

Lab 11: Image Registration



Primary Goal: Use image registration to morph images.

Secondary Goal: Embrace your inner spirit animal.

Step 1: Choose Your Images

First obtain a color photograph of yourself (or another person's publicly available portrait if you are camera-shy). The photograph should just include your head facing forward against a white background. Load your picture into a matrix A .

Next go to the internet and find a picture of your favorite animal, preferably just showing the head facing forward. The animal should also be on a white background, for example you could Google the phrase "bulldog white background". Ideally, the picture should show the same anatomical structures as your photo. For example, if your photo shows your head and shoulders, then you want to see just the head and shoulders of the corresponding animal. Load the animal picture into a matrix B .

Your goal is to gradually transform your picture A into the animal picture B , a process called morphing in special effects. You may wish to crop both pictures first in a program such as Paint to show just the head. Ideally, the two images will have the same aspect ratio and a white background.

Step 2: Cross-dissolve

First we will make the two images have the same size.

```
[m,n,k] = size(B);  
A = imresize(A, [m,n]);
```

Next, type the code below into a script. Note that each color image I is the weighted average of A and B , where the weight shifts gradually from $t=0$ to $t=1$. This process is called a cross-dissolve in video processing.

```
for t=0:0.01:1  
    I = (1-t)*A + t*B;  
    imagesc(I); axis off; drawnow;  
end;
```

You should see a short animation showing the image A dissolve into image B .

Step 3: Cross-Dissolve + Warp

To try to improve the morphing visual effects, we are going to gradually warp the image A into the image B while also performing a cross-dissolve. First, select corresponding control points in both images using the `cpselect` tool.

```
cpselect (A, B);
```

Click on at least 4 corresponding pairs of points. I recommend using the left eye, right eye, tip of the nose, and bottom of the chin. You may also want to use the tips of the left

and right ears. Export the control point for A and B to the workspace as PA and PB, respectively

Normally, we would register images A and B by computing the transformation T mapping PA to PB. Instead, we can *gradually* warp the image A to B by performing a weighted average of the control points.

```
P_mid = (1-t)*PA + t*PB;
```

The collection of point P_mid will be midway between the point sets PA and PB. Note that P_mid=PA initially and as t gets larger, the points P_mid get closer to the final points PB. We can then compute the affine transformation that maps the points PA to P_gradual.

```
T_mid = cp2tform(PA, P_mid, 'affine');
```

Add these two lines of code to the cross-dissolve loop in Step 2 so that the P_mid and T_mid are computed each iteration. Next place your transformed image A and the animal image B on the same coordinate system using the align function in the Activity11 folder, using T_mid as the transformation. Then modify the weighted average from Step 2 to compute I so that it cross-fades between the aligned images.

Paste your code for Step 3 into a figure in your report.

Also, create a figure showing the subplot of every 20th frame for Step 3. To make this subplot, replace the imagesc command inside the loop with the following code:

```
if mod(t,0.2) == 0
    subplot(1,6,1+5*t);
    imagesc(I); axis off; drawnow;
end;
```

What to Include in Your Report

1. Write a paragraph describing your approach to image morphing. Be sure to reference your figures in the text.
2. Create a figure showing your Matlab code for Step 3. Be sure to include a caption on your figure.
3. Create a figure showing every 20th frame of your image sequence in Step 3. Be sure to include a caption on your figure.