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BSCS 4A

MP2: Image Processing Techniques Applied to a Cityscape Image

This report outlines the application of basic image processing techniques using OpenCV, a popular library for computer vision tasks. We implemented four key transformations: scaling, rotation, blurring, and edge detection, using a sample image. Each method alters specific characteristics of the image, allowing us to observe how the image responds to different types of processing.

Tools used:

- **OpenCV** for image processing

- **Google Colab** for implementation

Original Image

The first step was to load the sample image into the system. Using OpenCV's image reading function. The image was displayed in its original form to provide a baseline for comparing the transformations.

Scaling

The scaled image in the provided grid demonstrates the effect of reducing the size of the original image. The smaller image appears pixelated due to the decreased resolution.

Scaled Image (50%)

Rotation

The rotated image showcases the impact of changing the orientation of the skyline. The Empire State Building is now positioned towards the bottom right corner, demonstrating the altered perspective.

Rotated Image (45°)

Gaussian Blurring

The Gaussian blurred image illustrates the smoothing effect of the technique. The details of the buildings and the sky are less distinct, and the noise is reduced, resulting in a more blurred appearance.
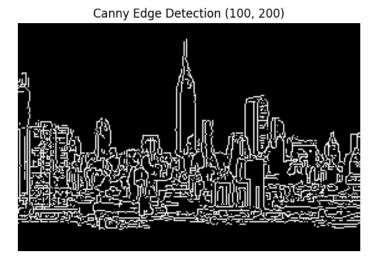
Gaussian Blur (5x5)

Median Blurring

The median blurred image highlights the ability of this technique to reduce noise while preserving some edge information. The image appears smoother, but the outlines of the buildings are still somewhat visible.

Median Blur (5x5)

Edge Detection (Canny Edges)

The Canny edge detection image emphasizes the effectiveness of the technique in highlighting the outlines of the buildings and other structures. The binary mask clearly outlines the edges, which can be useful for further analysis or applications like object detection.

Canny Edge Detection (100, 200)

Results

The following results were achieved:

- **Scaling:** The scaled image appeared smaller and had a lower resolution due to the reduction in size.

- **Rotation:** The rotated image was tilted at a 45-degree angle, altering the perspective and orientation of the skyline.

- **Gaussian Blur:** The Gaussian blurred image appeared smooth and less detailed, with the noise reduced.

- **Median Blur:** The median blurred image was also smoothed, but it retained some edge information better than the Gaussian blur.

- **Canny Edges:** The Canny edge detection highlighted the outlines of the buildings and other structures in the image, creating a binary mask.

Conclusion

The image processing techniques applied in this study demonstrated their effectiveness in modifying and analyzing the cityscape image. Scaling and rotation altered the image's appearance, while filtering techniques reduced noise and extracted features. These techniques can be used for various applications, such as image enhancement, analysis, and object detection.