LABELING STREETS IN INTERACTIVE MAPS USING EMBEDDED LABELS

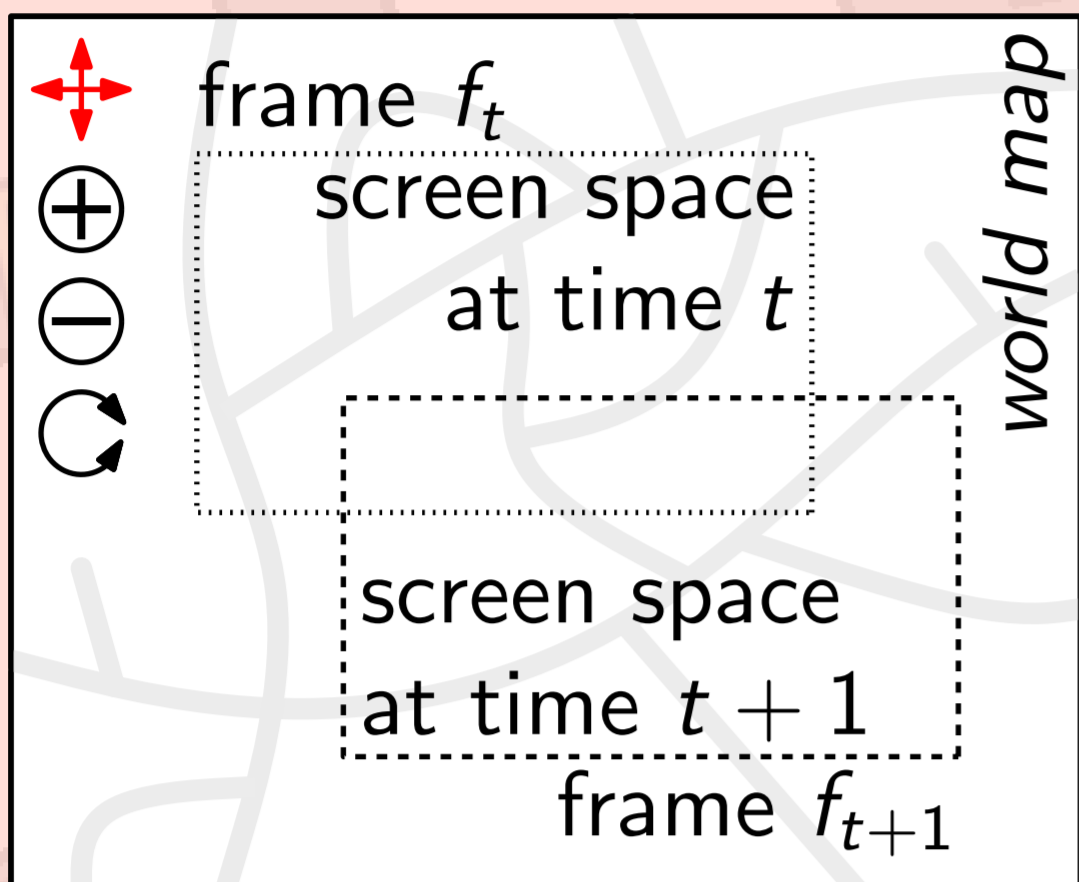Nadine Schwartges[1]   Alexander Wolff[1]   Jan-Henrik Haunert[2]

[1]University of Würzburg, Germany   [2]University of Osnabrück, Germany

Contrib.

frame f_t
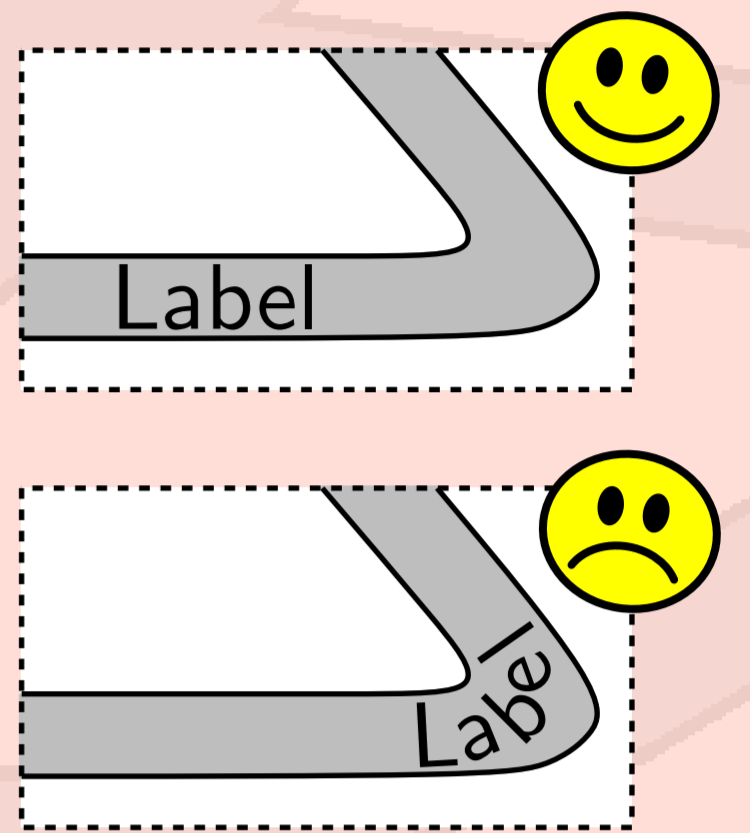screen space at time t
screen space at time $t+1$
frame f_{t+1}
world map

We present the **first algorithm** that

★ **embeds** labels into streets,
★ while avoiding intersections and strong bends,
★ computes **overlap-free** labelings,
★ and reacts to user interactions in **real time**.

The corresponding optimization problem (label-number maximization) is NP-hard even for one frame.

Label
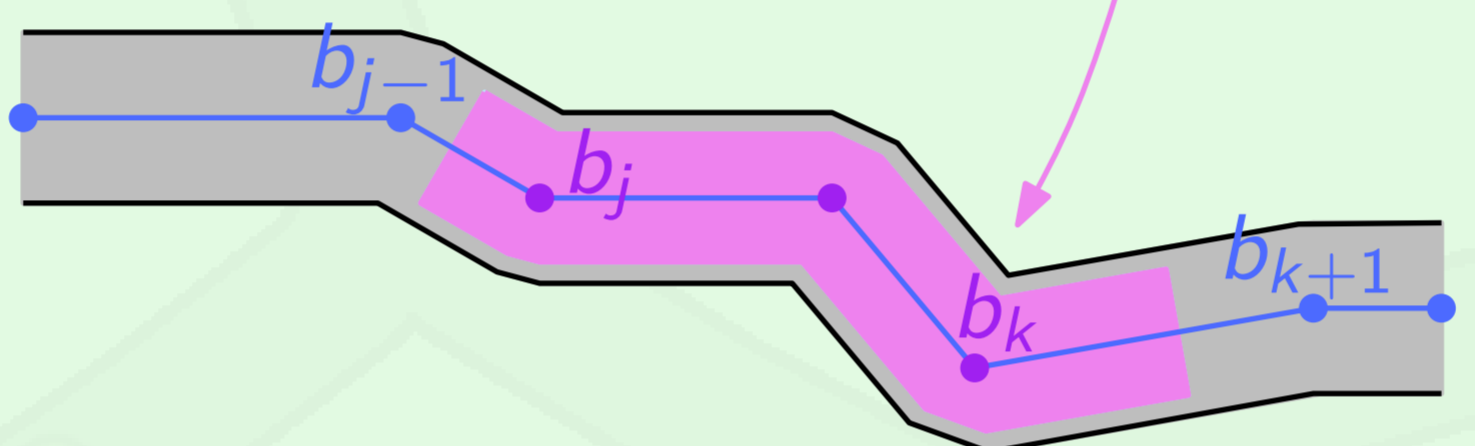
Label

Evaluations

Evaluating a bend b_i

s_i b_i s_j

segment
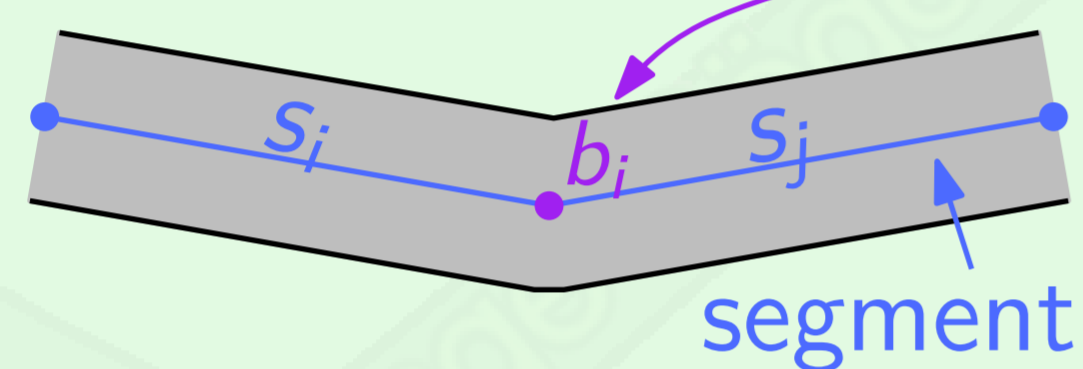
$C(b_i) = \sum_e c_e(b_i)$

with cost $c_e(b_i)$ caused by **criterion e**

Evaluating a label position ℓ

b_{j-1} b_j b_k b_{k+1}

$C(\ell) = \sum_{i=j}^{k} C(b_i)$

Discretization

ℓ ℓ'

$\ell \to \ell' \Rightarrow C(\ell) \leq C(\ell')$
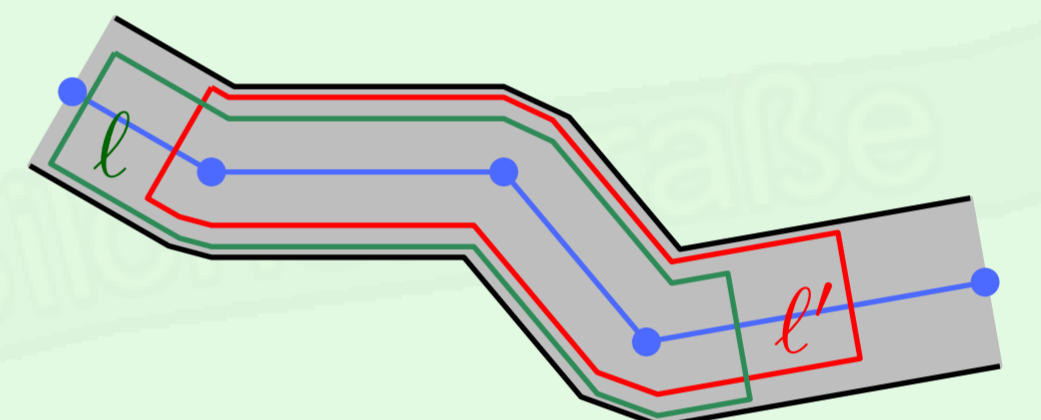
$\Rightarrow$ eval starts at bends only

Angle Criterion a

b_i α
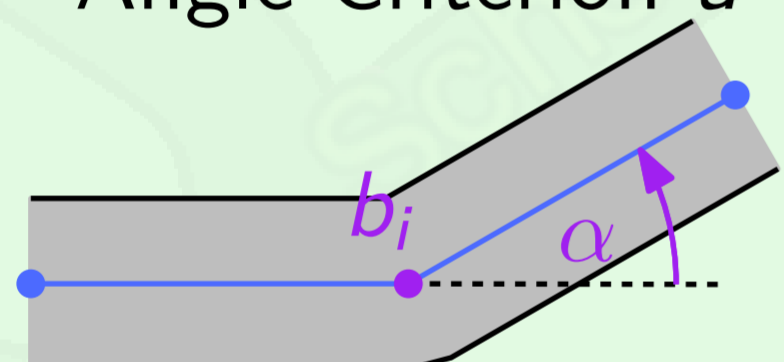
$c_a(b_i) = w_a \cdot \alpha^2$

weight factor w_a

Crossing Criterion x

b_i b_j

$c_e(b_j) = 0$
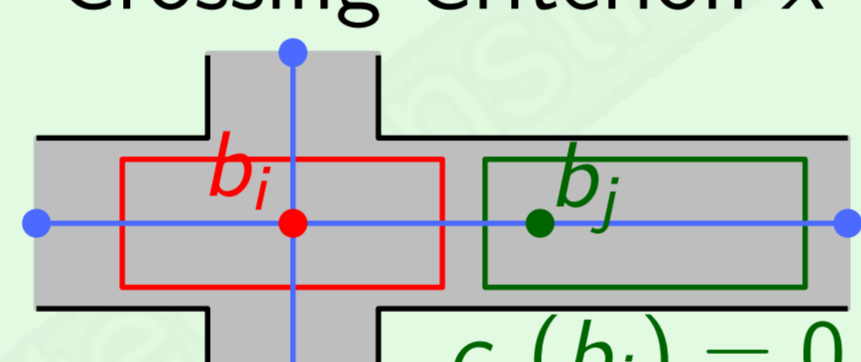
$c_x(b_i) = \mathrm{const}_x$

View Criterion v

ℓ ℓ'
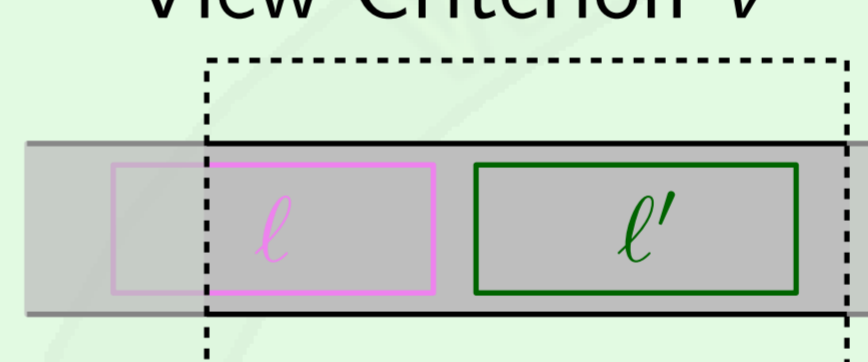
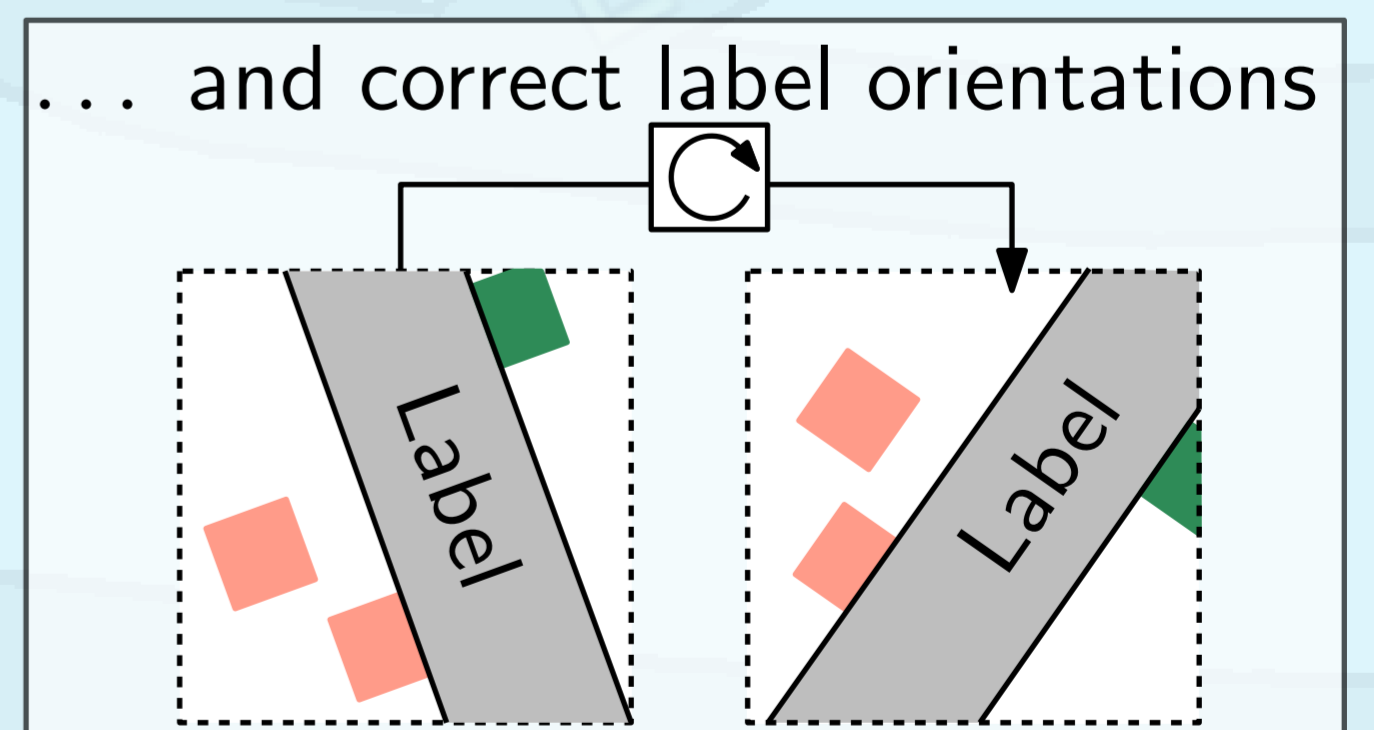$C(\ell) \leftarrow C(\ell) + \mathrm{const}_v$
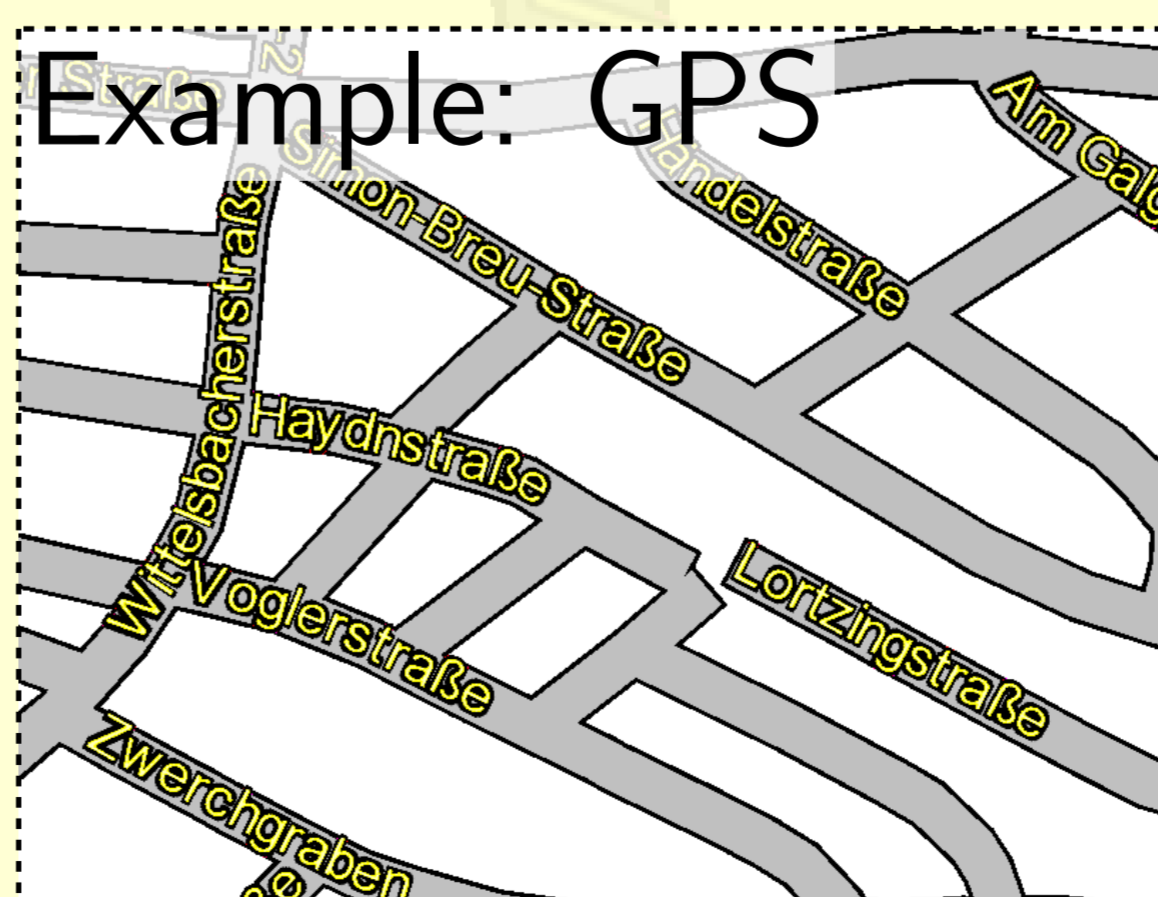$C(\ell') \leftarrow C(\ell') + 0$

Simplification Criterion s

$< T$ $\geq T$ $\geq T$ b_j b_k
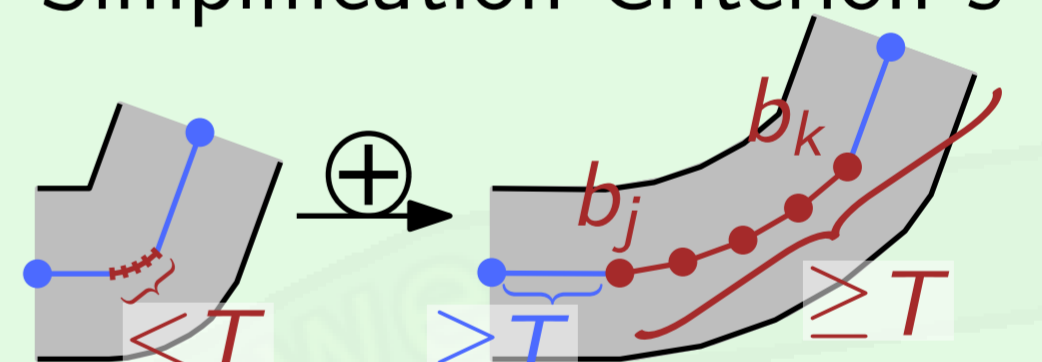
$c_s(b_j, \ldots, b_k) = w_s \cdot (\sum_{i=j+1}^{k} \alpha_i)^2$

Algorithm

in each frame...

... try to label each unlabeled street

Label   La

A Street C Ave B Street   A Street B Street C A

etc.

... and correct label orientations

Label   Label

Results

Frame Rate [FPS]

GPS
monitor

150
100
50
fluid

⊕ ⊖ ↻ all

Example: GPS

Example: Monitor
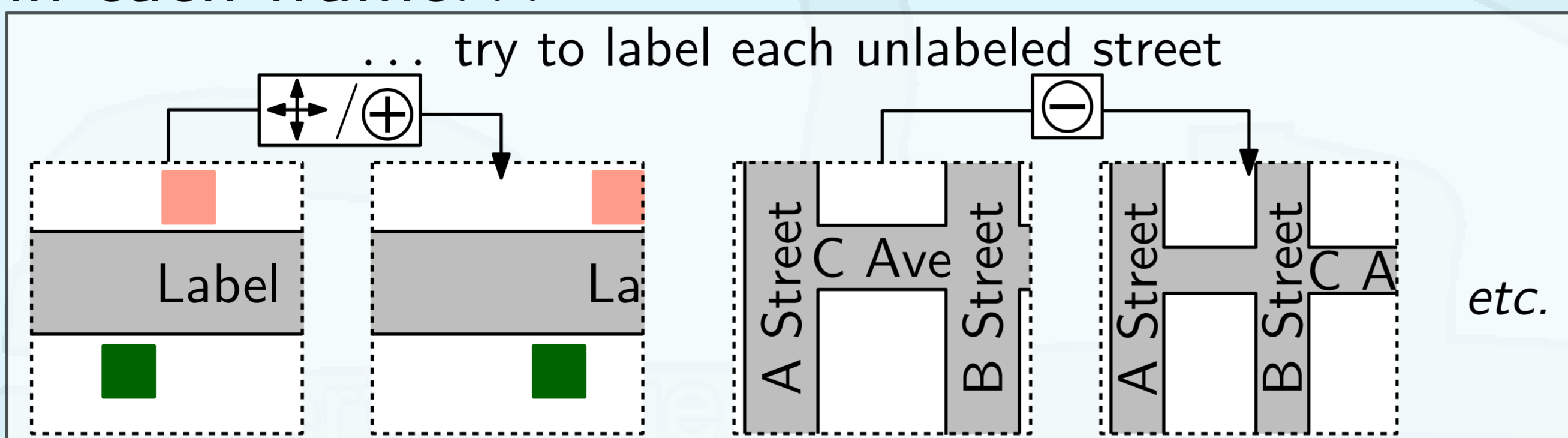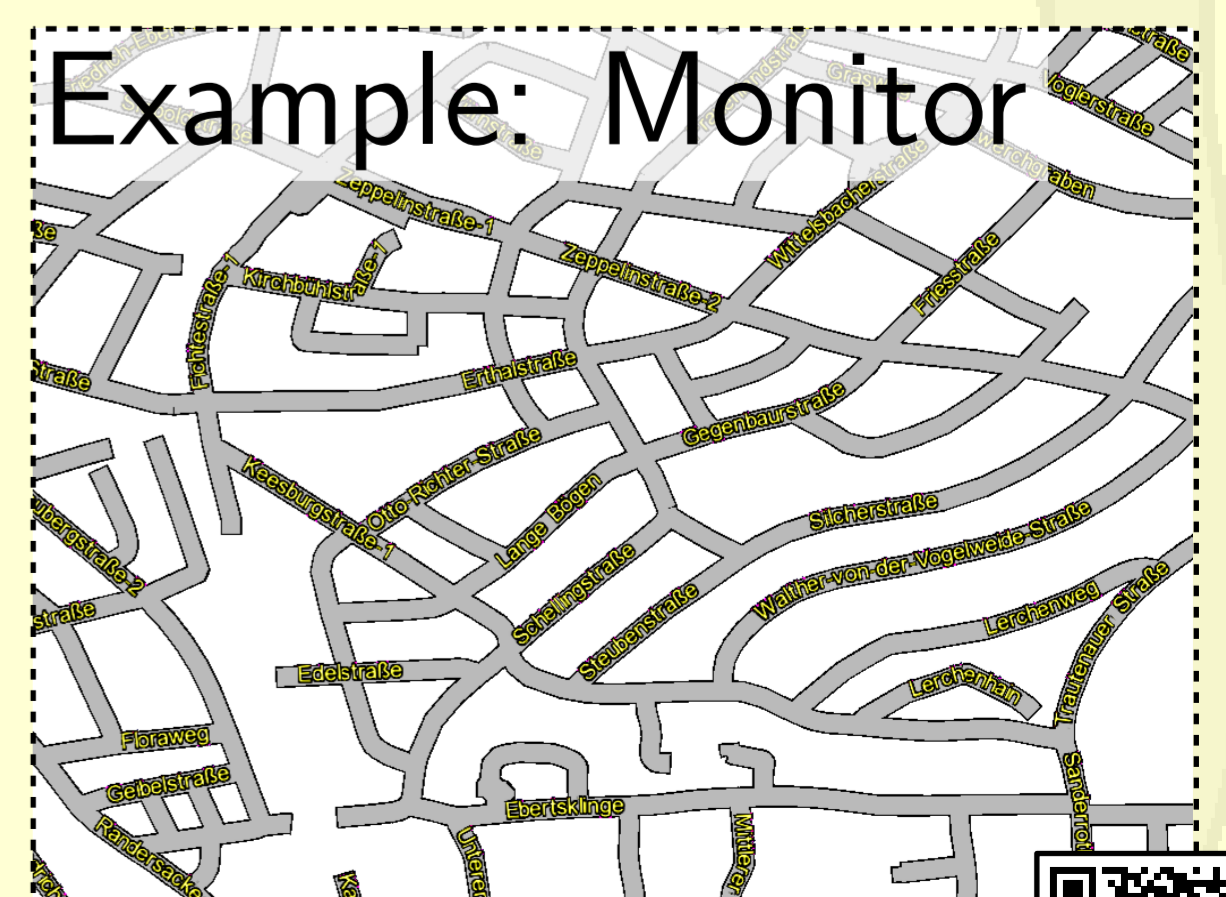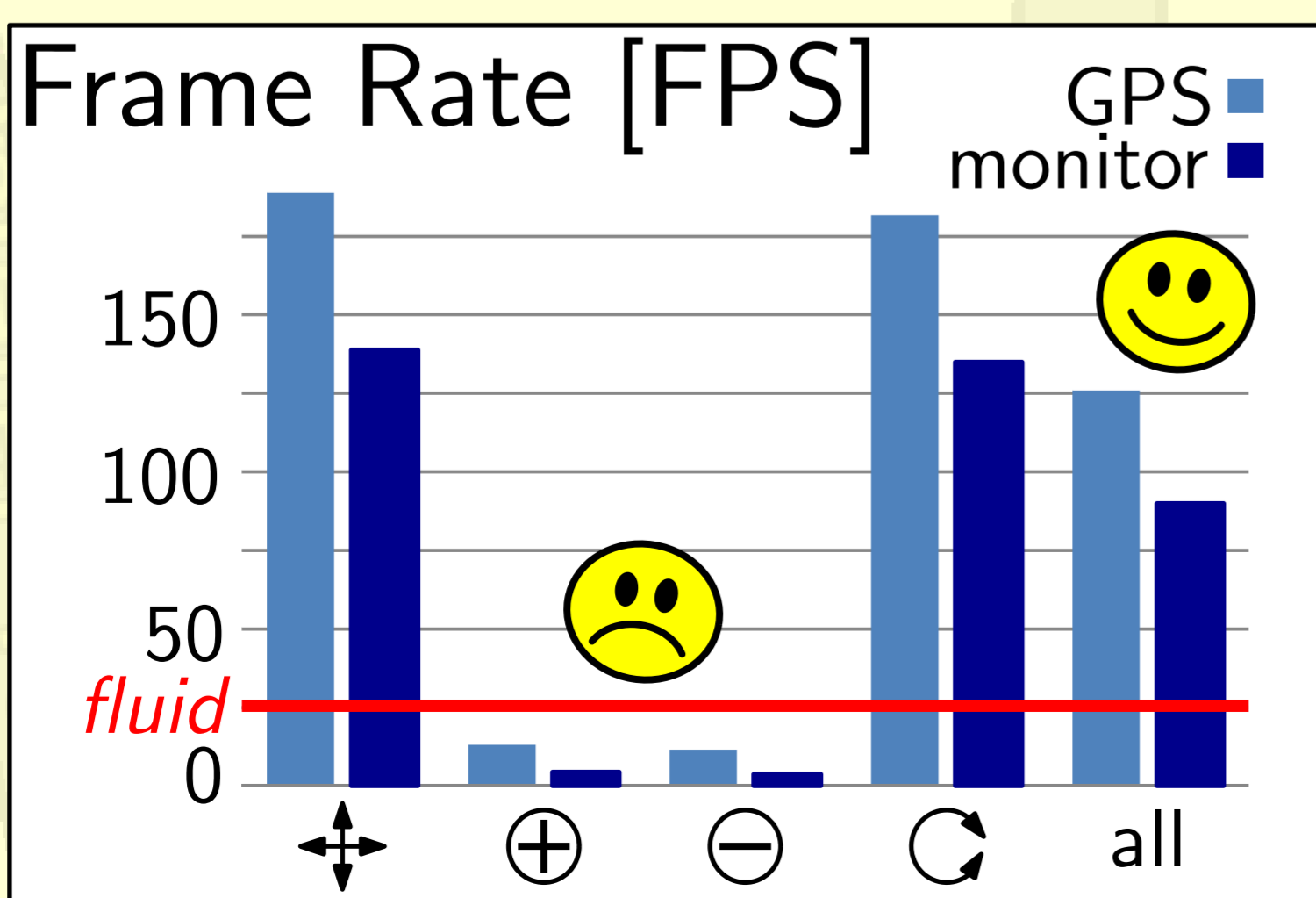
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