Coin Detection and Image Stitching
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Github Link of the Repository

https://github.com/Aayush-Bhargav/VR_Assignment1_AayushBhargav_IMT2022089

Introduction

This project involves two main tasks in computer vision: detecting and analyzing coins in images and stitching multiple images together to create a panorama. The work is divided into two parts:

1. **Coin Detection and Analysis**: Detecting, segmenting, and counting coins in images.
2. **Image Stitching**: Aligning and merging multiple images into a seamless panorama.

Part 1: Coin Detection and Analysis

The coin detection system processes images containing coins and performs three key tasks:

a. Coin Detection

- Multiple edge detection techniques (Canny, Sobel, Laplacian) are used to detect the outlines of coins.
- The detected edges are visualized by overlaying them on the original image.
- Edge detection results are saved in dedicated folders for each input image.
- Canny edge detector gave the best results as expected. Laplacian edges looked better than Sobel edges.

b. Coin Segmentation

- Region-based segmentation techniques isolate each individual coin.
- Adaptive thresholding and contour detection are applied to extract coin shapes.
- The segmented coin images are stored in separate folders.
- A combined visualization (detected_coins_overlay.png) highlights all detected coins.

c. Coin Counting

- The function that segments the coins is also used to count the total number of coins in each image.

- Size and circularity criteria help filter out non-coin objects.
- The final count is displayed as output.

Methods Used

- Gaussian blur for noise reduction.
- Adaptive thresholding for binary mask creation.
- Morphological operations to refine segmentation.
- Contour detection to outline coin boundaries.
- Circularity calculations to ensure accurate coin identification.

Part 2: Image Stitching

This section involves combining overlapping images to generate a panorama.

a. Key Point Extraction

- Key points in overlapping images are detected using SIFT (Scale-Invariant Feature Transform).
- The detected key points are visualized for analysis.

b. Image Stitching

- The extracted key points are used to align and merge images.
- Homography-based alignment ensures proper perspective transformation.
- Distance-weighted blending is applied to create seamless transitions.
- Empty margins in the final panorama are automatically removed.
- The process includes multiple steps, with intermediate visualizations saved.

Methods Used

- Feature detection and matching using SIFT.
- Homography calculation to align images correctly.
- Image warping and blending for smooth merging.
- Trimming of dark edges to produce a refined final output.
- Standardizing image sizes to ensure consistency.

Results

Coin Detection

- Edge-detected images show clearly outlined coins.
- Individual segmented coin images are successfully extracted.

- The system accurately counts and displays the number of coins in each image.

Image Stitching

- Key points are successfully detected and matched between images.
- High-quality panoramic images are generated from multiple input images.
- Margins are trimmed to produce a refined final output.
- Visualizations of features, matches, and blending steps are generated.

Conclusion

This project successfully implements computer vision techniques for both coin detection and image stitching. Edge detection, segmentation, and counting work effectively for identifying coins in various images. The image stitching process creates seamless panoramas by aligning and merging images based on detected key points. The methods used ensure robustness in both tasks, making them applicable in real-world scenarios involving object detection and panoramic imaging.