left and right views of the car. This spatial refinement was essential for a more focused and aesthetically pleasing panoramic result.

4. **Coordinate Looping:**

Leveraging Python's flexibility, the y-coordinate was looped to a dynamic $x(y)$ position for each pixel $(x(y), y)$. This approach ensured that each slice captured the varying views along the journey.

5. **Slice Characteristics:**

Each slice exhibited a consistent width of around 8 pixels, allowing for cohesive visual continuity. The height of the slices varied in the range of 1200-1500 pixels, introducing a dynamic element to the panorama.

6. **Temporal Looping:**

The slices were looped as a function of time, creating a seamless progression in the route panorama. This temporal looping technique contributed to the dynamic and continuous representation of the journey.

7. **Exportation:**

The final Route Panorama was generated by stitching together the sliced frames and was exported as a PNG image, creating the final panoramic view.

This methodology emphasizes the systematic approach taken to transform raw video data into a visually compelling and dynamic Route Panorama. The fusion of spatial refinement, coordinate looping, and temporal sequencing showcases the technical finesse applied throughout the image creation process. in the range 1200-1500 pixels. By looping these slices as a function of time, the route panorama was created and exported as a png.

Results

All images can be viewed individually in the "Panoramas" folder.

Video 1, Left:



Video 1, Right:



Video 2, Left:



Video 2, Right:



Video 3, Left:



Video 3, Right:



Video 4, Left:



Video 4, Right:



Video 5, Left:



Video 5, Right:



Analysis

Upon closer examination of the generated Route Panoramas, several notable observations and distortions come to light, shedding light on the intricacies of the panoramic creation process.

1. Height Discrepancies:

An apparent variation in the heights of the panoramas is observed. This discrepancy can be attributed to fluctuations in the y-coordinate just above the road across the different videos. The dynamic nature of the road environment led to differing heights in the panoramas, providing a nuanced representation of the journey.

2. Dashboard Cropping:

Panoramas derived from the right-side videos exhibit a distinct characteristic — they generally possess smaller heights compared to their left-side counterparts. This disparity arises from the need to crop out a more extensive portion of the dashboard in the right-side panoramas. The inclusion of additional dashboard elements in the footage prompted a more substantial cropping action, influencing the overall height of the panorama.

3. Spatial Distortion:

Notably, some panoramas showcase spatial distortions, exemplified by the extension of objects beyond their expected boundaries. For instance, in the left-side panorama of video 1, the truck appears to extend farther than conventional dimensions would dictate. This distortion is a consequence of external factors inherent in the driving environment, contributing to the unique visual characteristics of each panorama.

4. Dynamic Influences:

The identified distortions and variations serve as a testament to the dynamic nature of the driving environment. External factors, such as the speed and movement of objects within the scenery, play a crucial role in shaping the final panorama. This dynamic quality introduces an element of realism, encapsulating the ever-changing landscape experienced during a road journey.

In essence, the observed variations and distortions in the Route Panoramas contribute to the authenticity and uniqueness of each visual representation. Understanding these nuances enriches the analysis, providing valuable insights into the interplay between the panoramic creation process and the dynamic driving environment.

Conclusion

In summary, the creation of the route panoramas stands as a largely successful endeavor, despite the presence of some distortions. The systematic process of video segmentation into frames, subsequent slicing to isolate left and right views, and the temporal looping of these frames proved effective in crafting the final panoramic images seamlessly.

While acknowledging that the expansive nature of the panoramas might pose visibility challenges within the constraints of this document, I invite a more detailed exploration within the dedicated 'Panoramas' folder. There, the intricacies and nuances of each panorama can be appreciated in greater detail, providing a richer understanding of the journey encapsulated in these panoramic visual narratives.