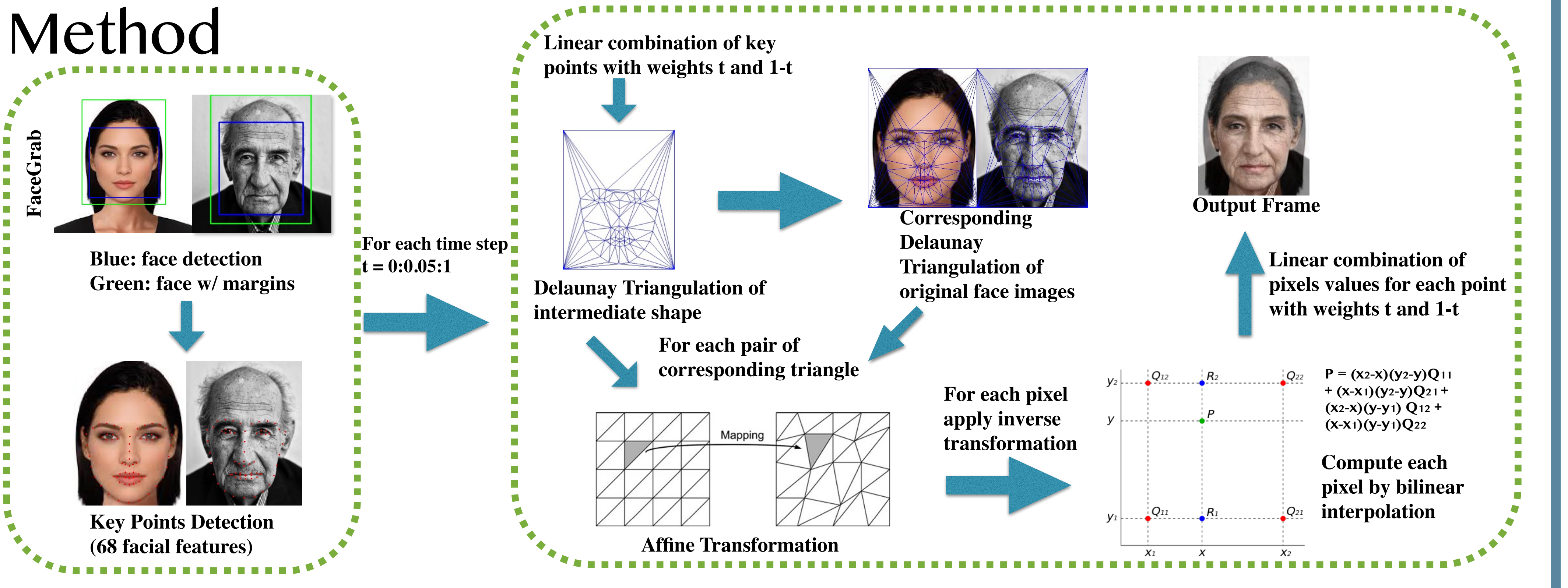# Automatic Face Morphing

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Introduction

Morphing is the process to morph one image to another through seamless transition by homography transitions. Here, we detect corresponding Key Points on faces automatically and apply morphing techniques to human faces. In all, we generate a pipeline for automatic face morphing, individually face and key points detection, triangulation, inverse mapping, bilinear interpolation and linear time interpolation.
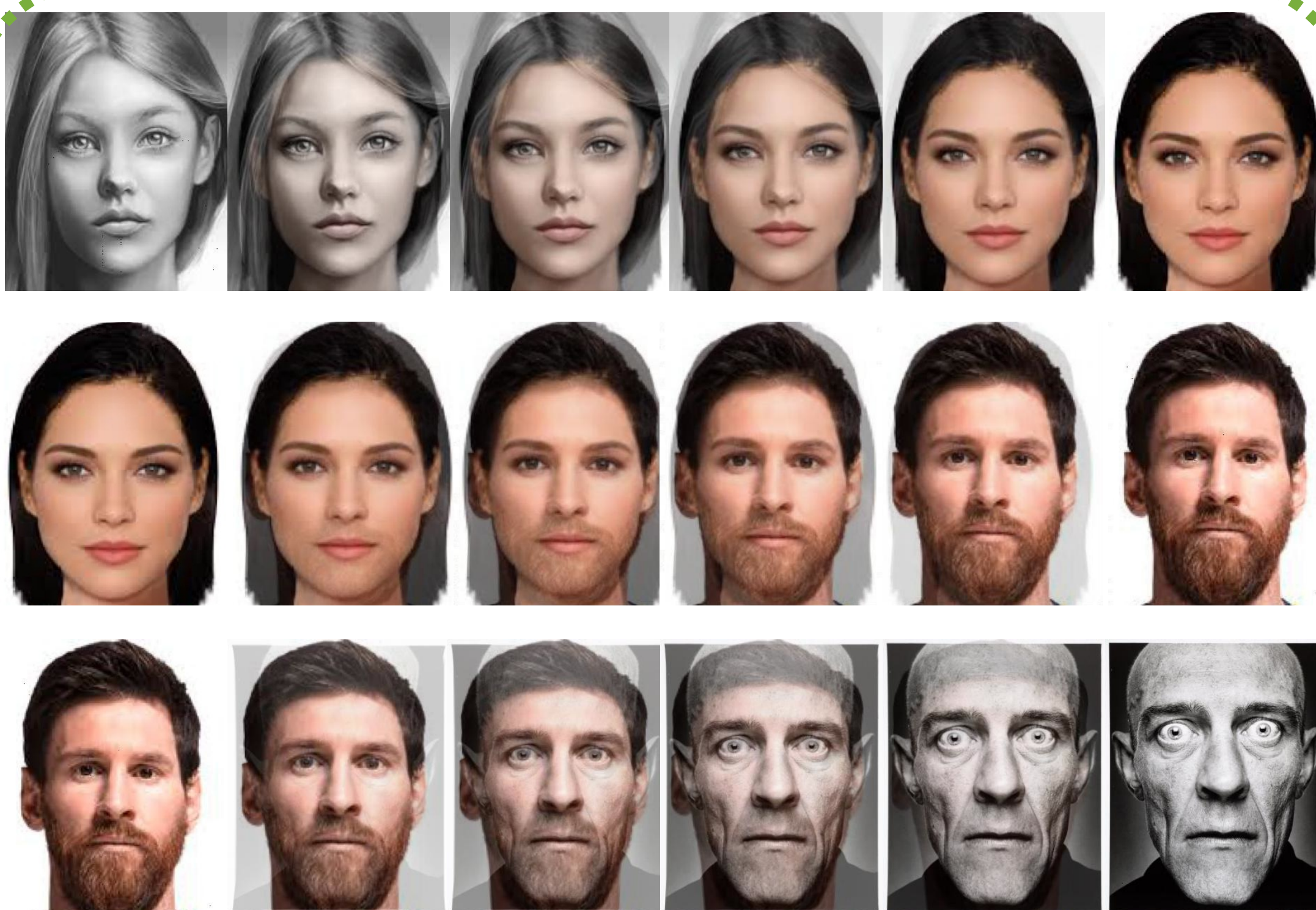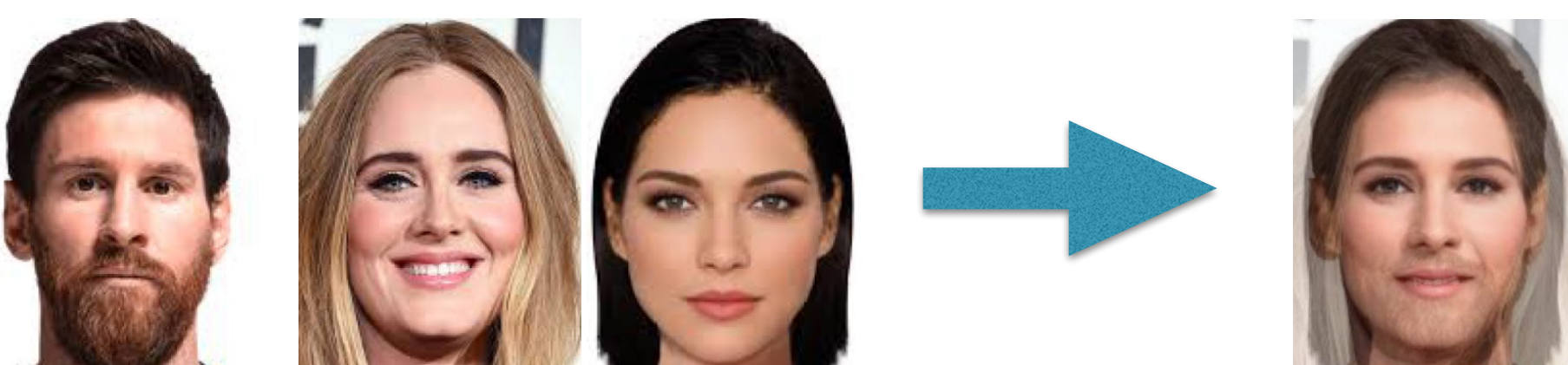
Method

FaceGrab

Blue: face detection
Green: face w/ margins

Key Points Detection
(68 facial features)

For each time step t = 0:0.05:1

Linear combination of key points with weights t and 1-t

Delaunay Triangulation of intermediate shape

For each pair of corresponding triangle

Affine Transformation

Mapping

For each pixel apply inverse transformation

Corresponding Delaunay Triangulation of original face images

Output Frame

Linear combination of pixels values for each point with weights t and 1-t

$$P = (x_2-x)(y_2-y)Q_{11} + (x-x_1)(y_2-y)Q_{21} + (x_2-x)(y-y_1) Q_{12} + (x-x_1)(y-y_1)Q_{22}$$

Compute each pixel by bilinear interpolation

Results

Video Morph: https://youtu.be/vI6KBtKDtrg

Sample Frames

Multiple Morph

Difficulties/Challenges

Foreground Extraction

We tried to extract the foreground from the image with several methods, including edge detection and GrabCut from OpenCV, but they did not produce accurate result.

More features besides facial structure

More comprehensive morphing results can be produced with more key points from the neck, hair and shoulders. However, a good detector for these features was not found.

Improving computational efficiency

We wrote the entire morphing codings from scratch, except for triangulation. The morphing process is not very fast.

Outside Resources

scipy.misc, scipy.spatial

cv2.resize, cv2.CascadeClassifier, cv2.cvtColor

cv2 drawing tools (polylines, rectangle, circle), dlib

Team Contribution

Ran Li was in charge of automatic correspondences detection in two face images.

Zijian Yao was in charge of triangulation and morphing by affine projection in time series.

Both collaborate on report, presentation and websites.