

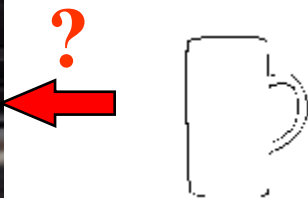
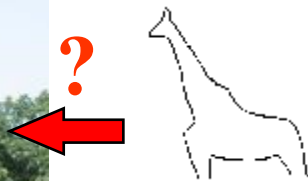
Chamfer-Based Shape Matching

Robert B. Fisher

School of Informatics

University of Edinburgh

Location and Matching Task



Chamfer matching

Gavrila and Philomin ICCV 1999

- Chamfer distance = average distance to nearest edgel

$$D_{chamfer}(T, I) \equiv \frac{1}{|T|} \sum_{t \in T} d_I(t)$$

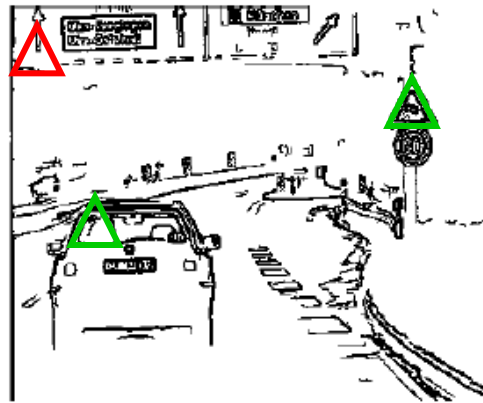
- T = template shape \rightarrow a set of points
- I = image to search \rightarrow a set of points
- $d_I(t)$ = min distance for template point t to any point in I

Chamfer matching

- Chamfer distance = average distance to nearest edge

$$D_{chamfer}(T, I) \equiv \frac{1}{|T|} \sum_{t \in T} d_I(t)$$

Key idea: response much smoother than filtering with a mask having the shape points !



Edge image

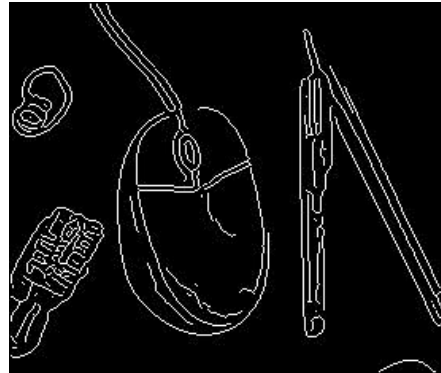
Match = local maxima of sliding-window output function

A naïve implementation is very expensive

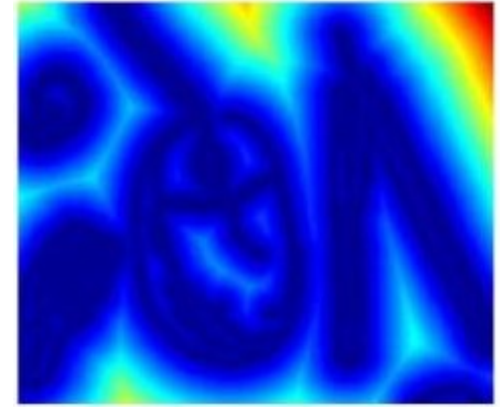
Distance transform



original



edges



distance transform

$$D_{chamfer}(T, I) \equiv \frac{1}{|T|} \sum_{t \in T} d_I(t)$$

If we have the distance transform of the image
→ use $d_I(t)$ as a lookup table, no need to
Find nearest edgel every time

Very efficient algorithms to compute the
distance transform are available
(linear in the number of image pixels)

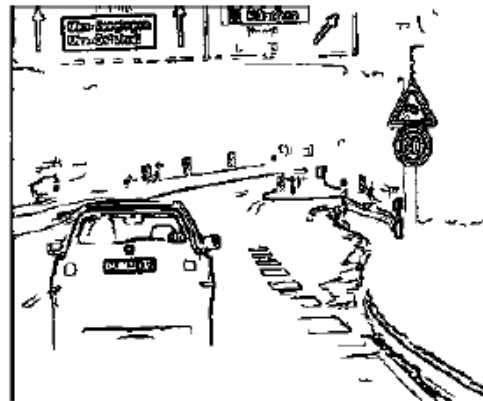
>> help bwdist

Value at (x,y) tells distance
to nearest edgel (or other
binary image structure)

Chamfer matching

- Chamfer distance = average distance to nearest edge

$$D_{chamfer}(T, I) \equiv \frac{1}{|T|} \sum_{t \in T} d_I(t)$$

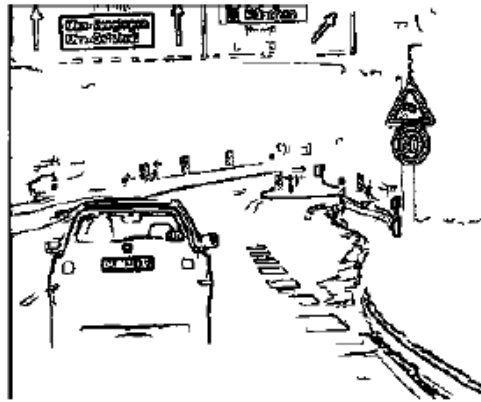


Edge image



Distance transform image

Sign recognition



Edge image

Distance transform image

Chamfer matching discussion

Cope with challenges

- + clutter
- + scale changes
- + fragmented edges
- * only small shape deformations

Advantages

- + simple to implement
- + quite fast

Disadvantages

- many false-positives in cluttered regions (due to weak notion of shape)
- need many training templates to handle shape variations.

a perfect circle ?



Lecture Overview

- + Method for complex shape matching
- + Doesn't need segmentation
- + Gives matched shape location
- Computationally expensive