# 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)

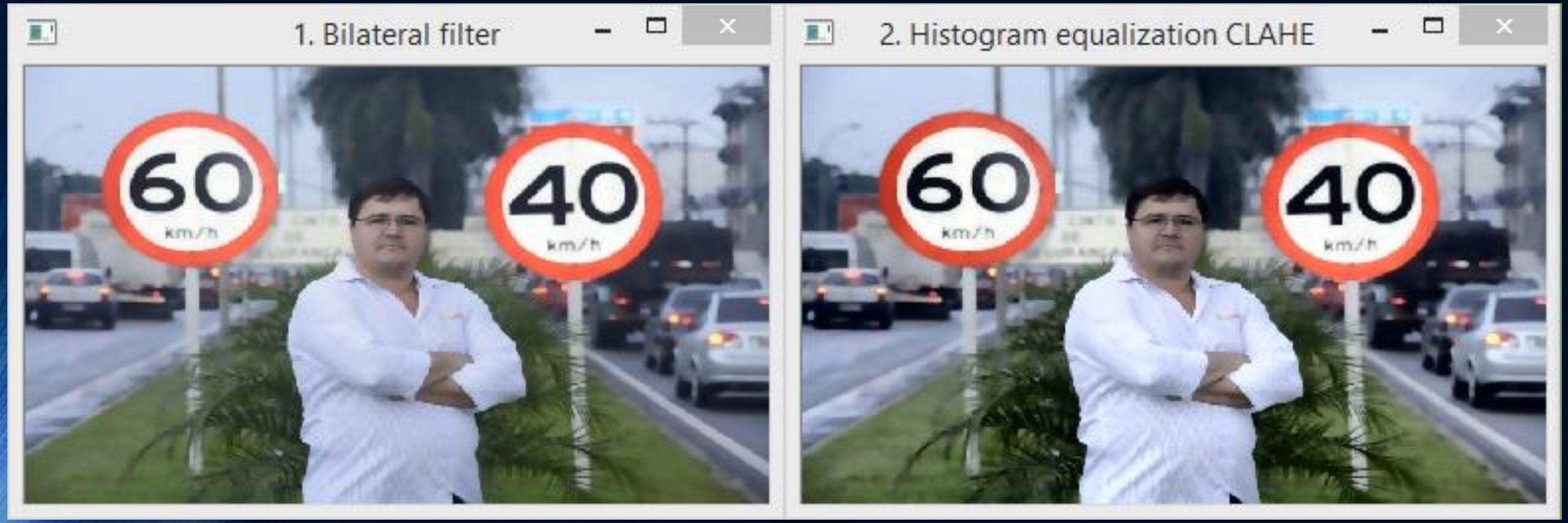


Fig. 2.1b – Effect of the CLAHE in increasing contrast

# 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

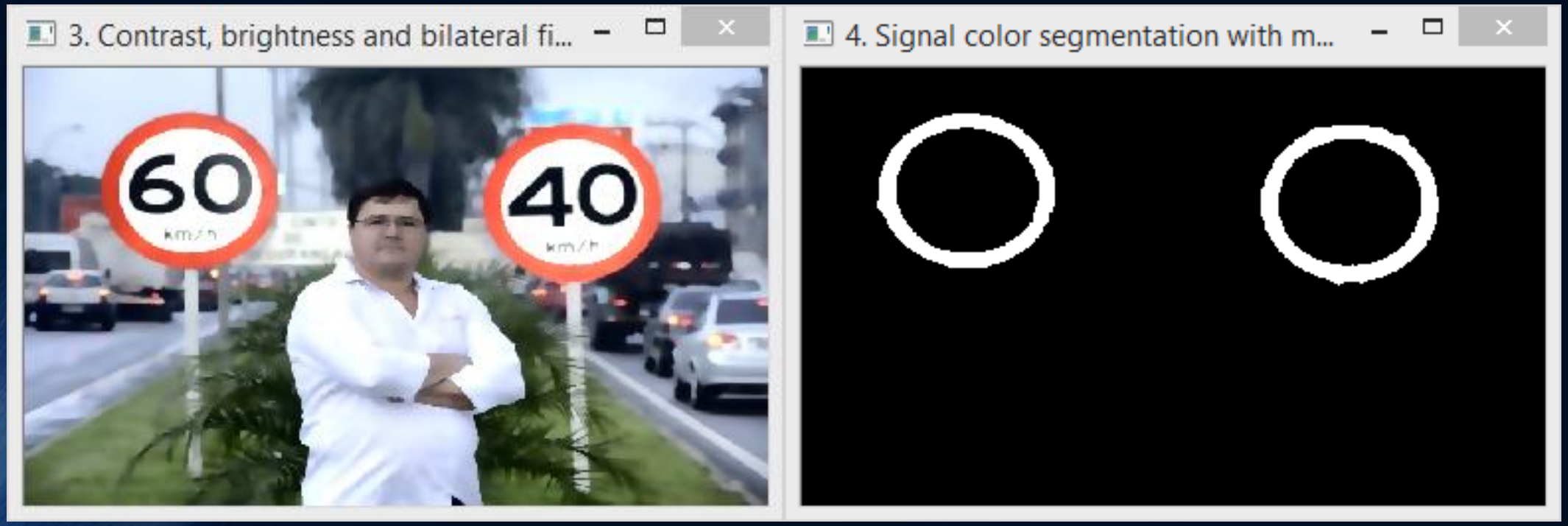


Fig. 2.2a – Identification of possible traffic sign positions using color segmentation

# 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

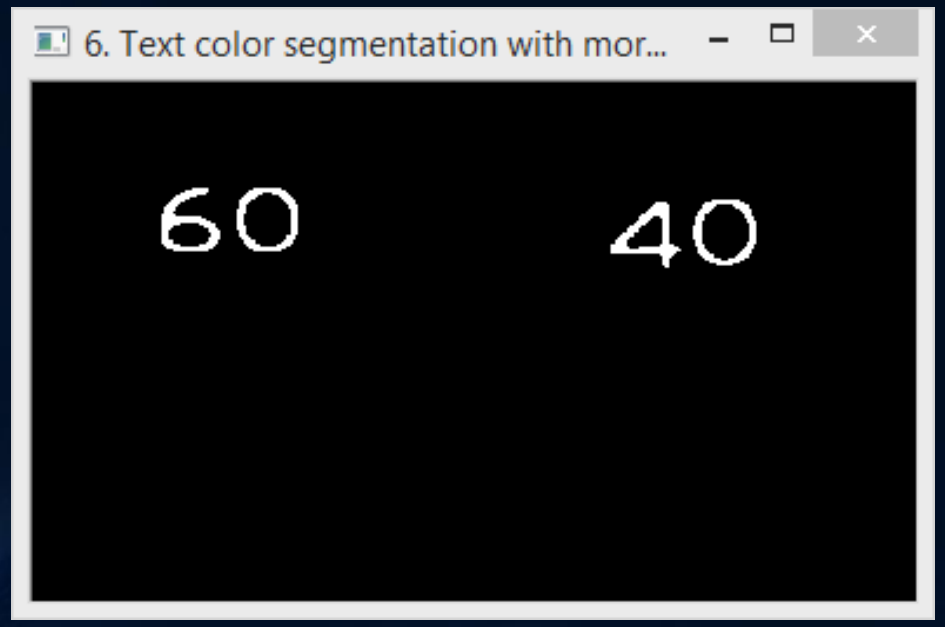


Fig. 2.3a – Text extraction using color segmentation


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

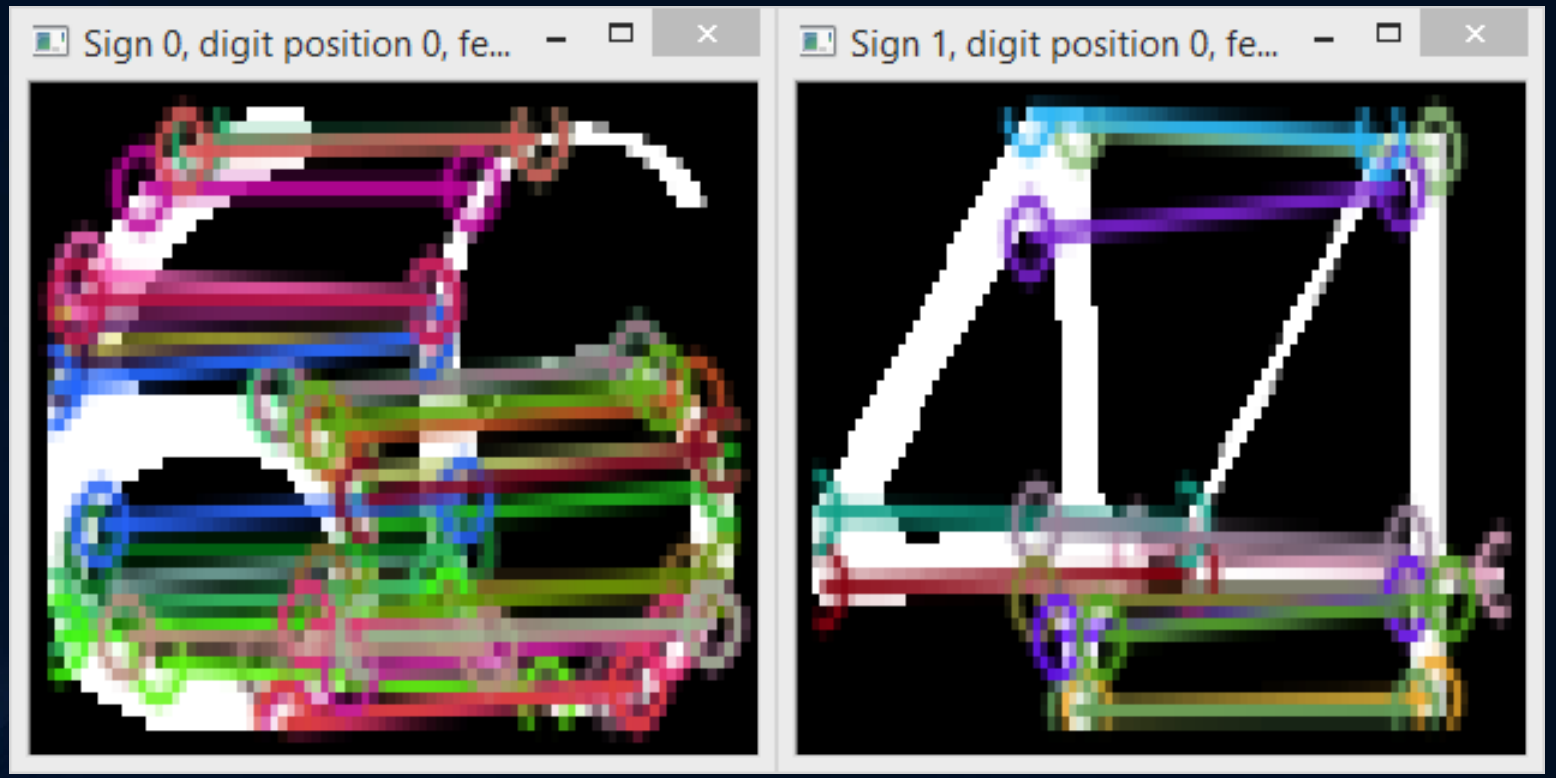


Fig. 2.4b – Good matches between feature points

# 2.4. Traffic sign recognition

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

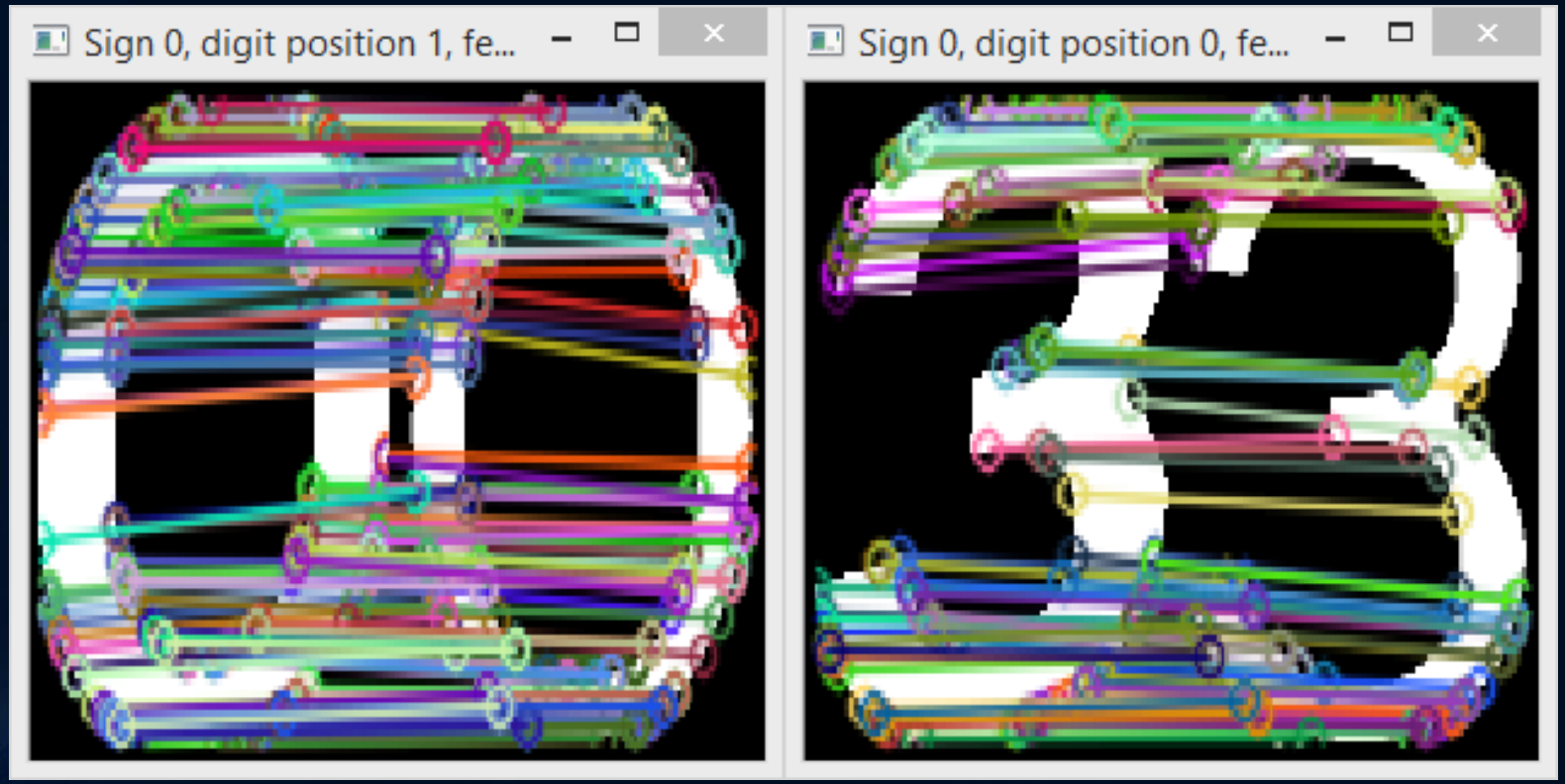


Fig. 2.4c – Good matches between feature points

# 2.4. Traffic sign recognition

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

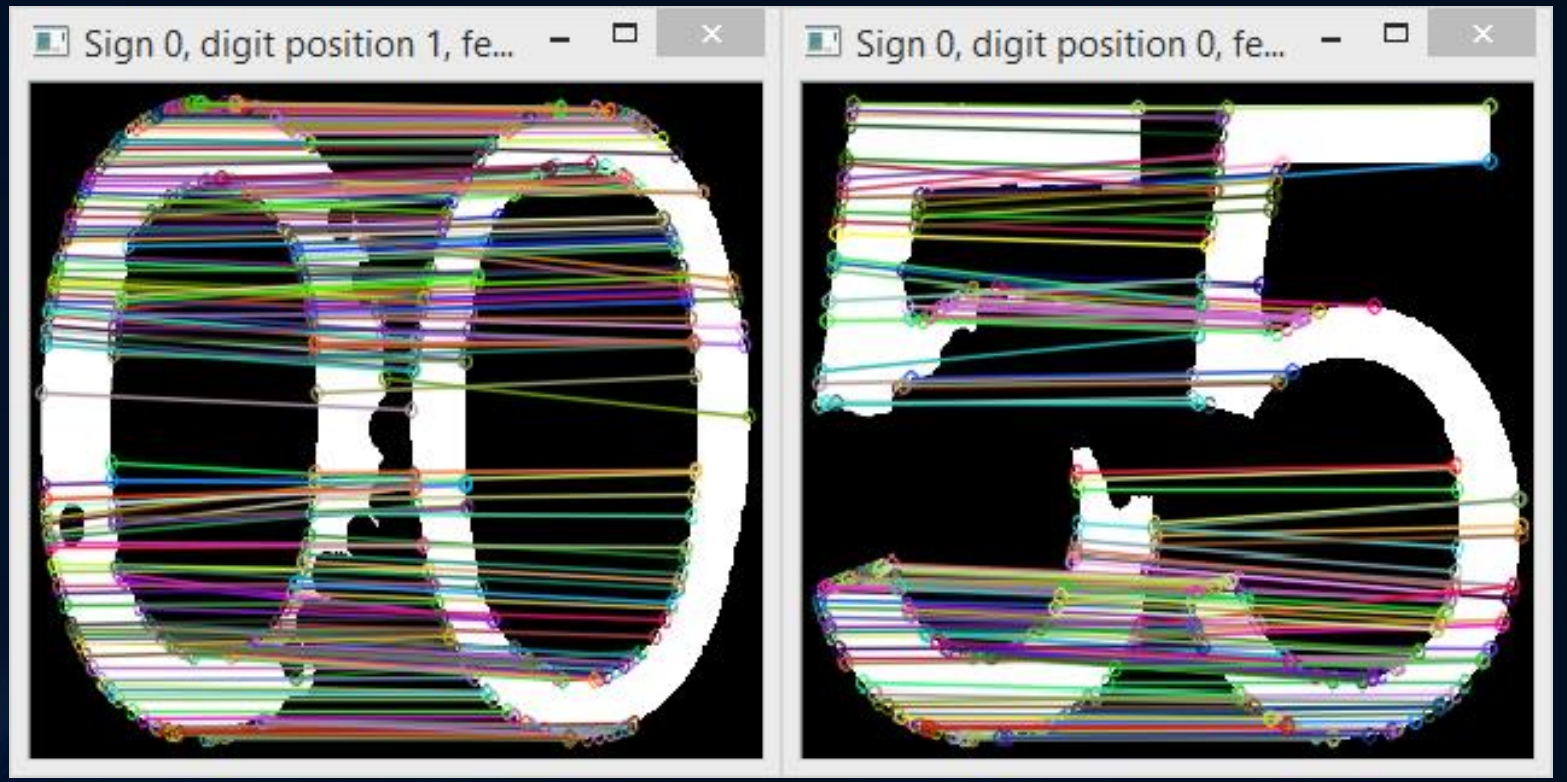


Fig. 2.4d – Good matches between feature points

# 3.1. Parameterization

a) The HighGUI interface for main algorithms parameterization


Fig. 3a – HighGUI parameterization interface allows the customization of the algorithms parameters to obtain better results

# 3.2. Parameterization

a) Default parameterization used

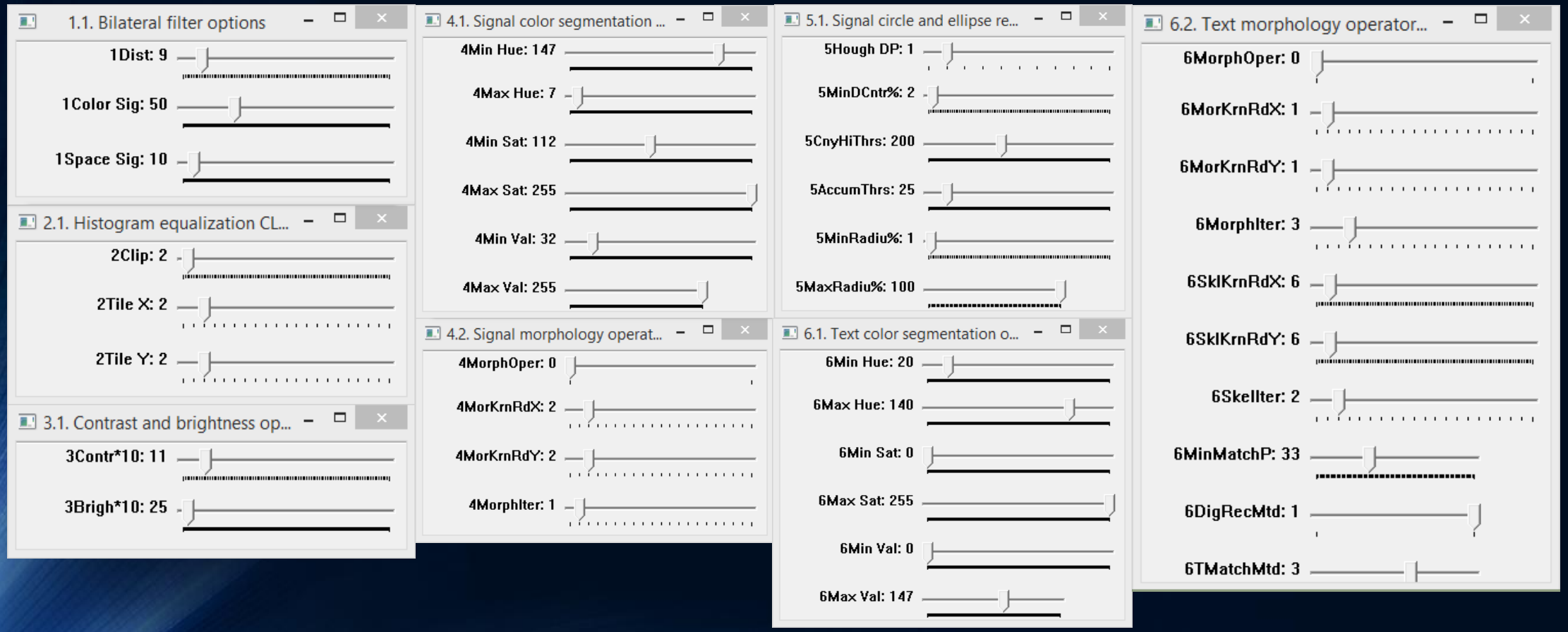


Fig. 3b – Parameterization to recognize normal speed limit signs

# Questions?