

# COS426 Precept3

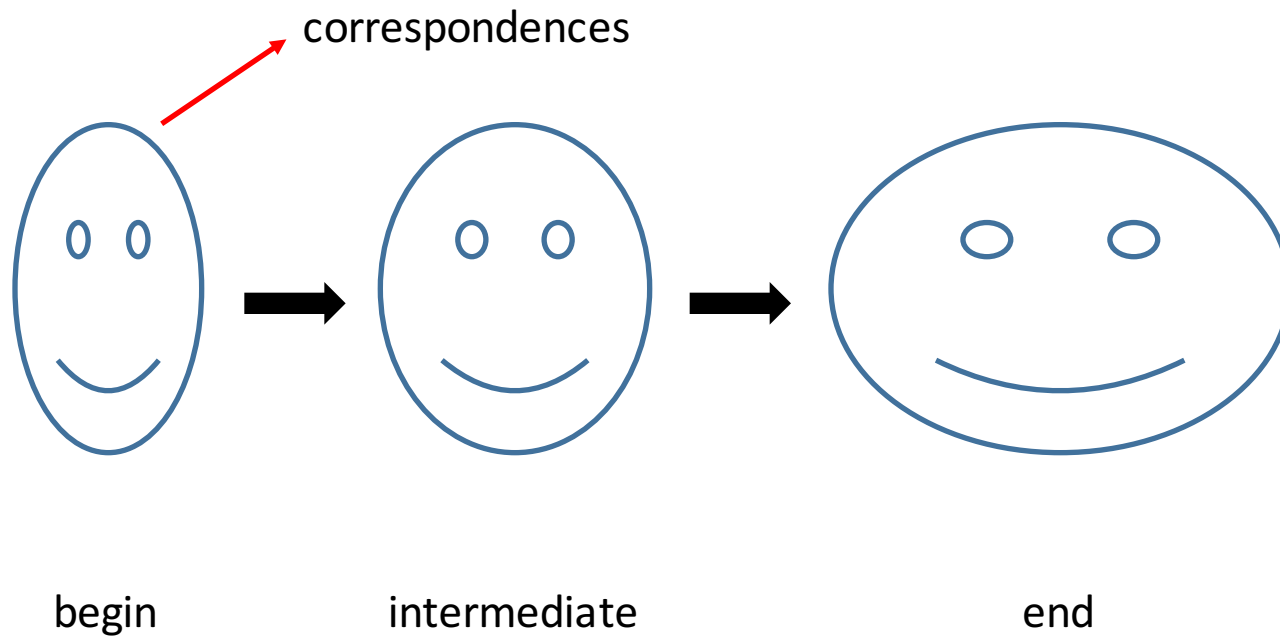
Image Processing

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# Morph

- Basic concepts
  - warp the background image to the foreground image
  - $\alpha = 0$ : show background
  - $\alpha = 1$ : show foreground
  - $\alpha$  is the blending factor / timestamp
- General approach
  - specify correspondences (morphLines.html)
  - create an intermediate image with interpolated correspondences ( $\alpha$ )
  - warp the background image to the intermediate image
  - warp the foreground image to the intermediate image
  - blend using  $\alpha$

# General approach



In our case, correspondences are morph lines.

# Morph

```
GenerateAnimation(Image0, L0[...], Image1, L1[...])
begin
  foreach intermediate frame time t do
    for i = 1 to number of line pairs do
      L[i] = line t-th of the way from L0 [i] to L1 [i]
    end
    Warp0 = WarpImage(Image0, L0, L)
    Warp1 = WarpImage(Image1, L1, L)
    foreach pixel p in FinalImage do
      Result(p) = (1-t) Warp0 + t Warp1
    end
  end
end
```

# Warp Image

For each pixel  $X$  in the destination

$DSUM = (0,0)$

$weightsum = 0$

For each line  $P_i Q_i$

calculate  $u, v$  based on  $P_i Q_i$

calculate  $X'_i$  based on  $u, v$  and  $P'_i Q'_i$

calculate displacement  $D_i = X'_i - X_i$  for this line

$dist =$  shortest distance from  $X$  to  $P_i Q_i$

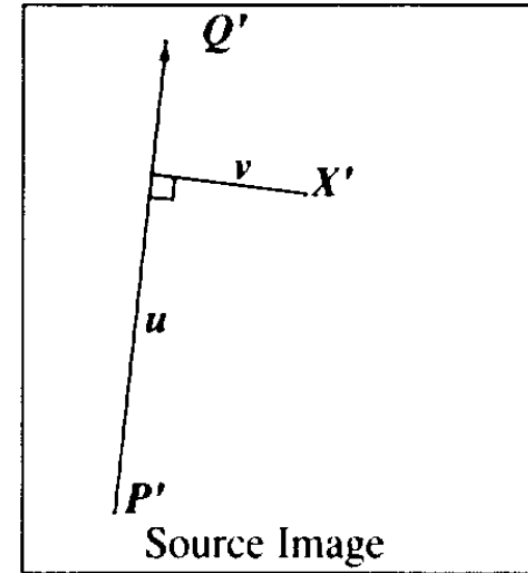
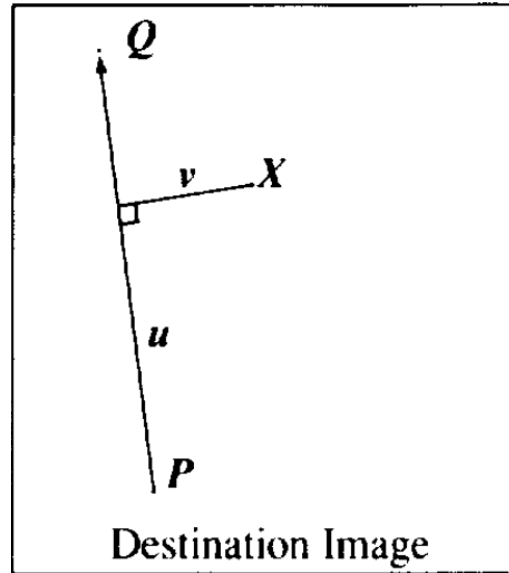
$weight = (length^p / (a + dist))^b$

$DSUM += D_i * weight$

$weightsum += weight$

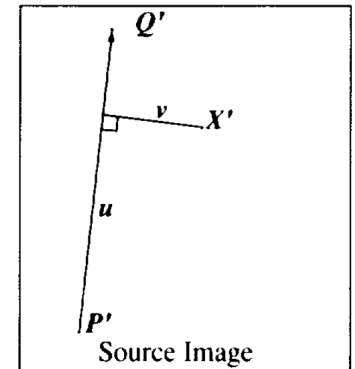
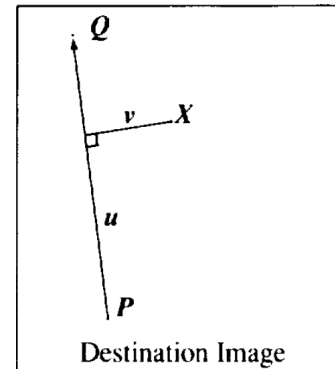
$X' = X + DSUM / weightsum$

$destinationImage(X) = sourceImage(X')$



# Warp Image

- $u = \frac{(X-P) \cdot (Q-P)}{\|Q-P\|^2}$
- $v = \frac{(X-P) \cdot \text{Perpendicular}(Q-P)}{\|Q-P\|}$
- $X' = P' + u \cdot (Q' - P') + \frac{v \cdot \text{Perpendicular}(Q' - P')}{\|Q' - P'\|}$
- $dist = \text{shortest distance from } X \text{ to } PQ$ 
  - $0 \leq u \leq 1$ :  $dist = |v|$
  - $u < 0$ :  $dist = \|X - P\|$
  - $u > 1$ :  $dist = \|X - Q\|$
- $weight = \left(\frac{length^p}{a+dist}\right)^b$ 
  - we use  $p = 0.5$ ,  $a = 0.01$ ,  $b = 2$



Q&A