Digital Image Processing (CSE 478)
Lecture 23: Chamfer matching

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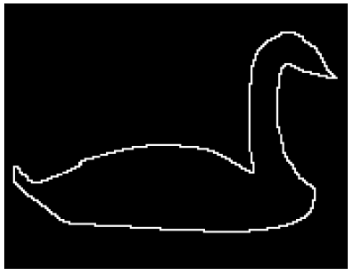
Many slides from Nicu Stiurca

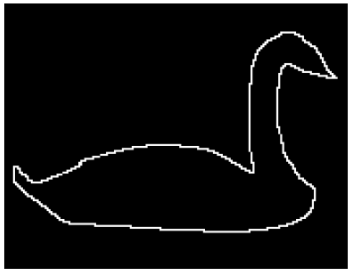
Contour based shape matching



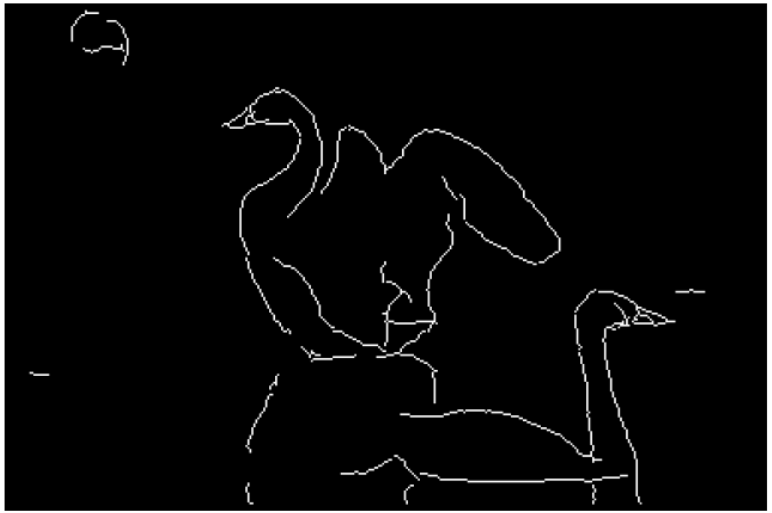
Template shape

Query Image

Contour based shape matching

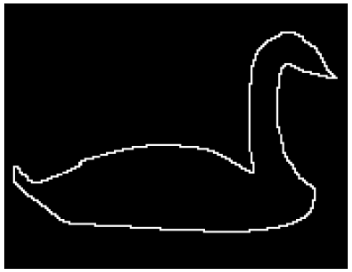


Template shape



Query Image

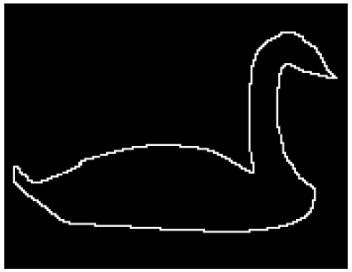
Contour based shape matching



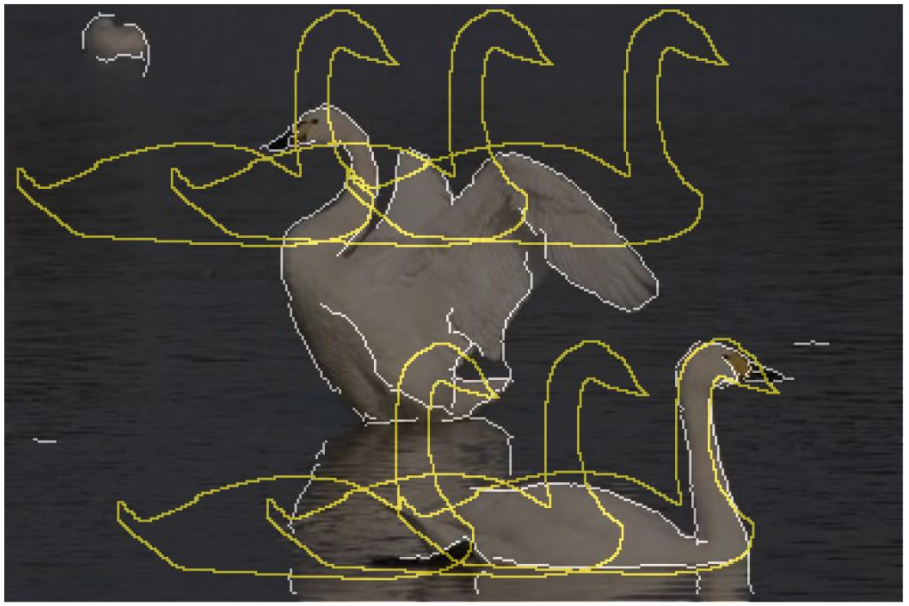
Template shape

Query Image

Contour based shape matching

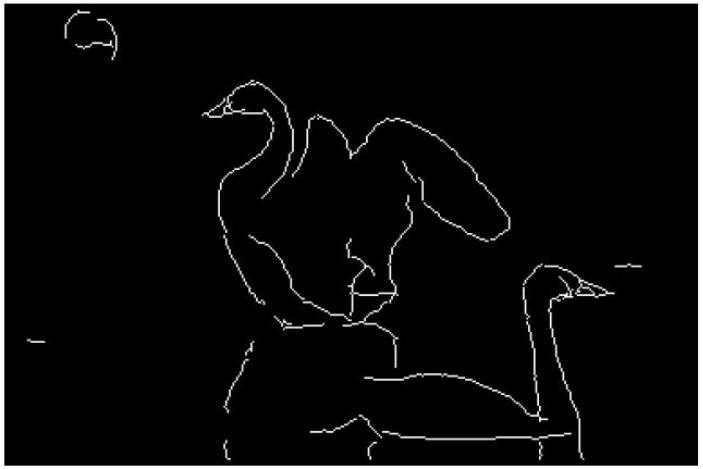


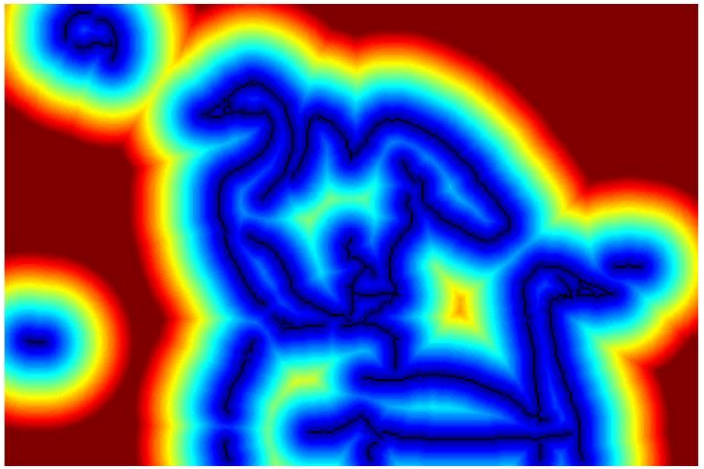
Template shape



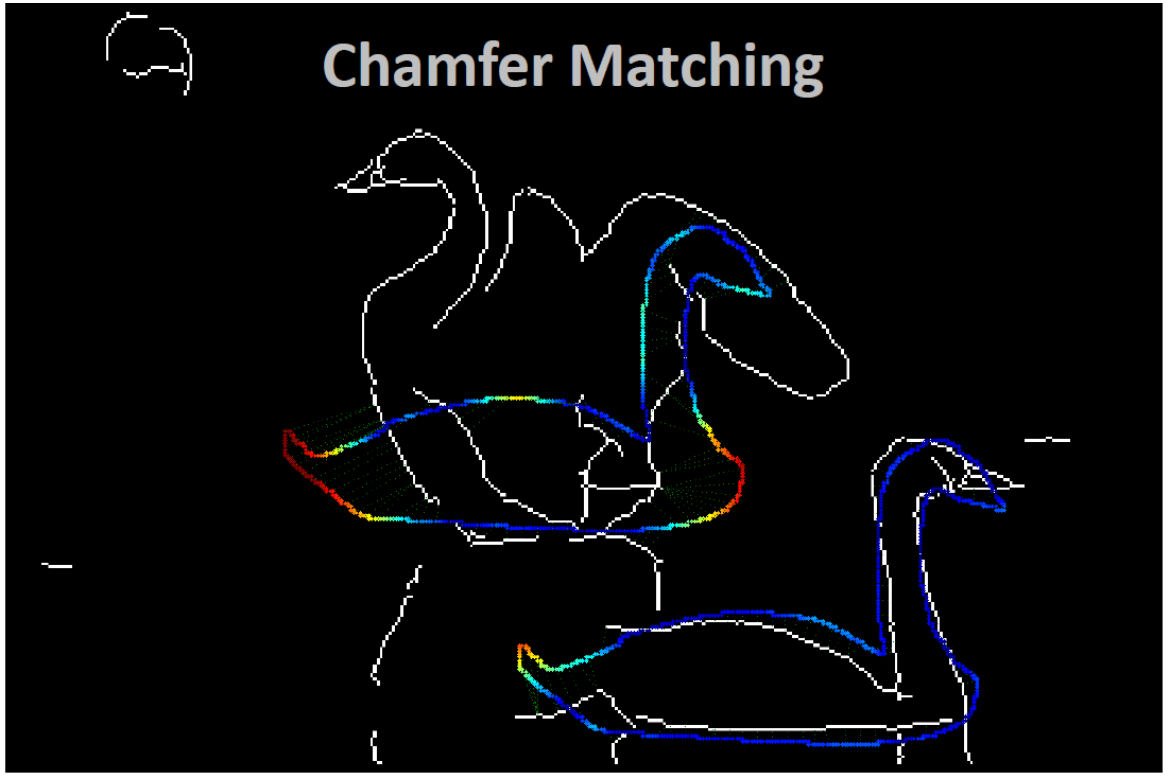
Query Image

Distance Transform

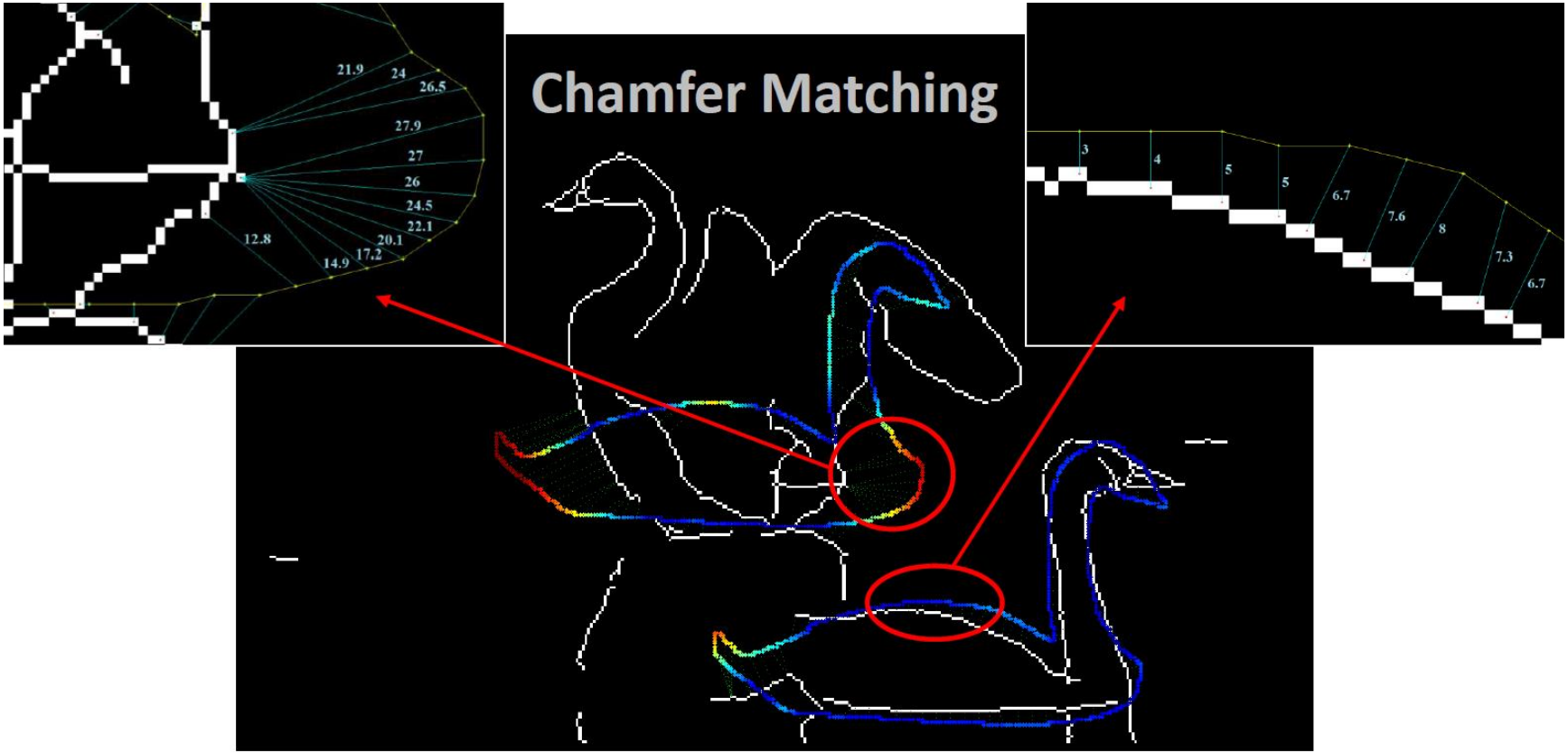




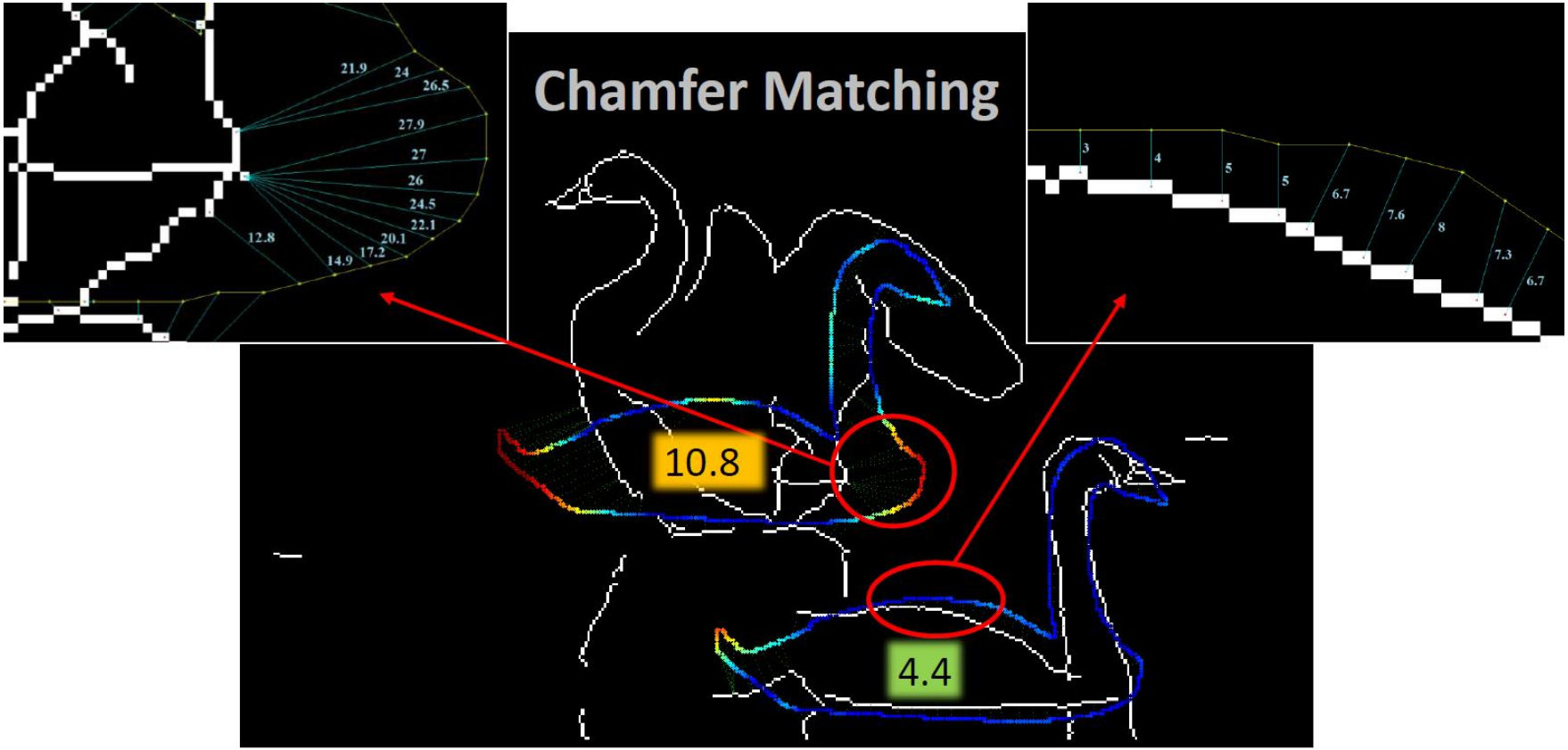
Chamfer Matching



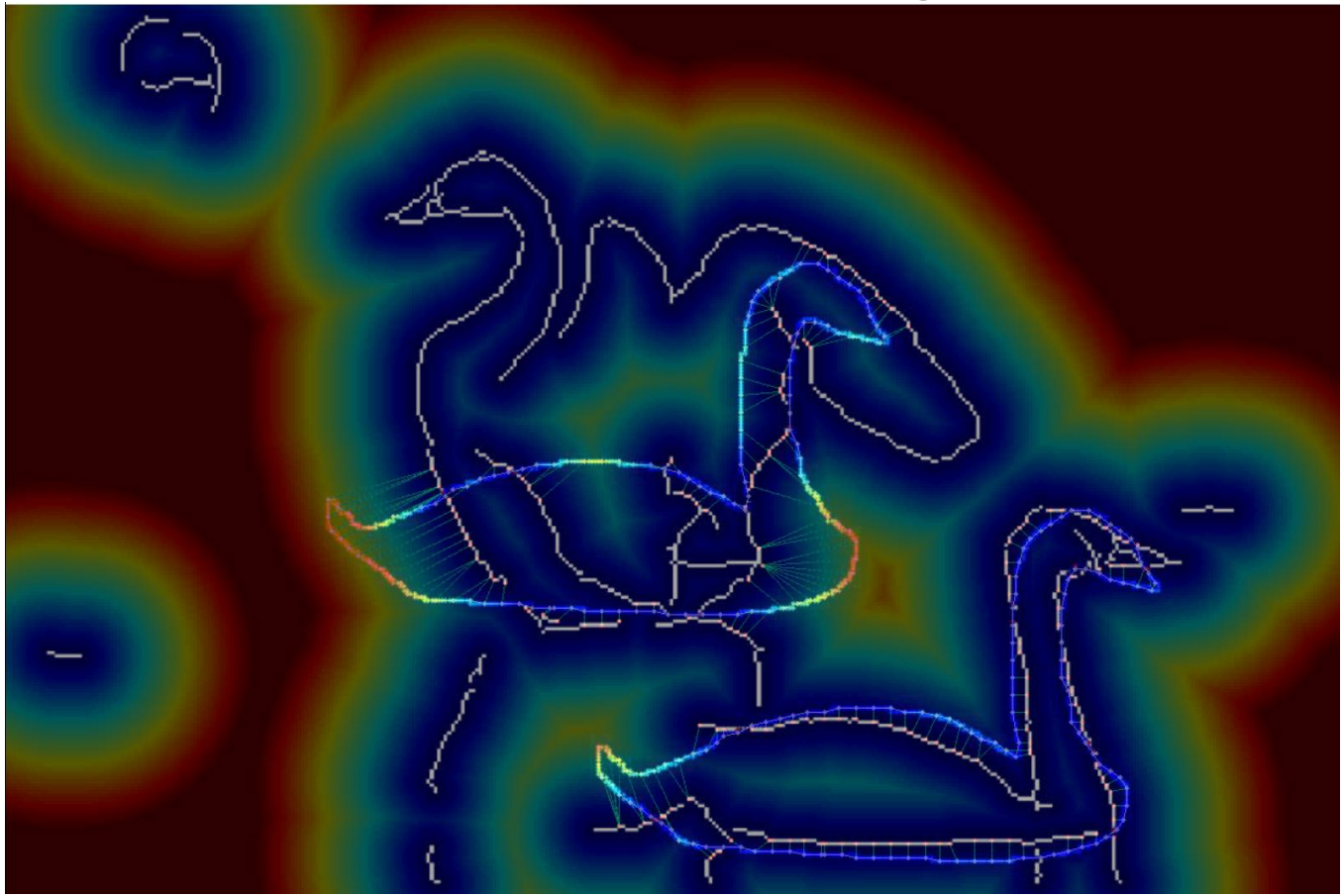
Chamfer Matching



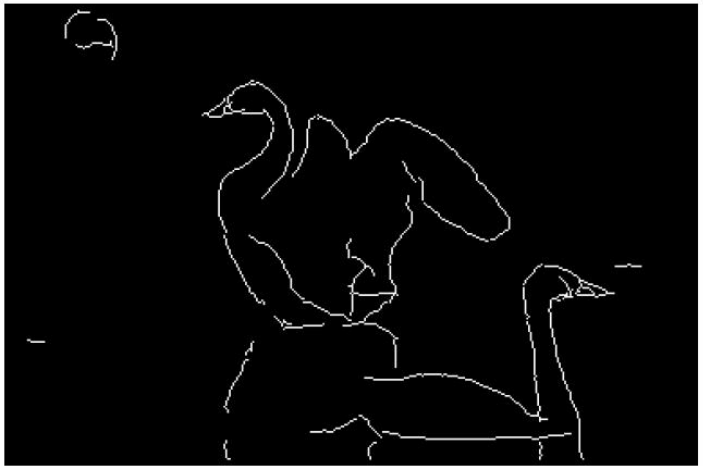
Chamfer Matching

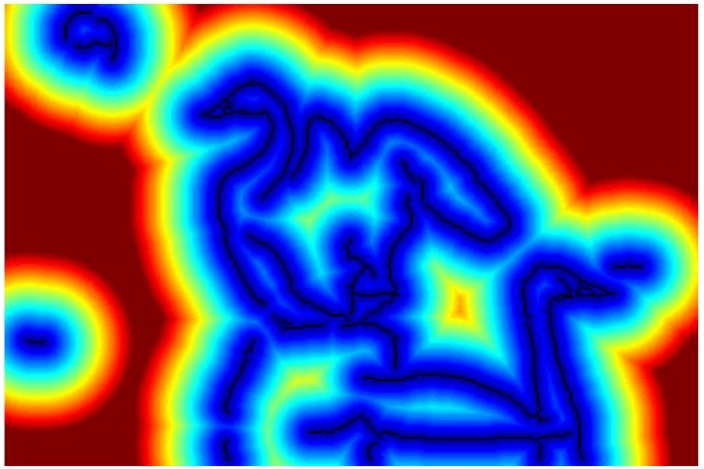


Chamfer Matching



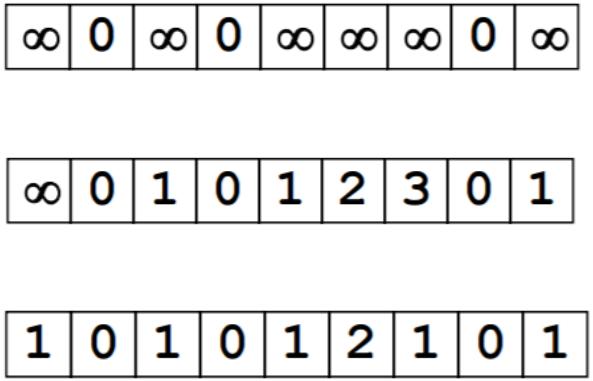
How to efficiently compute DT?





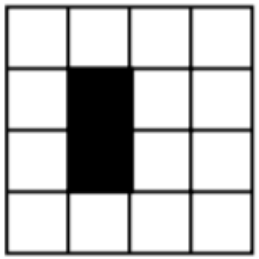
Distance Transform – 1D case

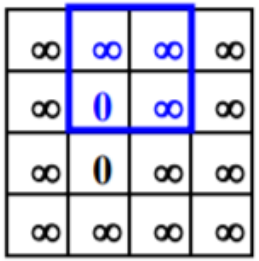
- Two pass O(n) algorithm
  - Initialize
  - Forward pass (1 to n-1) D[j] ← min(D[j],D[j-1]+1)
  - Backward pass (n-2 to 0) D[j] ← min(D[j],D[j+1]+1)

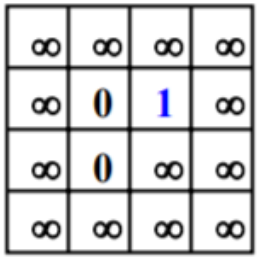


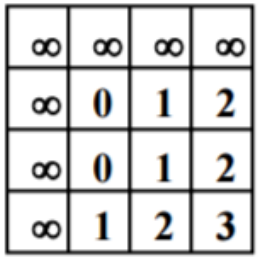
Distance Transform – 2D

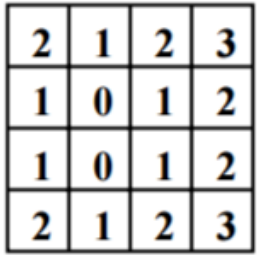
- 2D case similar to 1D
  - Initialize
  - Forward Pass (left and top)
  - Backward Pass (right and below)





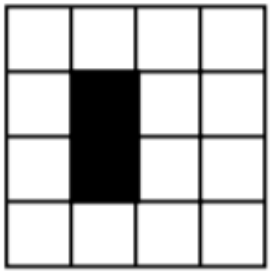


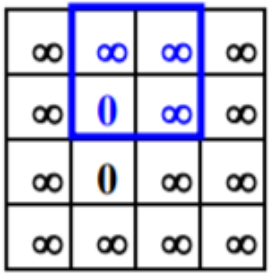


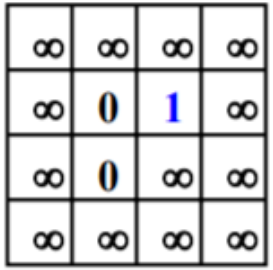


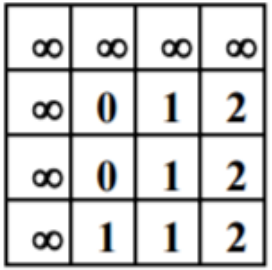
Distance Transform – 2D

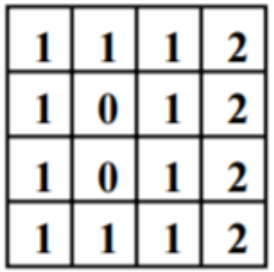
- Similar extension to 8 neighbours (Chessboard distance)
  - Initialize
  - Forward Pass (left, top, top-left)
  - Backward Pass (right, below, right-below)











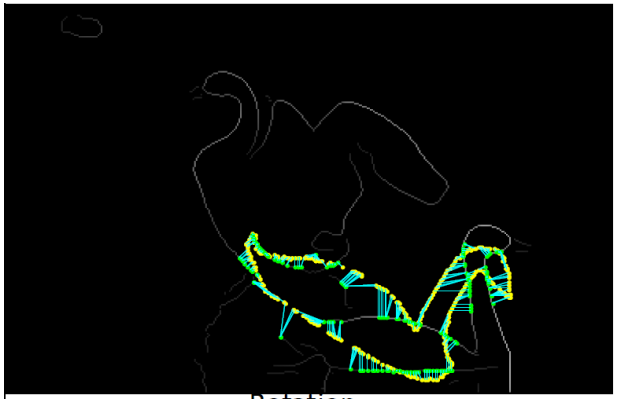
What about Euclidian Distance??

Courtesy: Dan Huttenlocher

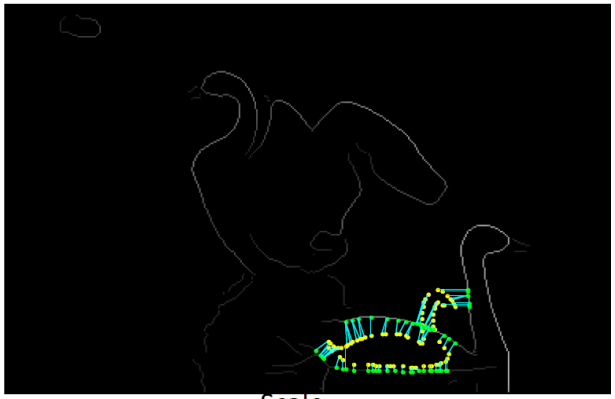
Chamfer Matching Overview

- Detect edges in query image
- Slide template over query image edge map
- Find closest edge pixel in image for each shifted template pixel
- At each location, compute average distance from each pixel in template to closest edge in image
- Lowest cost is the best match

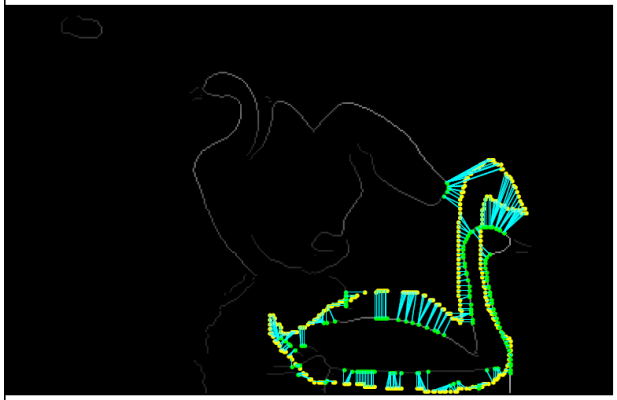
Limitations



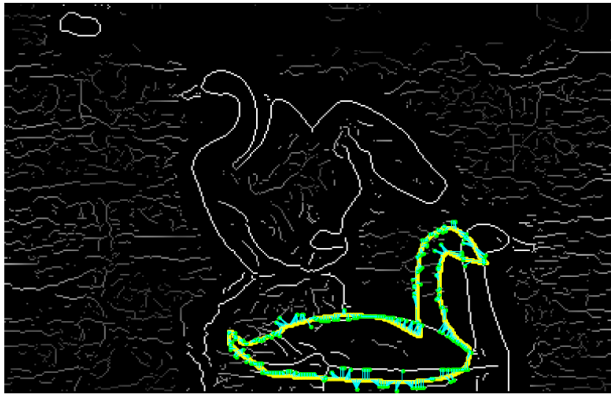
Rotation



Scale



Aspect ratio



Bad edge map threshold / Clutter

Possible improvement