BAR-CODE DETECTION AND DECODING

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Introduction

This project's main goal is to use computer vision and image processing techniques to identify and decode barcodes from photographs. The procedure for processing, improving, and extracting barcode information from an input image is described in this study

This report explains the methodology used to process, enhance and extract barcode information from the input image ***by:***

1. **Image Loading :**The input picture is loaded using OpenCV as the initial stage in the procedure. To confirm that it has loaded correctly, the picture is read and verified.

2. **Grayscale Conversion:** To make processing easier and improve contrast, the picture is transformed to grayscale, which aids in subsequent processing stages.

3. **Contrast Enhancement:** Histogram Equalization is applied to improve the contrast of the grayscale image. This technique helps highlight features of interest, such as the barcode region**.**

4. **Noise Reduction:** The equalized picture is smoothed and noise-reduced using a Gaussian Blur filter, which increases edge detection precision.

5. **Edge Detection:** Both horizontal and vertical edges may be found using the Sobel operator. To get a complete edge-detected picture, the magnitude of these gradients is calculated.

6. **Adaptive Thresholding:** The gradient picture is converted to a binary form using an adaptive thresholding approach, which improves the separation of the barcode from the backdrop.

7. **Morphological Processing:** To improve barcode characteristics and eliminate tiny gaps in the detected edges, a morphological closure technique is used. In this stage, tiny gaps are filled, and connectedness is enhanced by using a rectangular structural element.

8. **Contour Detection:** Using the processed picture, contours are identified. Based on its area, the greatest contour which most likely represents the barcode is found. A valid contour is then examined further in order to retrieve the barcode.

9. **Skew Correction:** The smallest area rectangle surrounding the observed contour is used to establish the barcode's orientation. If required, the barcode is horizontally aligned and its skew corrected using an affine transformation.

10. **Barcode Extraction:** The region of interest (ROI) of the rectified picture is cropped in order to retrieve the barcode. To improve readability, the captured barcode region is subjected to further noise reduction and thresholding.

11. **Barcode Decoding:** The Pyzbar library is used to parse the barcode ROI and decode barcode data. The retrieved data and barcode type are shown if the decoding process is successful.

Conclusion

Using image processing methods, this methodology offers an organized strategy for barcode recognition and decoding. Accurate barcode data extraction is ensured by combining grayscale conversion, contrast improvement, noise reduction, edge detection, morphological procedures, and contour analysis. The outcomes provide a dependable method for processing barcode images under different circumstances.

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