Chamfer-Based Shape Matching

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Slides credit: Bob Fisher & Vittorio Ferrari & Bas Boom
Location and Matching Task

Slide: Ferrari et al. ECCV 2006
Chamfer matching

Gavrila and Philomin ICCV 1999

• Chamfer distance = average distance to nearest edgel

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

• \( T \) = template shape → a set of points
• \( I \) = image to search → 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 edgel

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

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

Match = local maxima of sliding-window output function

A naïve implementation is very expensive

Slide extended from K. Grauman
Distance transform

\[ D_{\text{Chamfer}}(T, I) \equiv \frac{1}{|T|} \sum_{t \in T} d_I(t) \]

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

Slide extended from K. Grauman
Chamfer matching

- Chamfer distance = average distance to nearest edgel

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

Edge image

Distance transform image

Slide extended from K. Grauman
Sign recognition

Fig from D. Gavrila, DAGM 1999

Edge image
Distance transform image

Slide extended from K. Grauman
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