

Traffic Sign Detection

COMPUTER VISION – PROJECT 1 – MIEIC – 13/14
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1. Applications



Fig. 1.1 - Driver assistance systems



Fig 1.2 - Autonomous vehicles

2. Implementation main algorithms

- ✓ Scene acquisition (image, video, camera)
 1. Image preprocessing
 2. Signal color segmentation
 3. Text color segmentation
 4. Traffic sign recognition

2.1. Image preprocessing

a) Bilateral filtering



Fig. 2.1a – Effect of the bilateral filter in removing noise

2.1. Image preprocessing

b) Contrast limited adaptive histogram equalization (CLAHE)

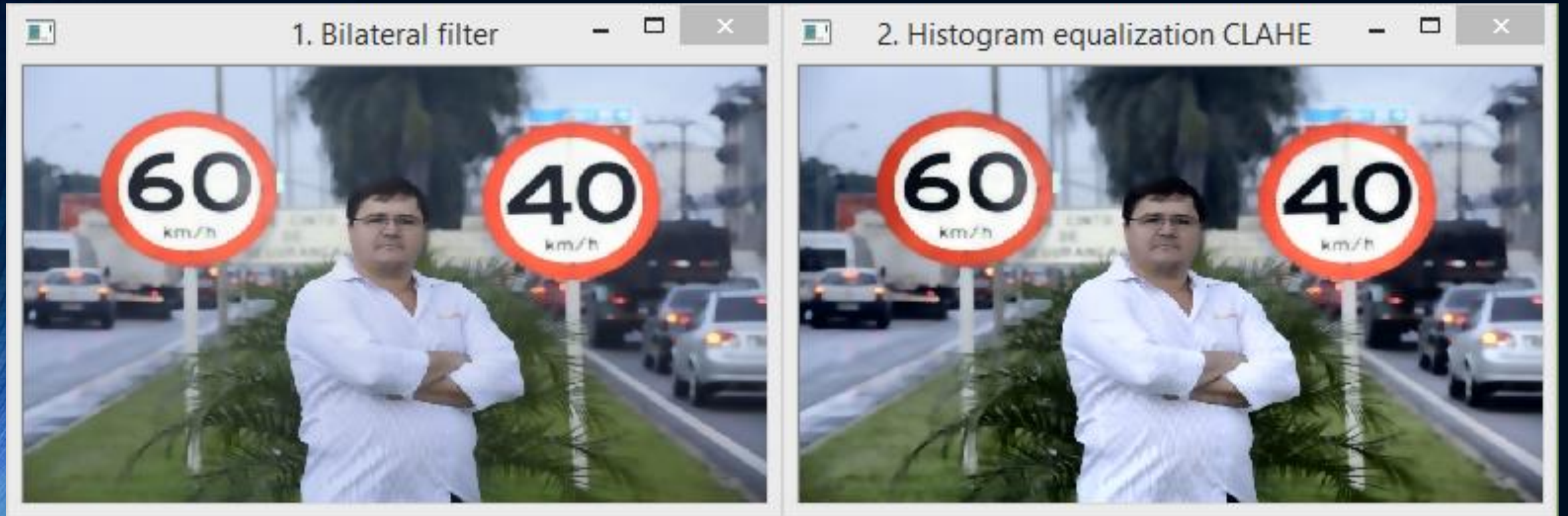


Fig. 2.1b – Effect of the CLAHE in increasing contrast

2.1. Image preprocessing

c) Contrast and brightness correction



Fig. 2.1c – Correction of contrast and removal of noise

2.2. Signal color segmentation

- a) Signal segmentation in HSV color space using the red borders
- b) Usage of opening morphological operation to remove small blobs

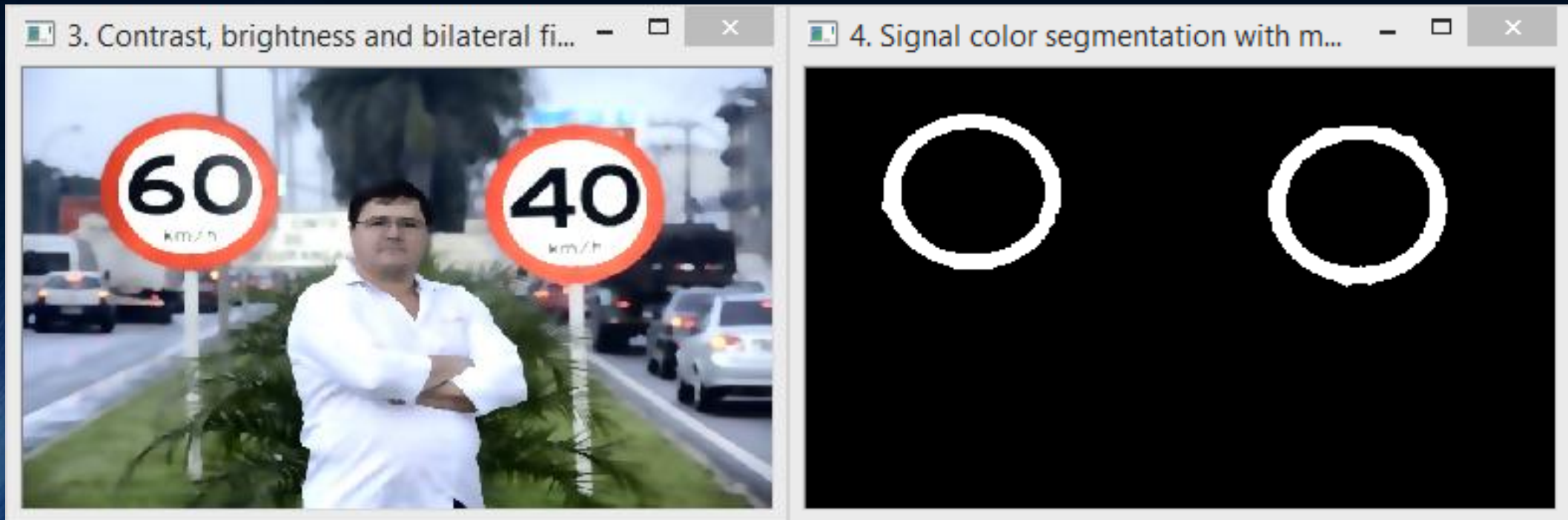


Fig. 2.2a – Identification of possible traffic sign positions using color segmentation

2.2. Signal color segmentation

- c) Identification of signals circles using HoughCircles transform
- d) Detection of signals borders with OpenCV fitEllipse



Fig. 2.2b – Usage of HoughCircles transform and ellipse extraction to segment the signals from the image

2.3. Text color segmentation

- a) Extraction of each signal from the image, removing the background
- b) Segment text only inside signs ellipsis
- c) Usage of erosion operation to thin the text and improve recognition

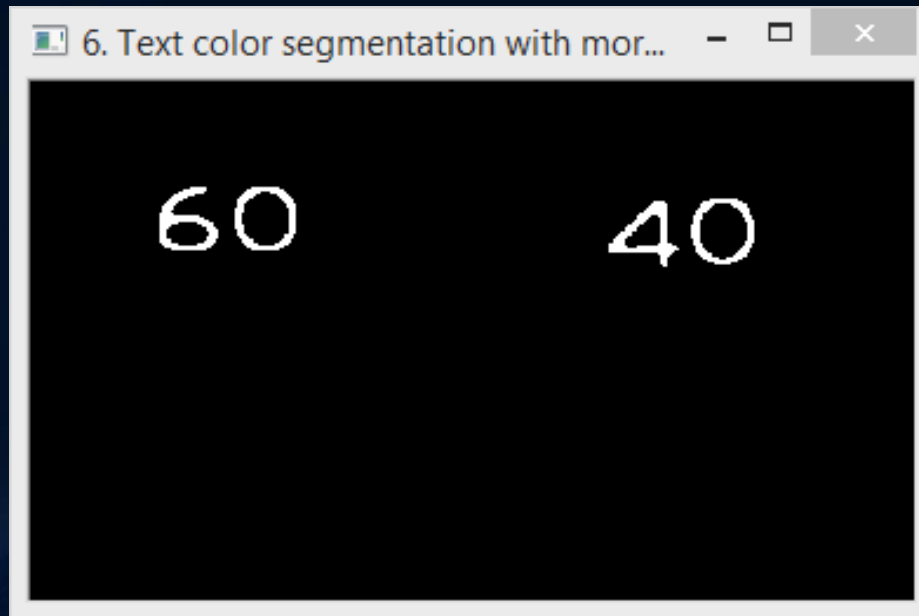


Fig. 2.3a –Text extraction using color segmentation



Fig. 2.3b – Application of the erosion operator

2.4. Traffic sign recognition

- a) Application of template matching or feature detection to identify the numbers inside the traffic signs ellipsis

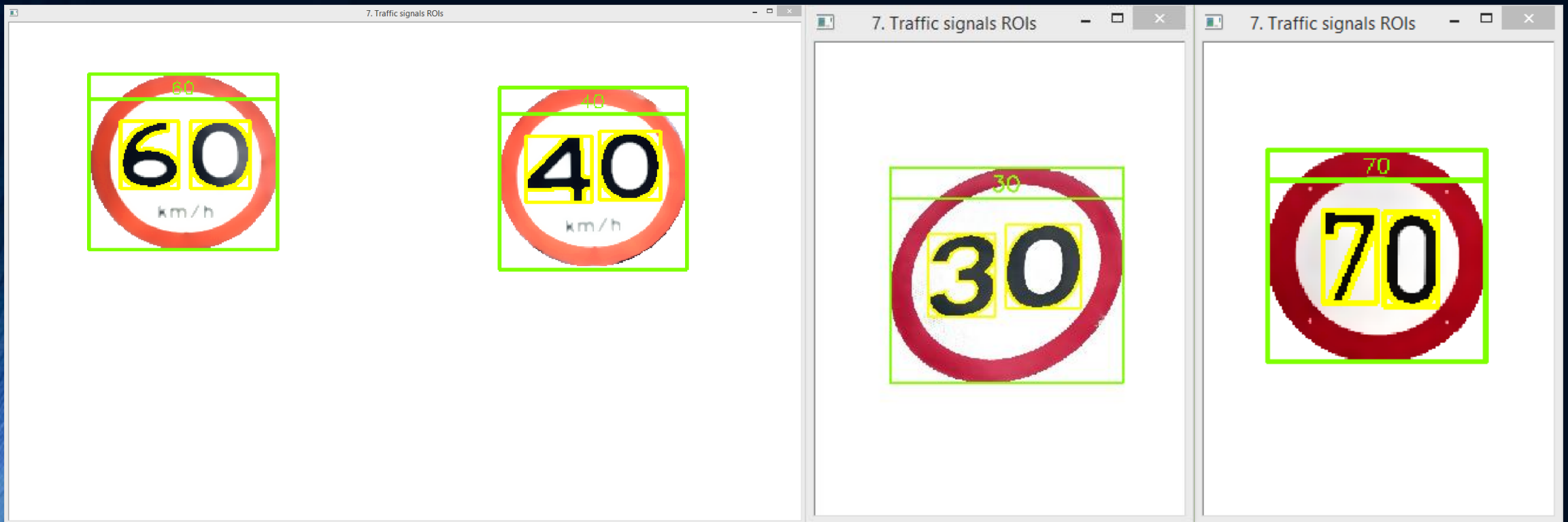


Fig. 2.4a – Number recognition using GoodFeaturesToTrackDetector, SiftDescriptorExtractor and FlannBasedMatcher

2.4. Traffic sign recognition

- a) Feature detection results for signals with good segmentation and positioning

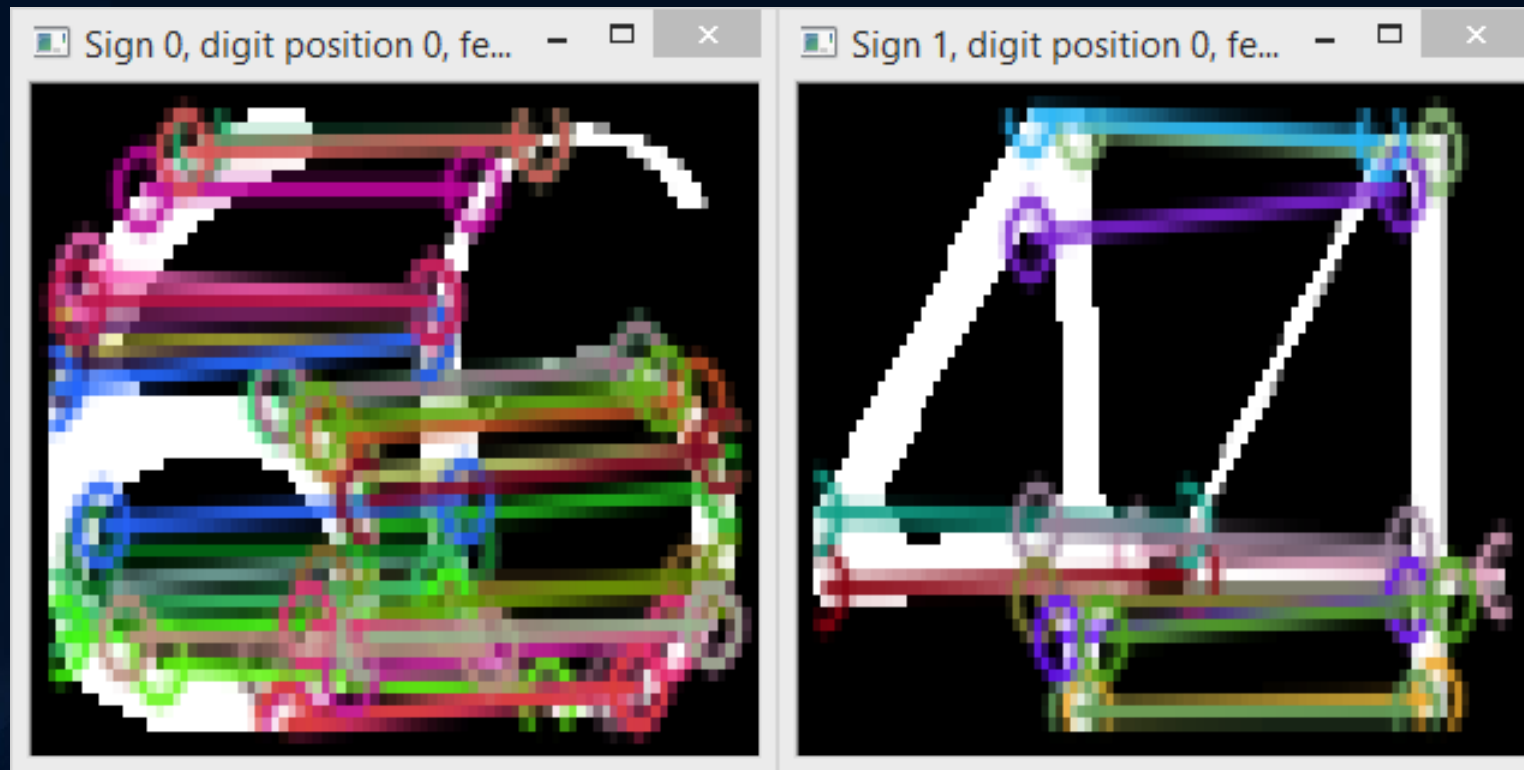


Fig. 2.4b – Good matches between feature points

2.4. Traffic sign recognition

- a) Feature detection results for signals with good segmentation and some perspective distortion

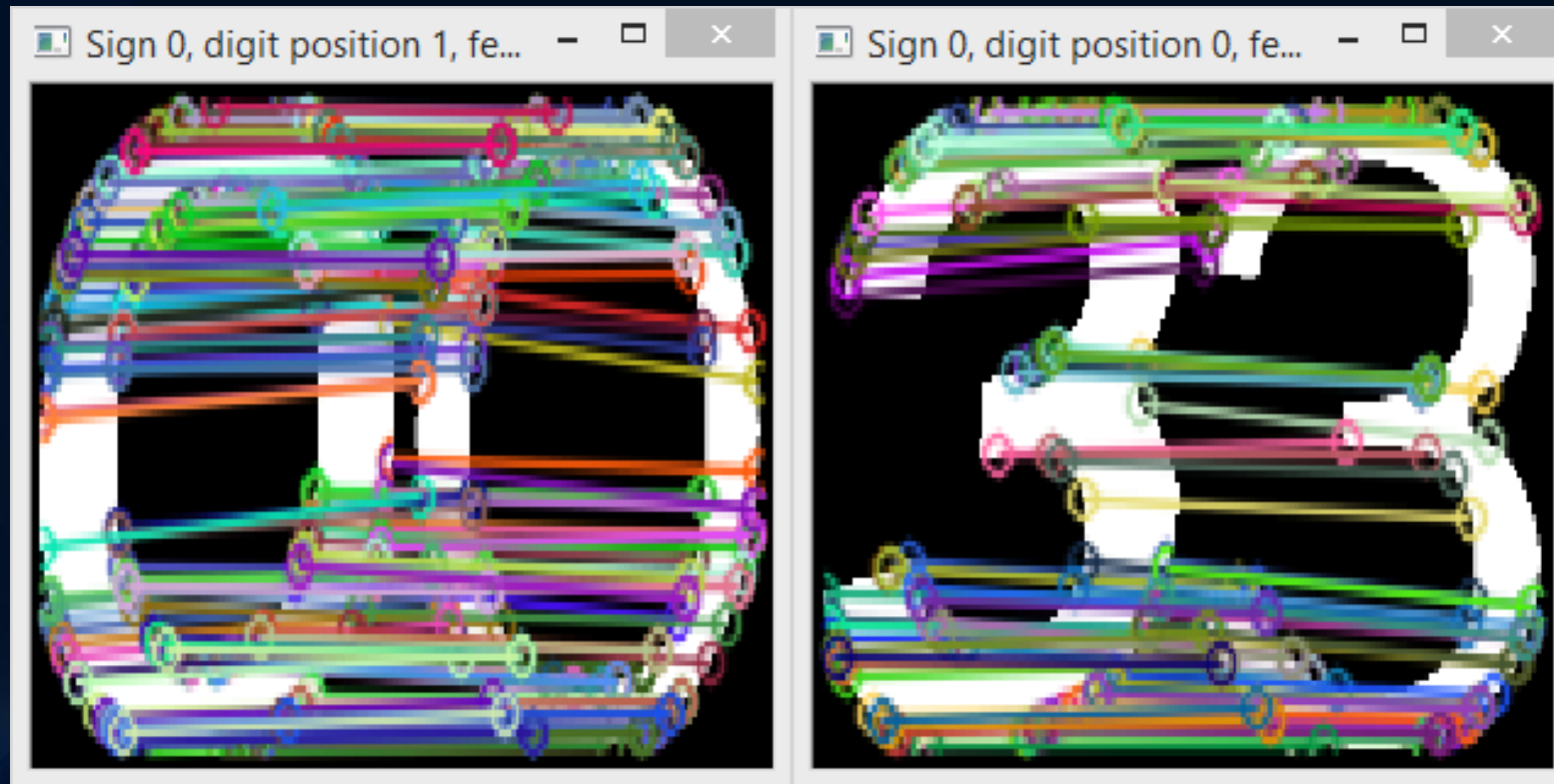


Fig. 2.4c – Good matches between feature points

2.4. Traffic sign recognition

- a) Feature detection results for signals with suboptimal segmentation (on purpose), and how the feature points adapted

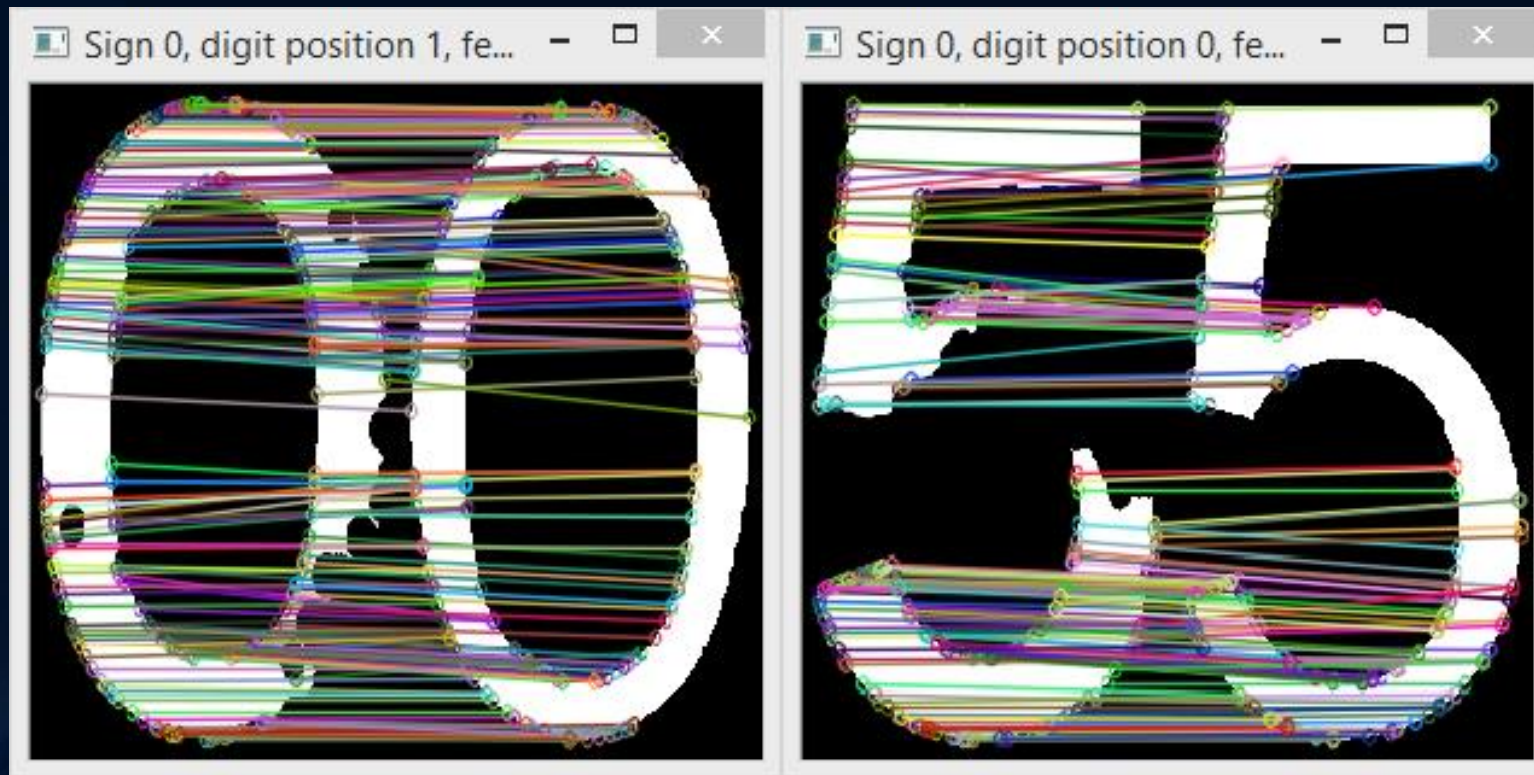


Fig. 2.4d – Good matches between feature points

The background is a deep blue gradient. On the left side, there is a faint, light blue grid pattern. On the right side, there are several concentric, curved lines that create a sense of depth and movement, resembling a tunnel or a stylized eye.

Questions?