

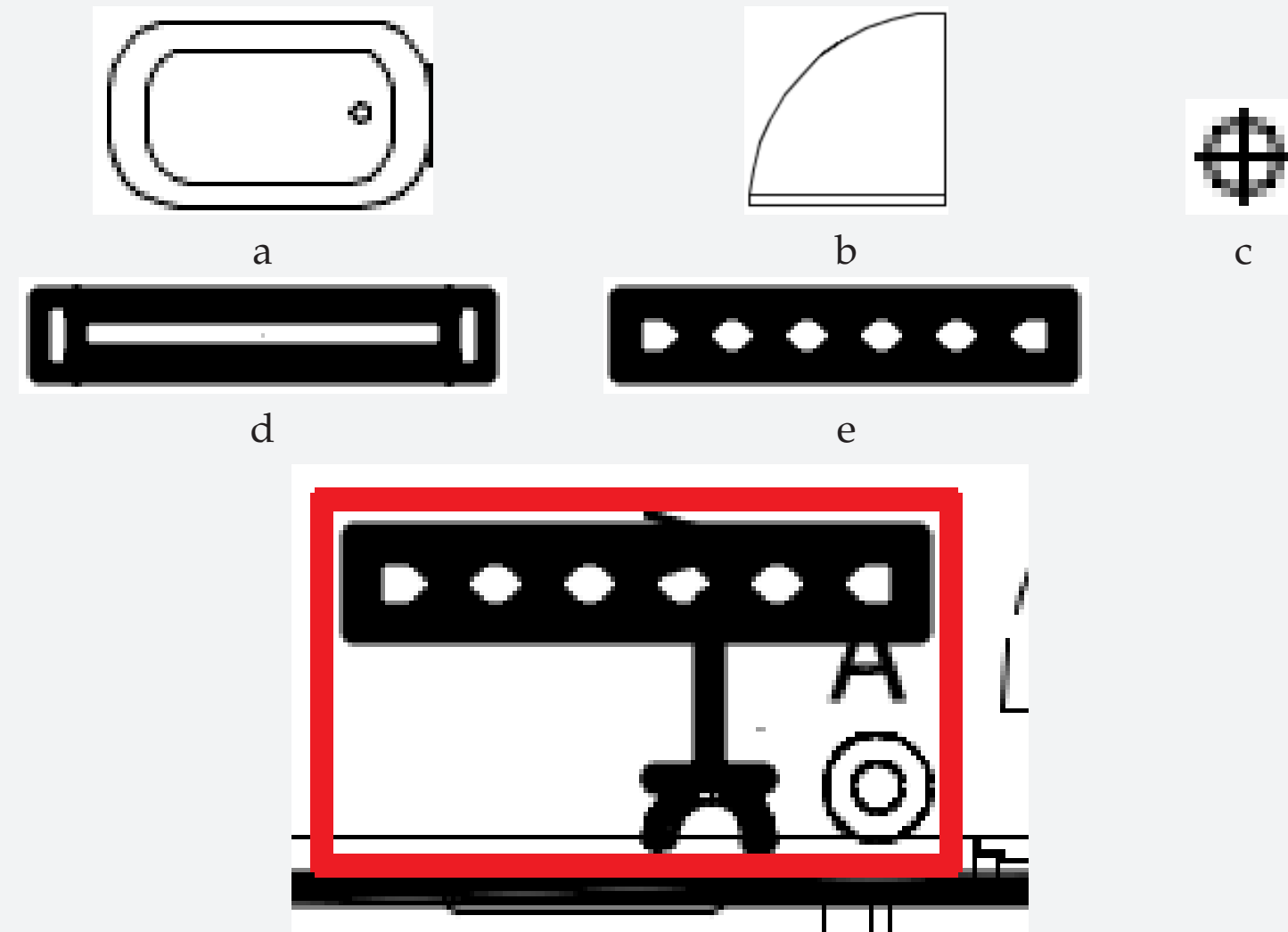
## Context

### Symbol spotting in technical plans :

- User-defined queries (crop)
- Symbol occlusion/overlapping problem
- Heavy user involvement

### Proposed solutions :

- Use a pixel-based template-matching operator
- Adapt it to overlapping/occlusion
- Imply the user in interactive and real-time process



## Hit-or-miss transform

Math. Morph. Template-matching operator.

Two structuring functions are defined :

- One to match the foreground of the template
  - One to match the background of the template
- Defined for binary, grey-level and color images. Fuzzy definitions exist but are adapted to noise not to information overlapping.

⇒ Need of a HMT adapted to information overlapping (HMTAIO).

## HMTAIO operator for symbol spotting

### HMTAIO definition

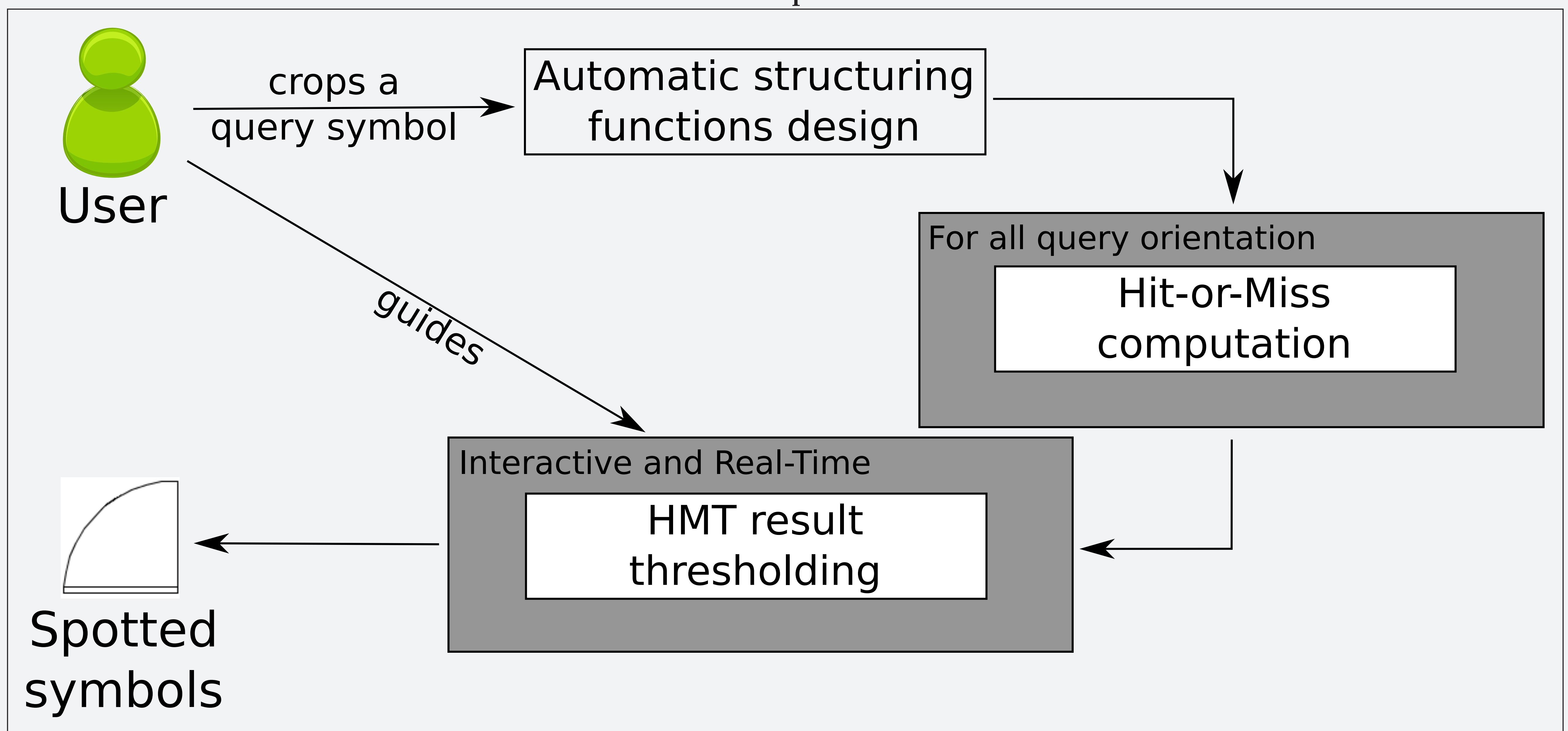
$$HMTAIO_{F,B}(I)(x) = \frac{HMTAIO_F(I)(x)^\alpha + HMTAIO_B(I)(x)^\beta}{2}$$

$$HMTAIO_F(I)(x) = \frac{\sum_{p \in F} \min\{1, \frac{I(x+p)}{F(p)}\}}{\text{card}(F)}$$

$$HMTAIO_B(I)(x) = \frac{\sum_{p \in B} \min\{1, 1 - \frac{I(x+p) - B(p)}{I^{\max} - B(p)}\}}{\text{card}(B)}$$

$I$  is an image,  $F$  is the foreground SF,  $B$  is the background SF and  $I^{\max}$  is the highest grey-level of the image  $I$ .  $\alpha$  and  $\beta$  are empirically set to 3 and 1.

### Method process



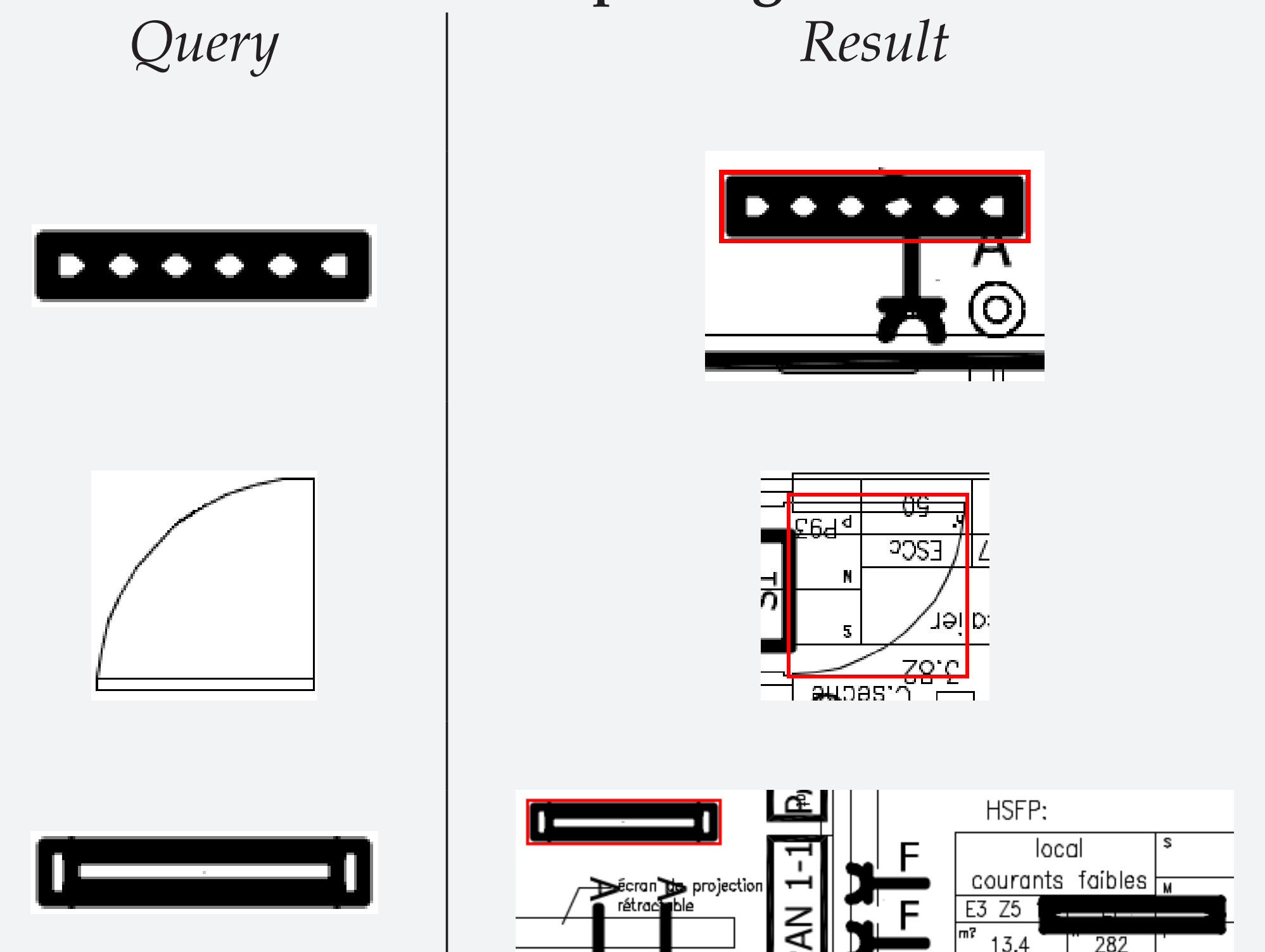
## Experiments and results

### Experiments on different symbols

Query	Thresh.	TP	FN	Time (sec)	Spotting rate
	0.57	80	0	12,340	100%
	0.71	141	2	35,750	99%
	0.77	91	2	699	98%
	0.91	24	0	15,319	100%
	0.89	227	2	15,060	99%

Experiments have been performed on a real technical plan of  $13,979 \times 9,871$  (137,986,709 pixels)

### Difficult spotting cases



## Conclusion and Perspectives

### HMT adaptation to technical plan context :

- efficient in dense and cluttered information cases
- automatic structuring functions design

### Perspectives :

- automatic parameters setting
- plan more experiments (symbols, technical documents) to fully validate our method