OpenGL HW2

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Description

In this homework, we are asked to implement the algorithm from [1]. The feature-based image metamorphosis needs pre-defined feature lines for image morphing. The approach gives the animator high-level control of the visual effect by providing natural feature-based specification and interaction.

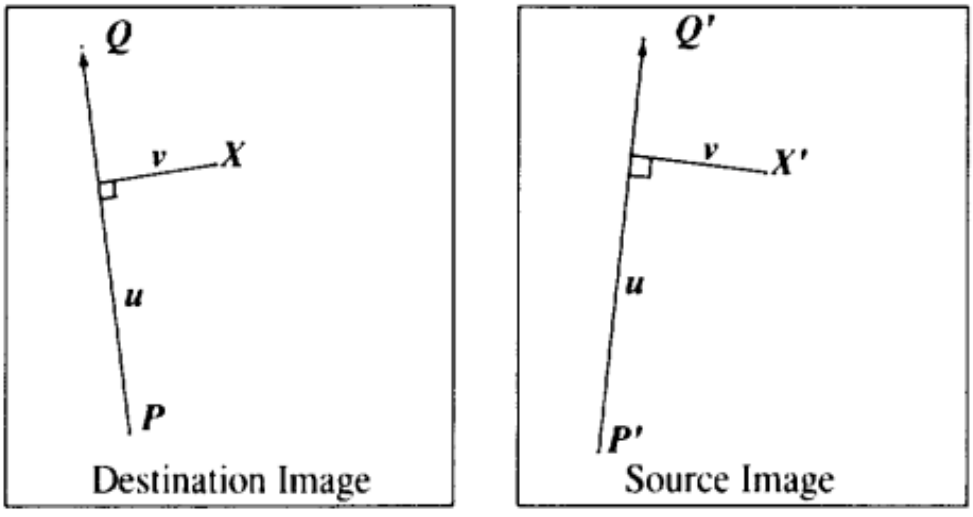
Algorithm

For the transformation with one pair of lines, the algorithm can be simple as following:

```
For each pixel X in the destination image
  find the corresponding u, v
  find the Xs in the source image for that u, v
  destinationImage(X) = sourceImage(Xs)
```

We could further explain the procedure by Fig. 1. For these two feature lines in destination image and source image, the pixel X' In source image can be calculated under below equations (eq 1-3).

Fig 1. Single line pair



$$u = \frac{(X - P) \cdot (Q - P)}{\|Q - P\|^2} \tag{1}$$

$$v = \frac{(X - P) \cdot Perpendicular(Q - P)}{\|Q - P\|} \tag{2}$$

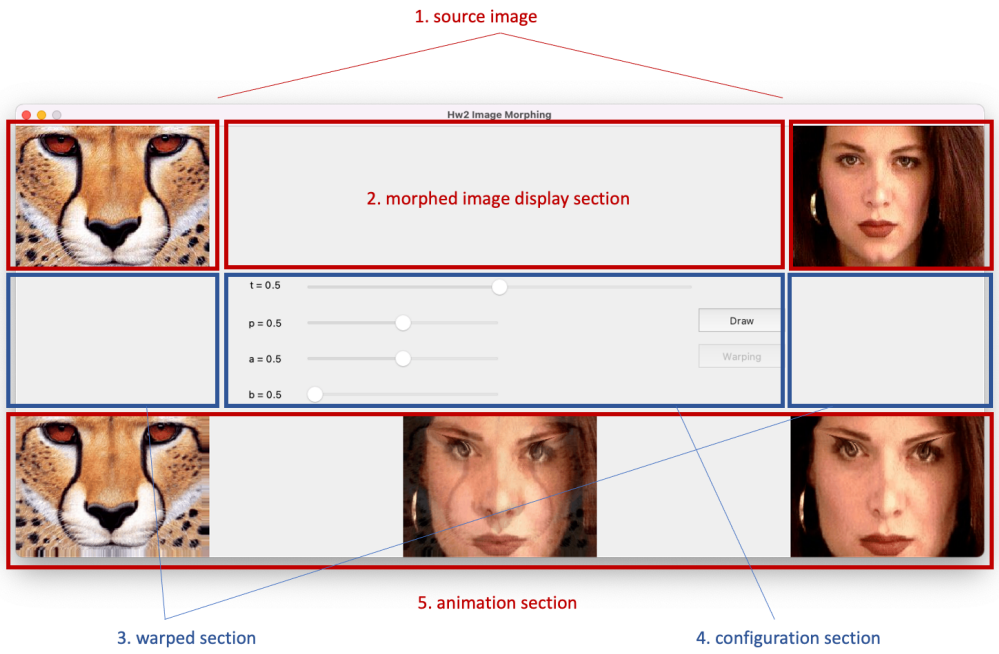
$$X' = P' + u \cdot (Q' - P') + \frac{v \cdot Perpendicular(Q' - P')}{\|Q' - P'\|} \tag{3}$$

The algorithm can be expanded when we got more than a single pair of feature lines as following:

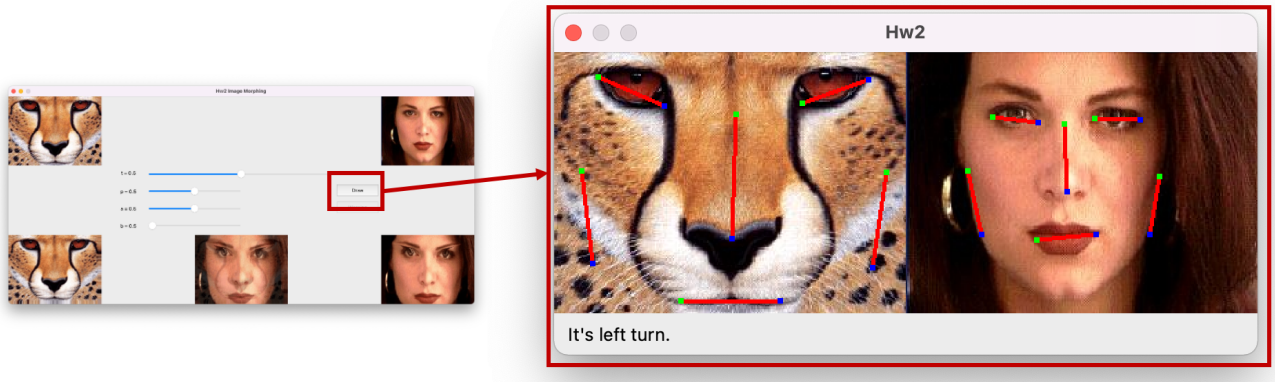
```
For each pixel X in the destination
  DSUM = (0,0)
  weightsum = 0
  For each line PiQi
    calculate u, v based on (Pi Qi)
    calculate X'i based on u, v and (P'i Q'i)
    dist = shortest distance from X to (Pi Qi)
    weight = (length^p / (a+dist))^b
    DSUM += Di * weight
    weightsum += weight
  Xs = X + DSUM / weightsum
  destinationImage(X) = sourceImage(Xs)
```

Usage

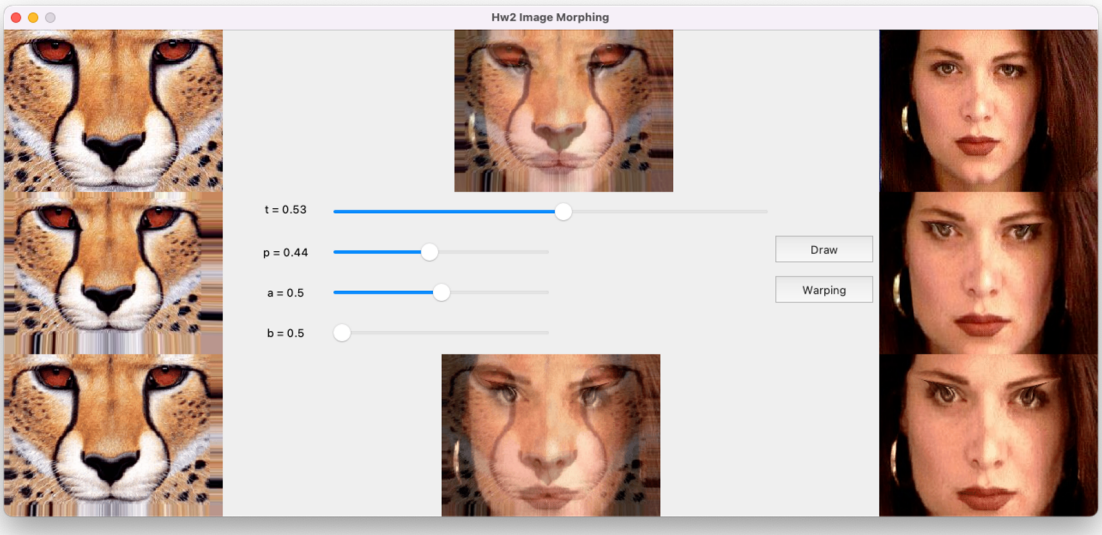
1. open the terminal under project's root directory
2. install the requirements by `pip3 install -r requirements.txt`
3. execute `python3 main.py`
4. GUI application



5. click `Draw` button for feature line(s) drawing. A new window would open after clicked. Follow the instructions to draw the line.



6. You can modify the configuration parameters and then clicked `warping` button for displaying the following results.



Reference

[1] Beier, Thaddeus, and Shawn Neely. "Feature-based image metamorphosis." *ACM SIGGRAPH computer graphics* 26.2 (1992): 35-42.