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(Image_0, L_0[...], Image_1, L_1[...])
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 L_0 [i] to L_1 [i]
    end
    Warp_0 = WarplImage(Image_0, L_0, L)
    Warp_1 = WarplImage(Image_1, L_1, L)
  end
  foreach pixel p in FinalImage do
    Result(p) = (1-t) Warp_0 + t Warp_1
  end
end
Warp Image

For each pixel $X$ in the destination

$DSUM = (0,0)$

$weightsum = 0$

For each line $P_iQ_i$

- calculate $u,v$ based on $P_iQ_i$
- 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 $P_iQ_i$
- $weight = (length^p / (a + dist))^b$
- $DSUM += D_i * weight$
- $weightsum += weight$

$X' = X + DSUM / weightsum$

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

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