Automatic Document Skew Correction

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1 Abstract

This project is designed to correct rotated document images. The system estimates the dominant angle of the page and rotates the image to a horizontal position. The method uses edge detection and the Hough transform. The evaluation uses synthetic images with known angles. The mean absolute error is 0.49 degrees. All images fall within one degree of the true angle and show consistent performance.

2 Introduction

Document images can show up as tilted after scanning or photography. A tilted page also reduces the readability of the page and the accuracy of text extraction systems. Manual correction is slow and inconsistent. This project's task is to detect the angle of the document and rotate it to an upright position.

The main challenge is stable angle detection. The system must extract reliable features even when the image contains noise. Line detection must also avoid false angles from clutter or graphics. The method in this project uses standard computer vision tools to address these problems.

3 Methodology

The system begins when an input image converts to grayscale to reduce noise. A Gaussian blur smooths local variation. Canny edge detection extracts strong edge lines. The Hough transform finds straight line segments across the page where each line has an associated angle. The system filters these angles to keep values near the horizontal range. A histogram of these angles identifies the dominant angle of the document. The system rotates the image by the opposite of this angle. The rotation uses an expanded canvas to avoid clipping. The synthetic dataset contains one hundred images with known rotations. These images support direct evaluation of error between true angles and estimated angles.

4 Results

The evaluation uses one hundred synthetic document images. Each image has a known true angle. Each base image has 9 rotations from –20 degrees to 20 degrees that increases in 5-degree intervals. The system estimates one angle for each sample. The error is the absolute difference between the estimated angle and the true angle. The calculation checks for sign mismatch and uses the smaller value.

The mean absolute error is 0.49 degrees. The median error is 0.50 degrees. The maximum error is 0.50 degrees. All images fall within one degree of the true rotation. These results show stable performance across the entire dataset.

4.1 Figures

Figure 1: angry_rot_20 original vs angry_rot_20_deskewed
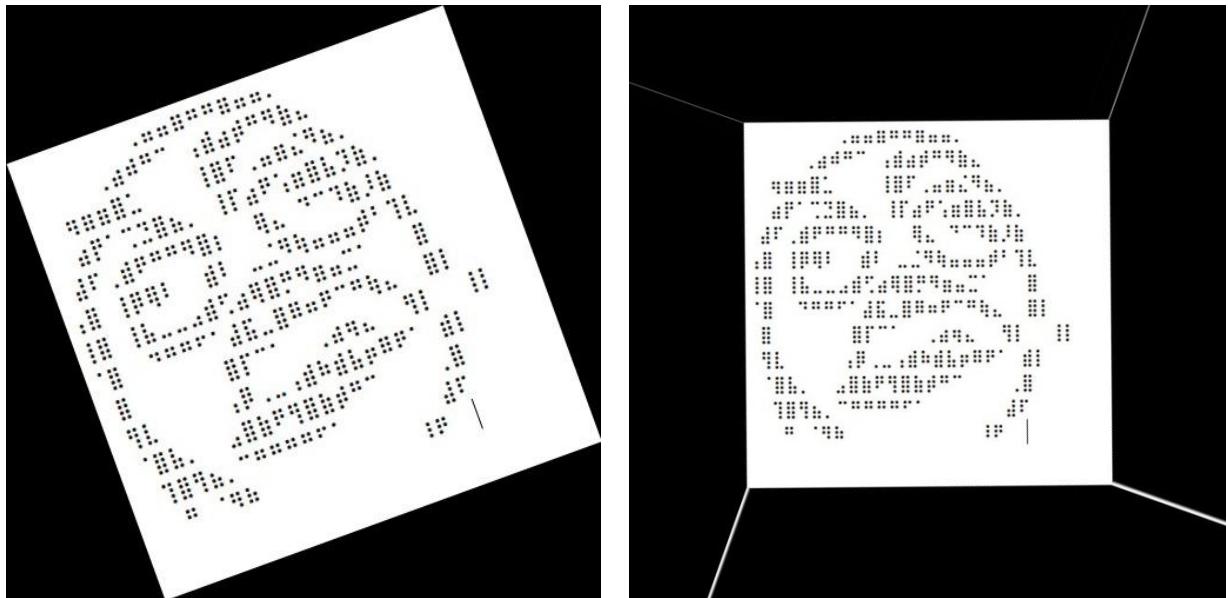

Figure 2: tree_rot_-15 original vs tree_rot_-15_deskewed
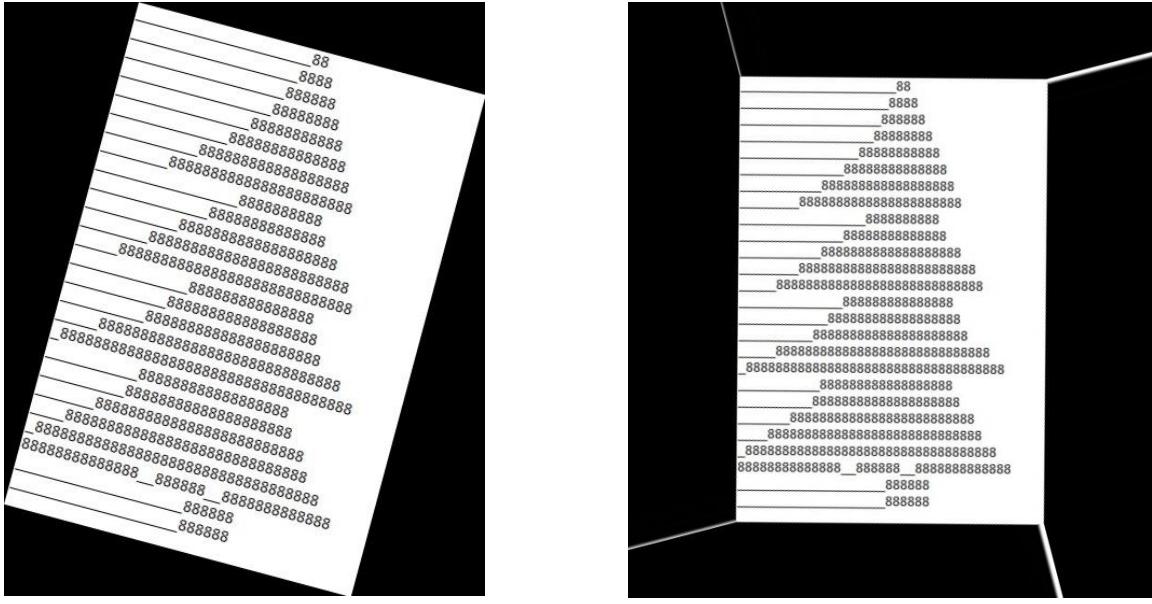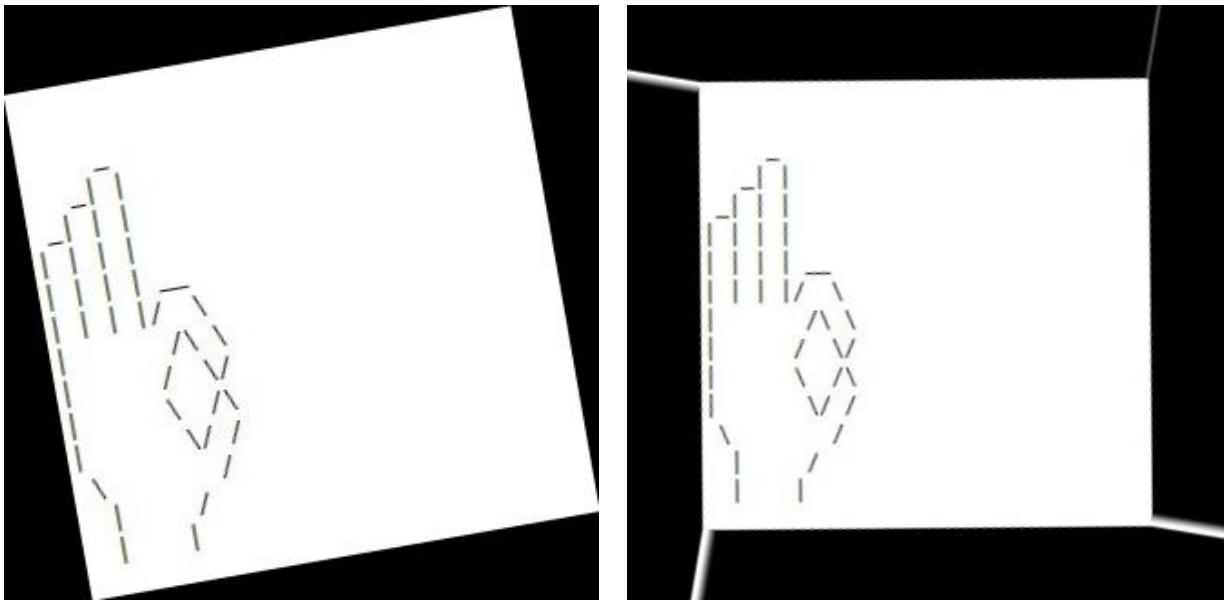
Figure 3: hand_rot_10 original vs hand_rot_10_deskewed

4.2 Tables

Table 1: skew correction accuracy

Metric	Value
Mean absolute error	0.49 degrees

Median error	0.50 degrees
Maximum error	0.50 degrees
Percent within 1 degree	100
Percent within 2 degrees	100

5 Discussion

The method performs well on synthetic images. These images contain clear edges and consistent text. The Hough transform identifies reliable line segments. The histogram step reduces noise from outlier angles. The rotation step preserves all content by expanding the output canvas.

The method creates strong results in structured settings. Some limitations appear in low contrast images. Weak edges give fewer usable lines. Pages with irregular layouts or heavy graphics may also shift from the dominant angle. A contour-based method may improve performance when line structure is weak.

Future work that is possible here includes testing the system on real images. Real images contain uneven lighting and background clutter. Adding a second method for angle confirmation may also improve stability. Measuring the effect of correction on text extraction accuracy would extend the study.

6 Conclusion & Future Work

The project detects and corrects document skew with high accuracy. The pipeline remains simple and repeatable. The method reaches sub-degree accuracy on one hundred controlled samples. The results confirm that the Hough method is effective for this task. Future work will extend the method to real scenes and mixed page layouts.