A Multimodal Image Registration Technique for Structured Polygonal Scenes

correspondence between images in IR and visible spectra

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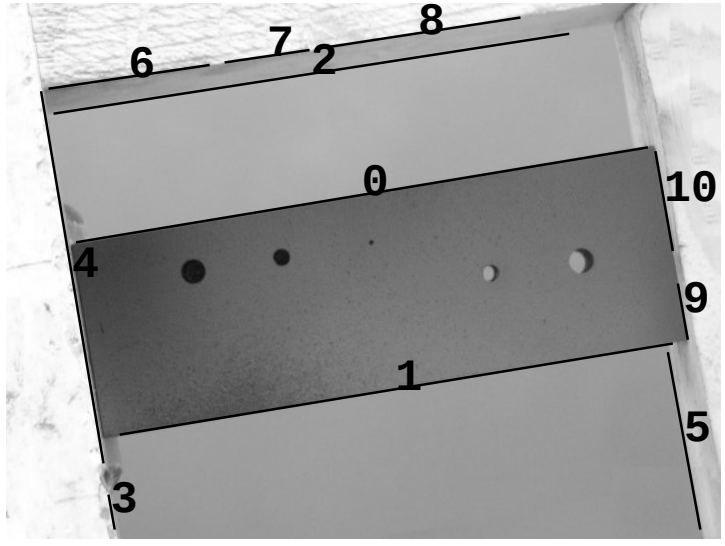
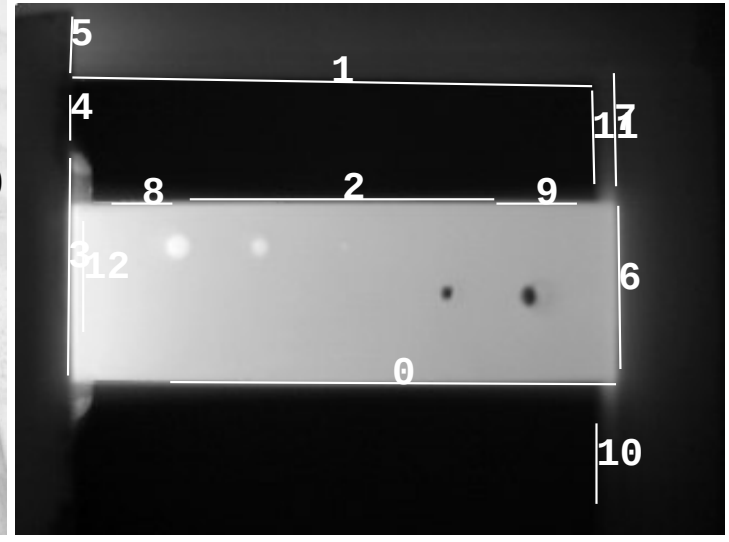
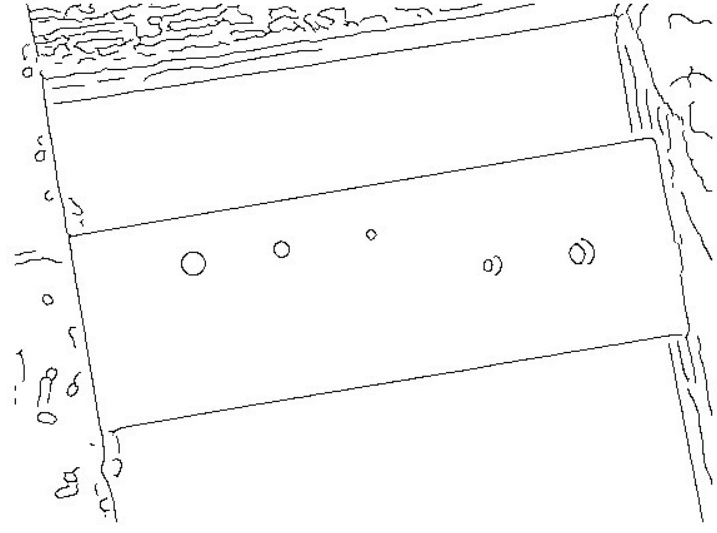
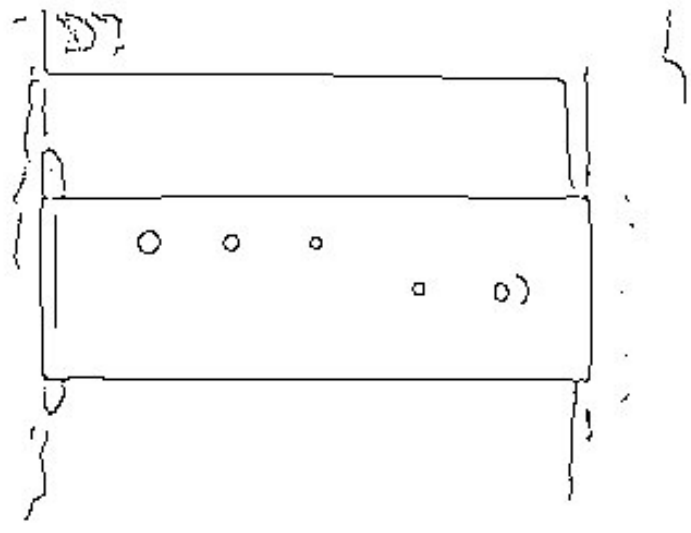
Input images and the extracted lines

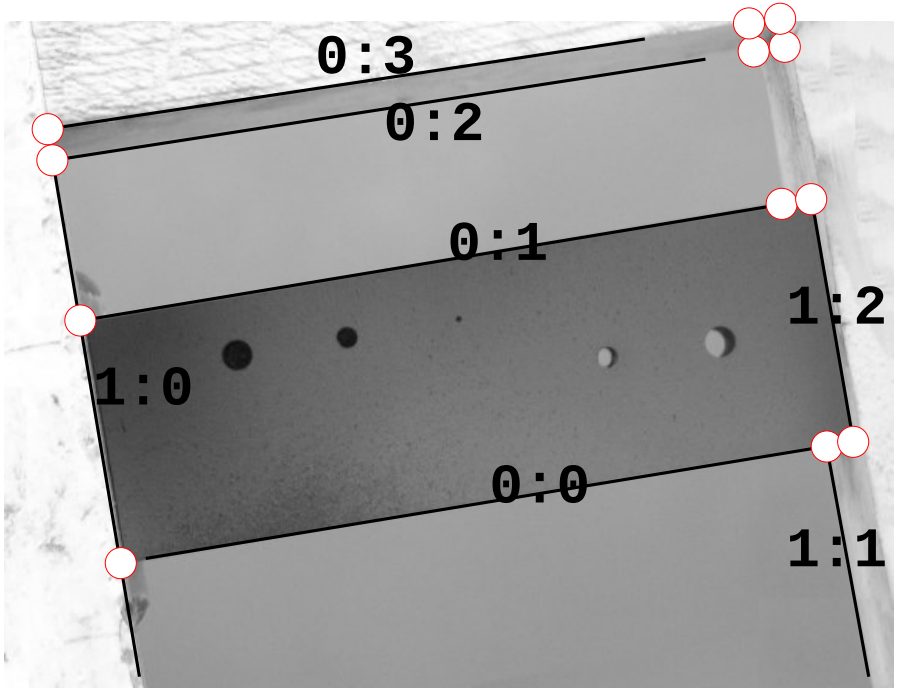


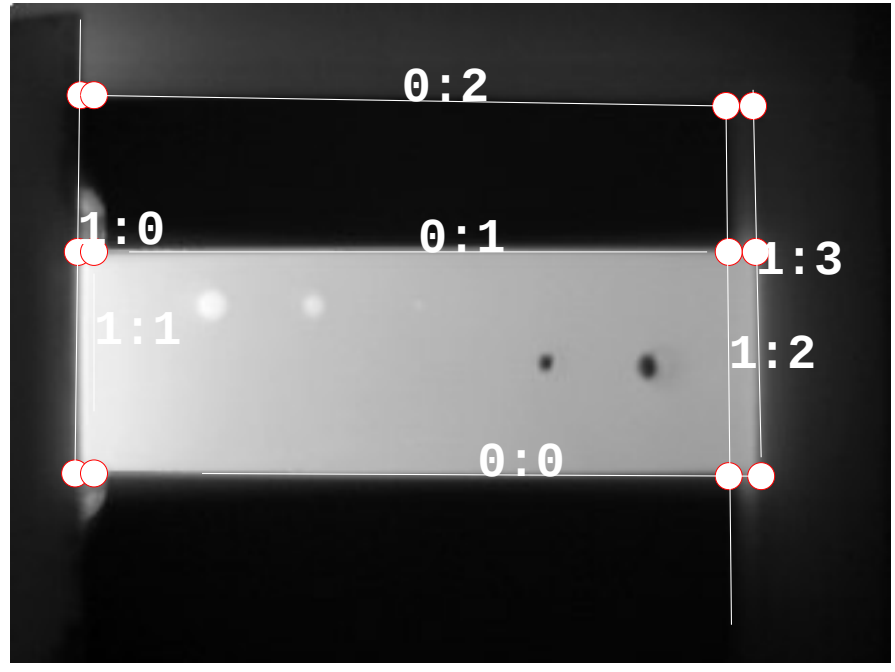






Regularized line segments, point features

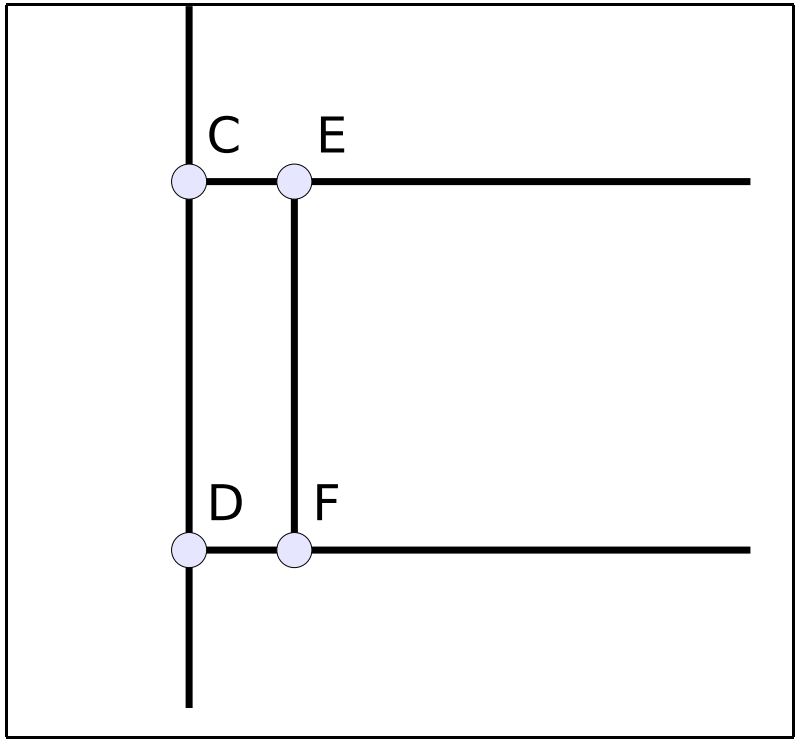




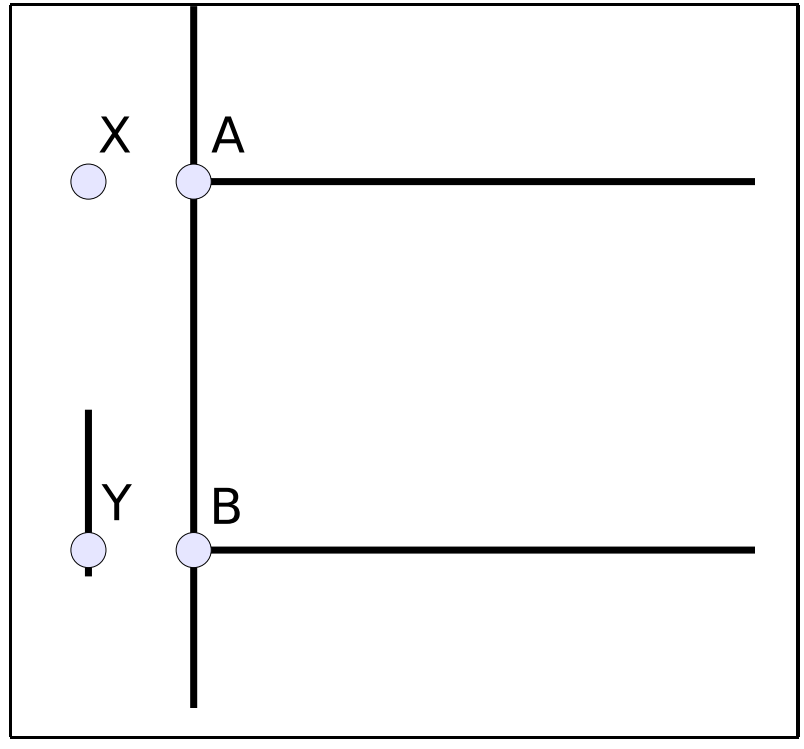
Filtering small quadrangles $(s_{00}, s_{01}, s_{10}, s_{11})$:

$$s_{i0}, s_{i1} \in c_i, i = 0, 1$$
$$d(s_{i0}) - d(s_{i1}) > d_{min}, i = 0, 1 \quad (1)$$

Evaluating hypotheses (a)



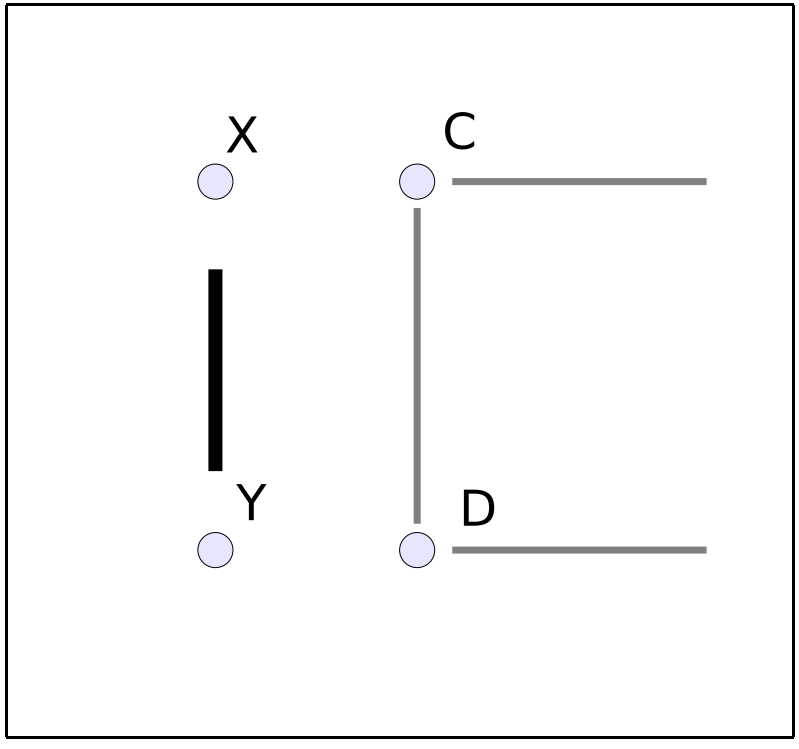
(I_1)



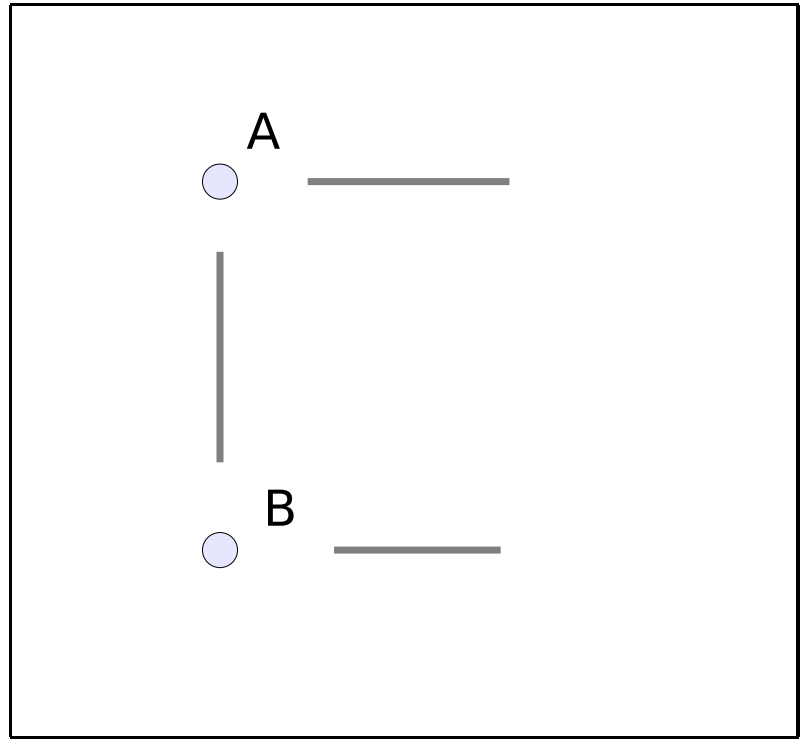
(I_2)

Evaluating hypotheses based on point features promotes a false correspondence (X,Y,A,B)$\rightarrow$(C,D,E,F).

Evaluating hypotheses (b)



(I_1)



(I_2)

Evaluating hypotheses by summing gradient contributions promotes a false correspondence (A,B)$\rightarrow$(X,Y).

Evaluating hypotheses (c)

The proposed evaluation procedure *counts* high gradient pixels from I_2, $p_i \in g(I_2)$, landing on high gradient pixels in I_1, $T(p_i) \in h(I_1)$:

$$\sum_{p_i \in g(I_2)} \delta_{I_1}(T(p_i)), \tag{2}$$

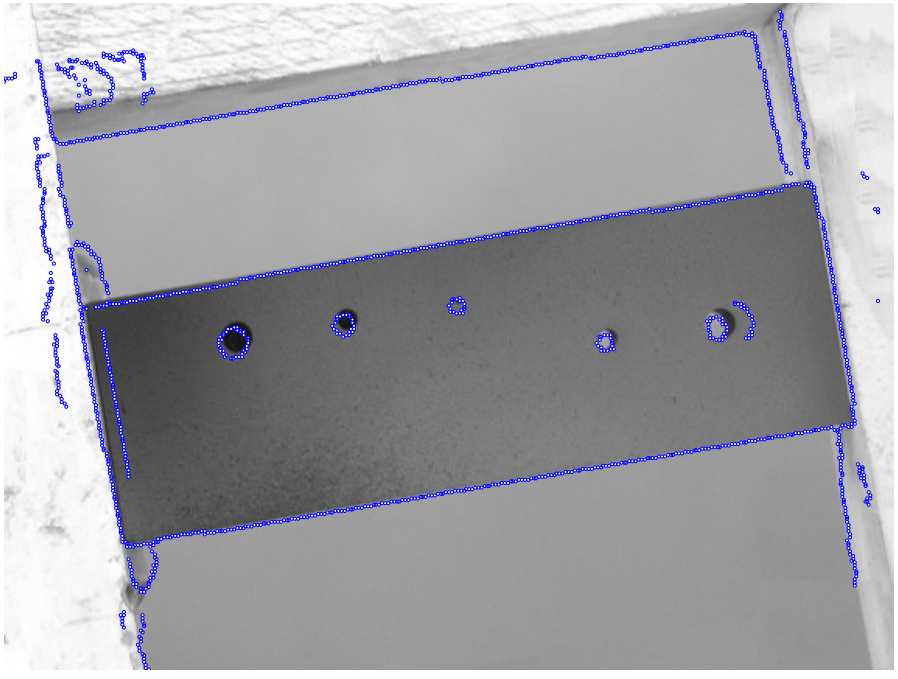
where

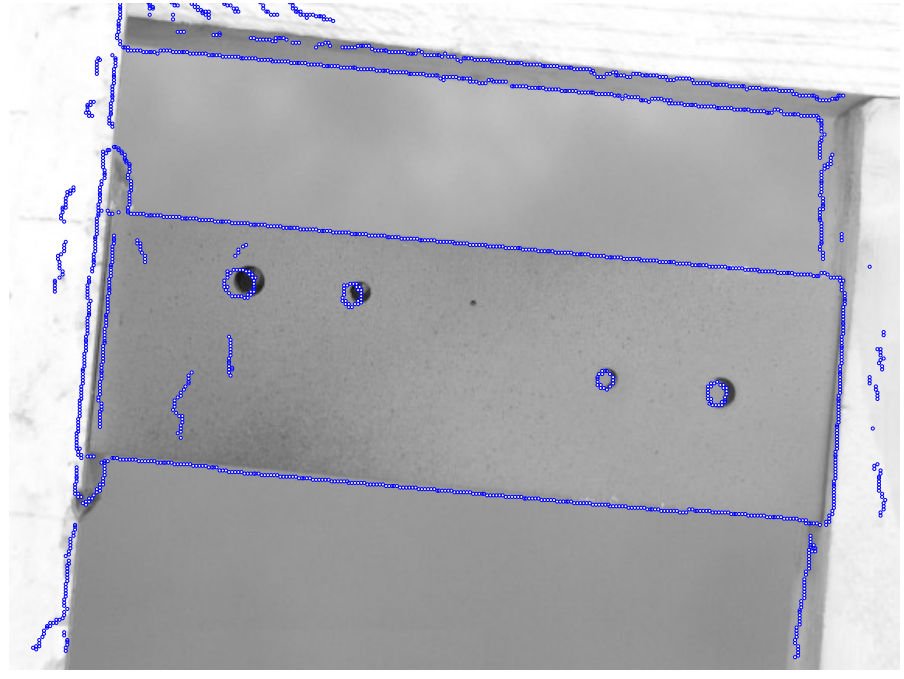
$$\delta_I(p) = \begin{cases} 1, & p \in h(I), \\ 0, & \text{otherwise}, \end{cases} \tag{3}$$

g . . . thinned edges obtained by Canny's operator
h . . . smoothed g

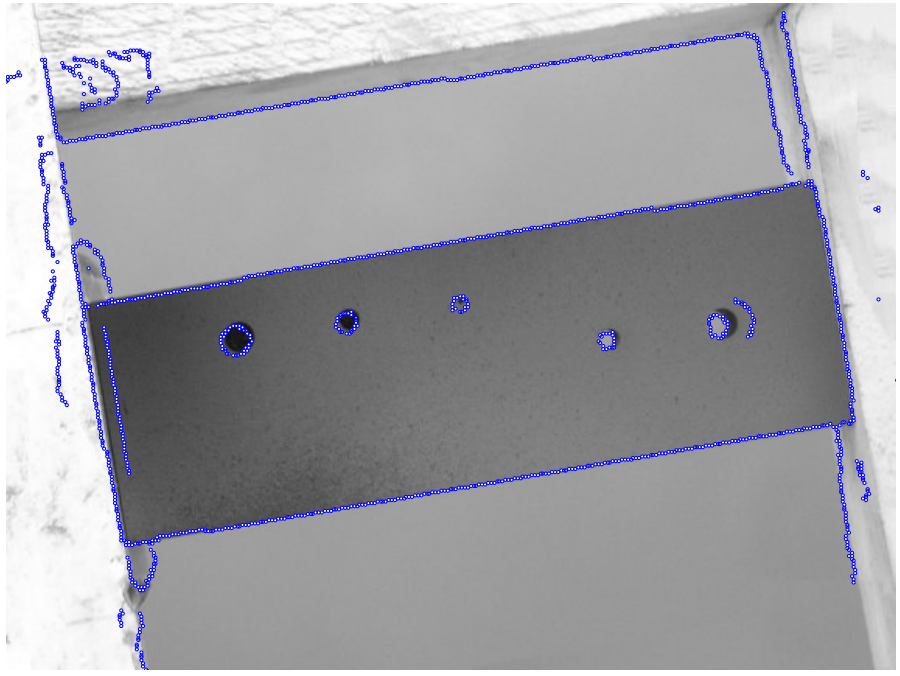
the criterion is similar to the partial Haussdorf distance, $H_q(T(p_i), r_j)$, $p_i \in g(I_2)$, $r_j \in g(I_1)$.

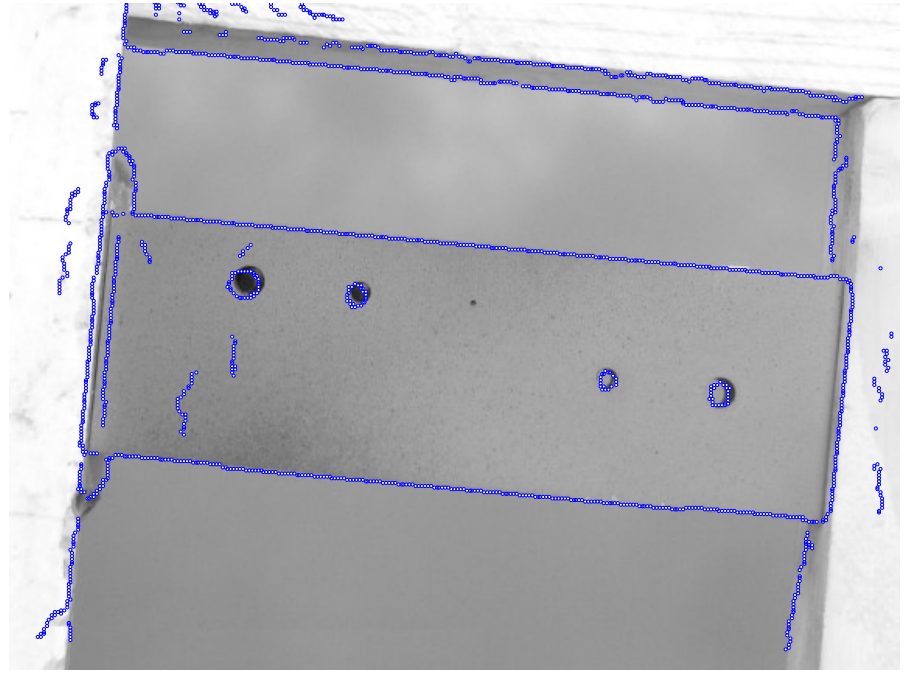
Results with no optimization





Results with optimization turned on

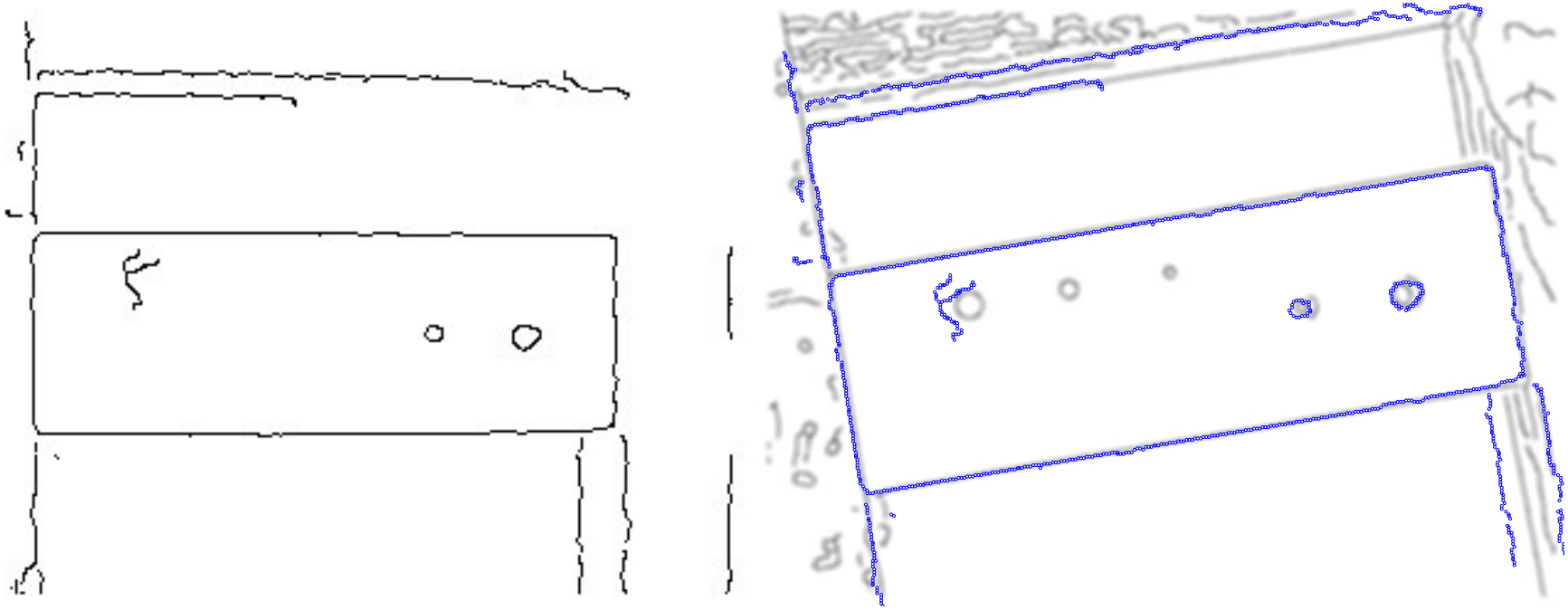




Even with optimization switched on, the procedure does not manage to find a perfect alignment for vertical edges

imperfect IR imaging conditions: the wooden frame supporting the metal object reflects the infrared radiation from the metal making the object appear wider in the infrared spectrum.

Results for distant viewpoints



The procedure has ignored the impossibility of matching the 1. and the 3. vertical edge from the right in the IR image

the alignment is performed on other edges for which a planar correspondence can be found.

Some negative results