12.19

In today’s report, I summarized the topics and practices from the previous nine sessions, including template matching, geometric transformations, erosion and dilation, differential image processing, edge detection, and basic image preprocessing techniques.

1. Template Matching

I explored various methods for calculating image similarity:

- **SSD (Sum of Squared Differences) and SAD (Sum of Absolute Differences)**: These calculate pixel differences between a template and target region to find the best match.
- **NCC (Normalized Cross-Correlation)**: It normalizes values to improve robustness against lighting changes.
- **Pyramid Matching**: Matches at multiple resolutions, significantly improving speed and accuracy.

Among these, pyramid matching stood out for its efficiency and precision, leaving a strong impression.

2. Erosion and Dilation

Erosion and dilation are fundamental morphological operations, effective in noise removal and background restoration:

- **Erosion**: Shrinks white pixel regions to eliminate small noise.
- **Dilation**: Restores and expands structural details after erosion.

These techniques greatly enhance image clarity and reduce interference.

3. Geometric Transformations

I studied a range of geometric transformations:

- **Rotation and Scaling**: Adjusting image orientation and size using matrices.
- **Affine and Perspective Transformations**: Achieving image warping and plane-to-plane mapping.

- **Binarization Methods**: Tested OTSU, Minimum Error, and P-tile methods, with OTSU showing the best results.
- **Topological Transformations**: Achieved image distortion through remapping techniques.

These transformations provide versatile tools for image analysis and manipulation.

4. Differential Image Processing and Edge Detection

Learned techniques in differential processing and edge detection:

- **Differential Processing**: Highlights changing regions, ideal for detecting moving objects in dynamic scenes.
- **Edge Detection**: Uses image derivatives to emphasize sharp changes, identifying edges effectively.

Reflections

Through this learning experience, I deeply appreciated the power and practicality of computer vision technologies. Pyramid template matching significantly enhanced processing speed, while erosion and dilation proved simple and effective, especially for noise removal tasks. Geometric transformations provided great flexibility for image operations. However, these techniques are merely the first step in preprocessing for visual analysis. In practical applications, it is essential to select or design models tailored to specific scenarios and objectives for recognition and detection.

My research focuses on intrusion detection in network security, where preprocessing is relatively simpler compared to image processing, but data handling remains equally critical. From this course, I gained numerous methods that can be adapted to my research field.

Next Time

I have found the code corresponding to the paper I chose and successfully ran the demo to observe its results. Currently, I am using the provided pre-trained model for image recognition. In the next session, I plan to train the model myself.