# CS 181 Report for Programming Assignment 1

Rajan Saini

January 24, 2020

## 1 Methodology

For this assignment, we were tasked with perspective-shifting two images of the same object. I used python 3, with opencv and numpy to do the rendering and computation.

1. A set of points common to both images were identified and labeled, using the OpenCV library in Python to take care of I/O. I assigned each point a different color along a blue-green gradient so that common points can be better identified by a human.

2. The homography problem was solved manually in get_H(). I set up a system of equations encoded by matrices A and B, and used numpy's lstsq function to find the solution of minimal norm. This was necessary because the number of equations exceeded the number of variables.

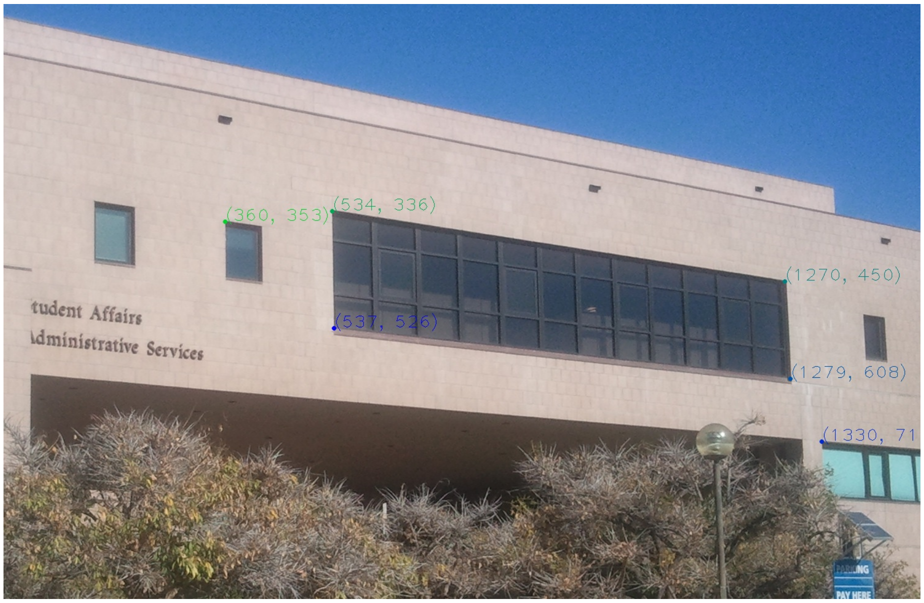
3. The homography matrix was then used to transform one image to match the perspective of the other, using OpenCV's warpPerspective. An interesting artifact is that the transformation also warps the labels. I chose to keep that the skewed labels because they visually illustrate the effects and shortcomings of the perspective-shifting.

## 2 Results

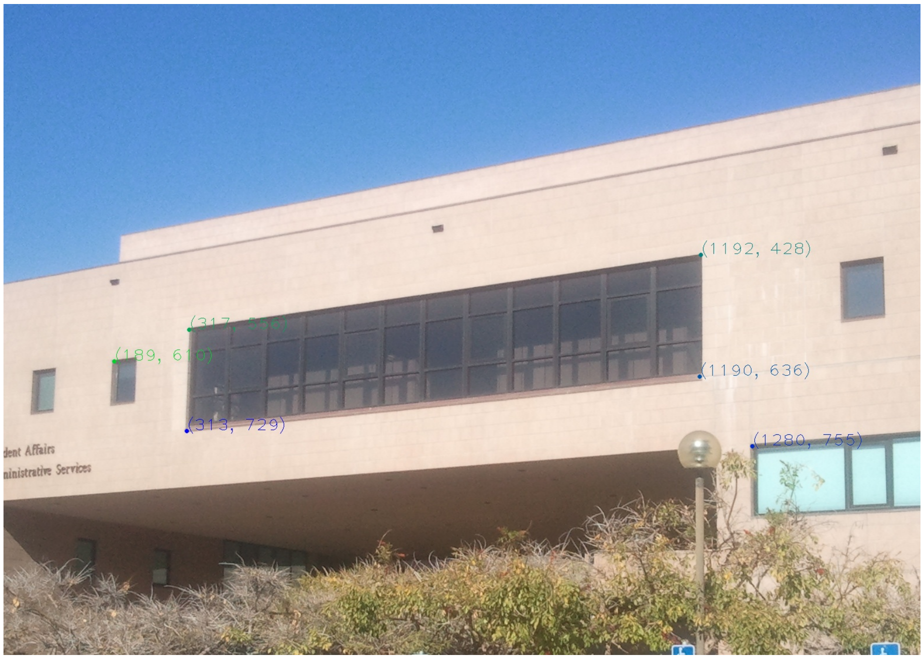
### 2.1 Building at UCSB

Points on the left image: [(360, 353), (534, 336), (1270, 450), (1279, 608), (1330, 710), (537, 526)] Points on the right image: [(189, 610), (317, 556), (1192, 428), (1190, 636), (1280, 755), (313, 729)] H matrix when transforming left to match right: [[ 5.17213949e-01 4.46050703e-02 -2.27947002e+01] [-4.09746925e-01 7.92448909e-01 4.07924600e+02] [-3.63547094e-04 6.92570923e-05 1.00000000e+00]] H matrix when transforming right to match left: [[ 1.89031295e+00 1.21536422e-01 -1.11487360e+01] [ 6.62536716e-01 1.43342651e+00 -5.83816082e+02] [ 6.68941110e-04 5.48086805e-05 1.00000000e+00]]

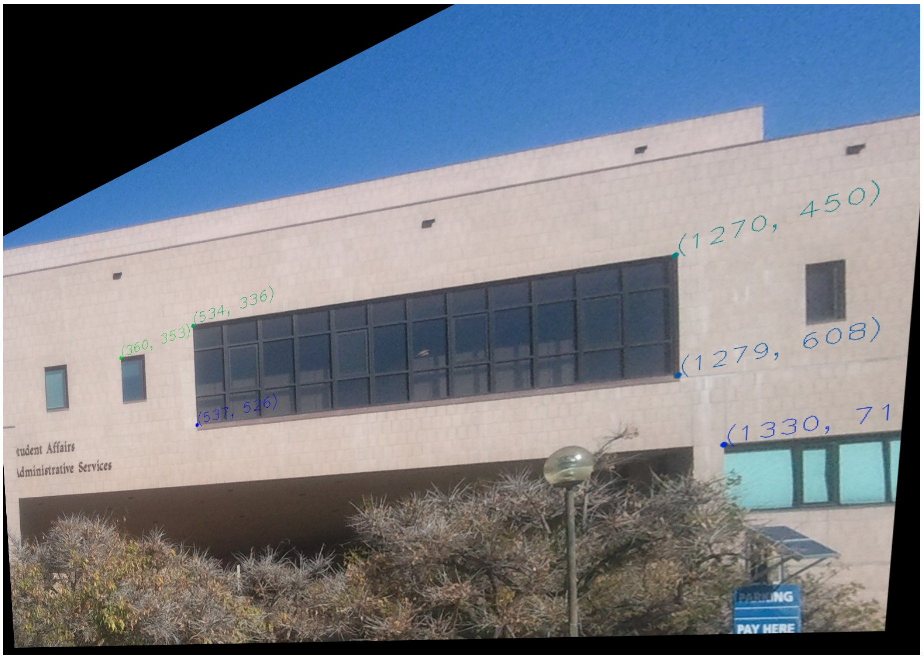
- I used the given images on GauchoSpace for this part.



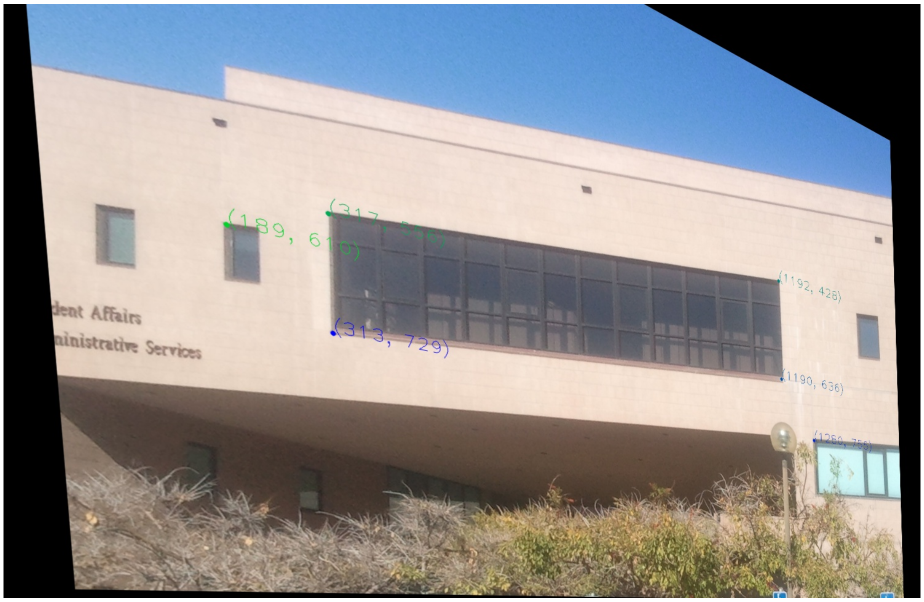
Left original



Right original



Left transformed to right

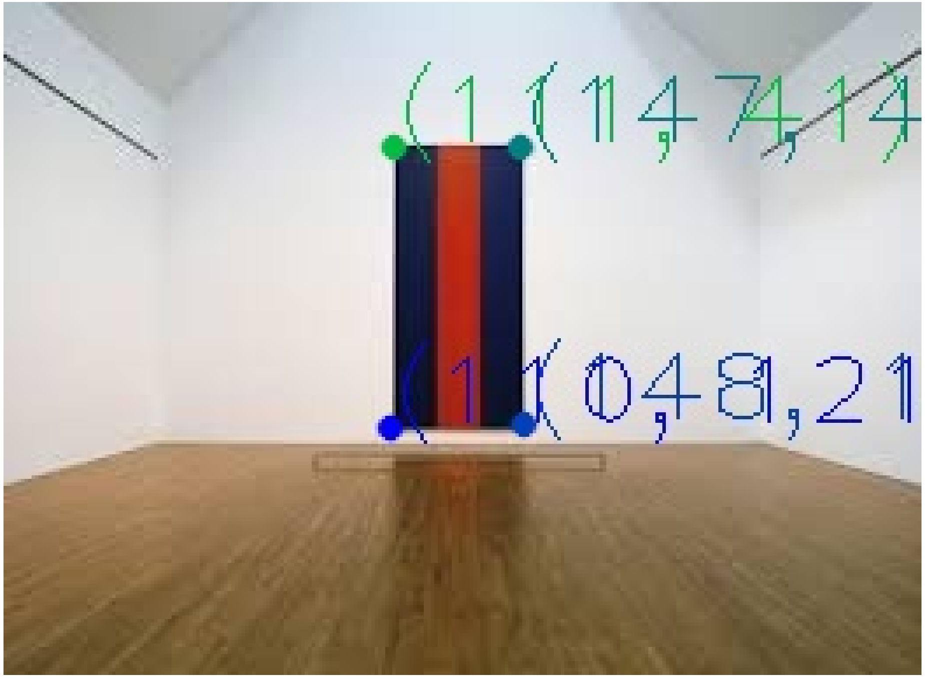


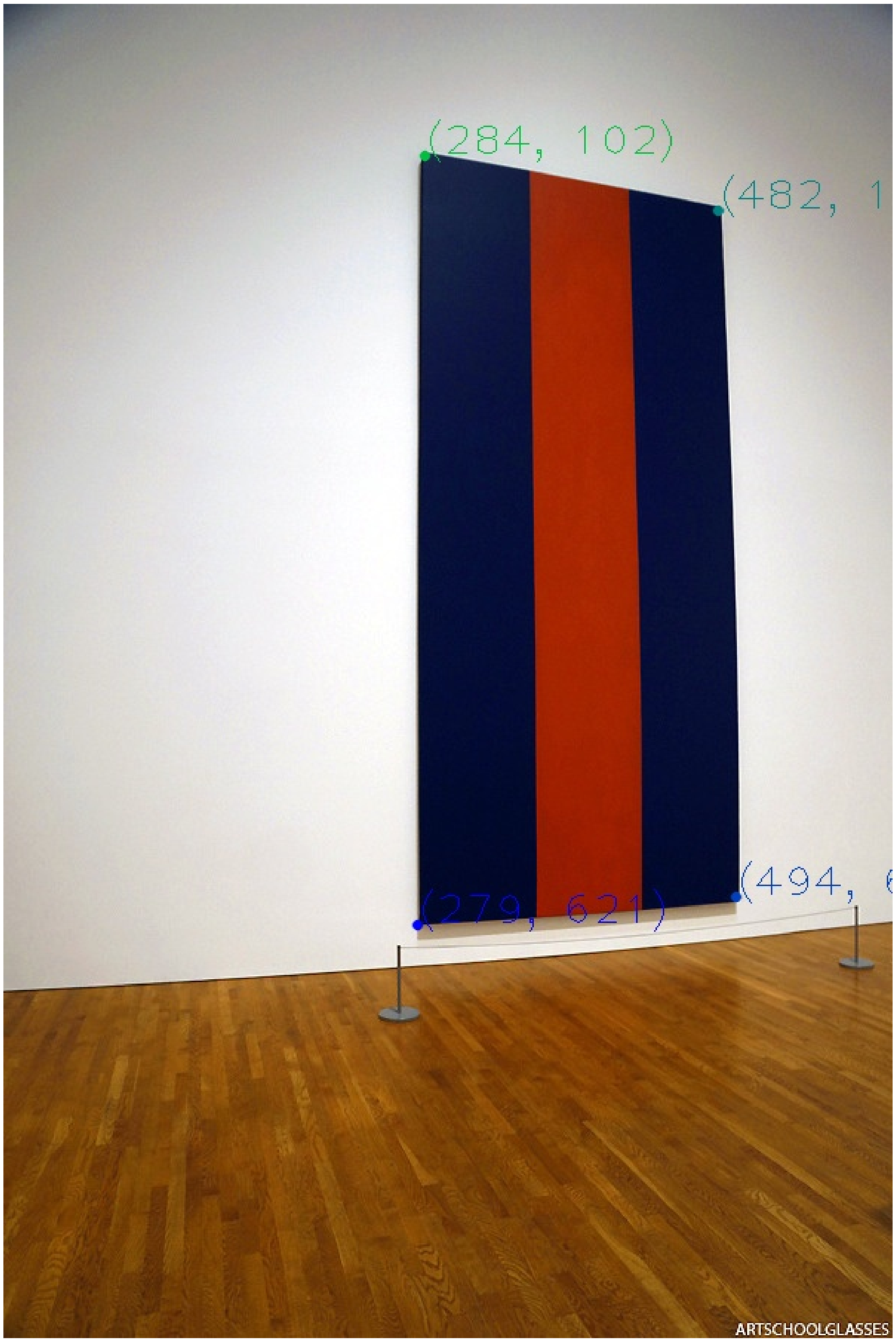
Right transformed to left

## 2.2 Voices of Fire Painting

Points on the left image: [(111, 41), (147, 41), (148, 120), (110, 121)] Points on the right image: [(284, 102), (482, 139), (494, 602), (279, 621)] H matrix when transforming left to match right: [[ 1.03756256e+01 2.46860072e+00 -

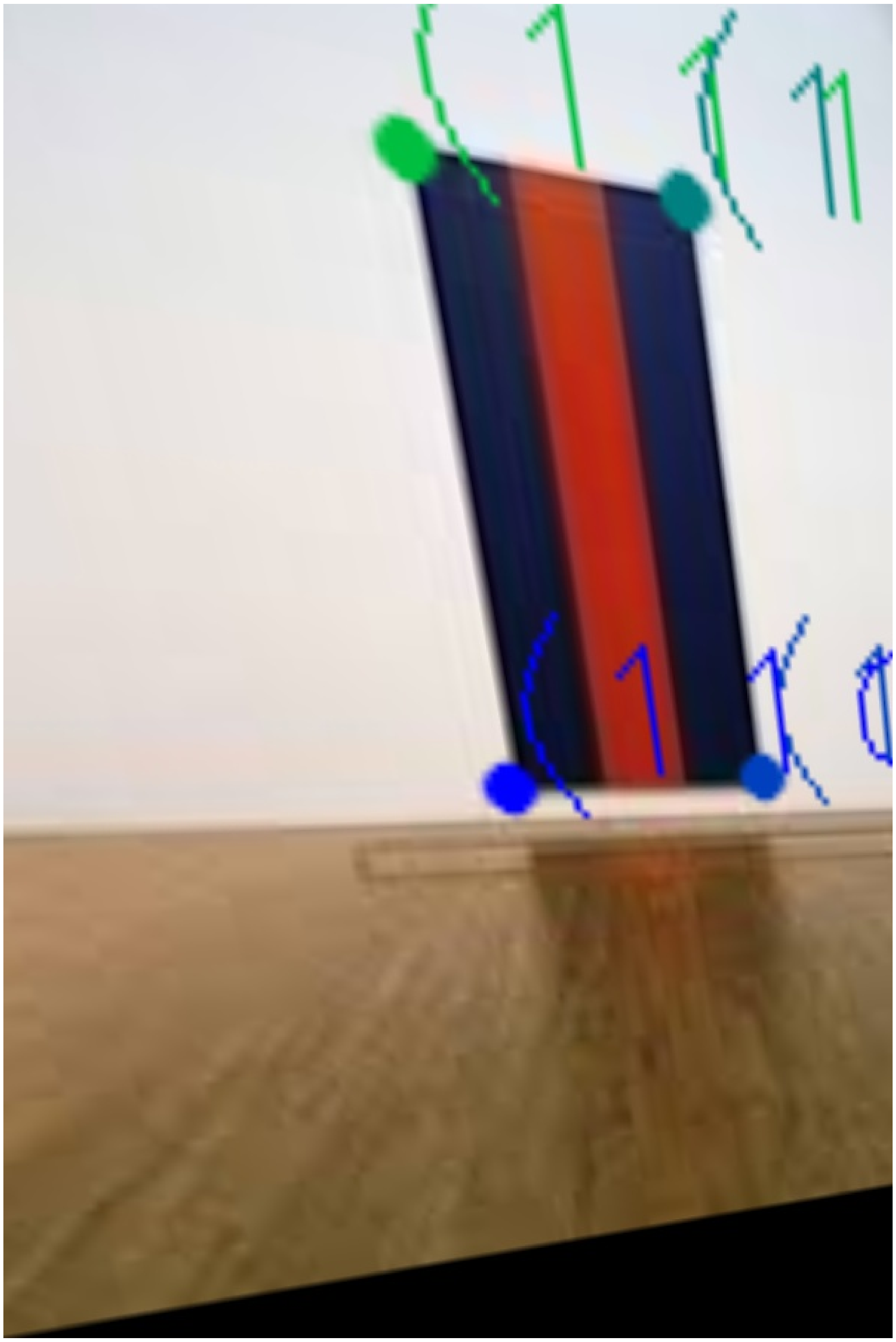
8.20039118e+02] [ 2.13031357e+00 1.00643095e+01 -4.93141013e+02] [ 4.35641405e-03 2.75857441e-03 1.00000000e+00]] H matrix when transforming right to match left: [[ 6.61115198e-02 3.64662373e-02 7.20229606e+01] [-7.14122458e-02 3.24562974e-01 2.44761202e+01] [-5.58597259e-04 2.69585950e-04 1.00000000e+00]] Far original

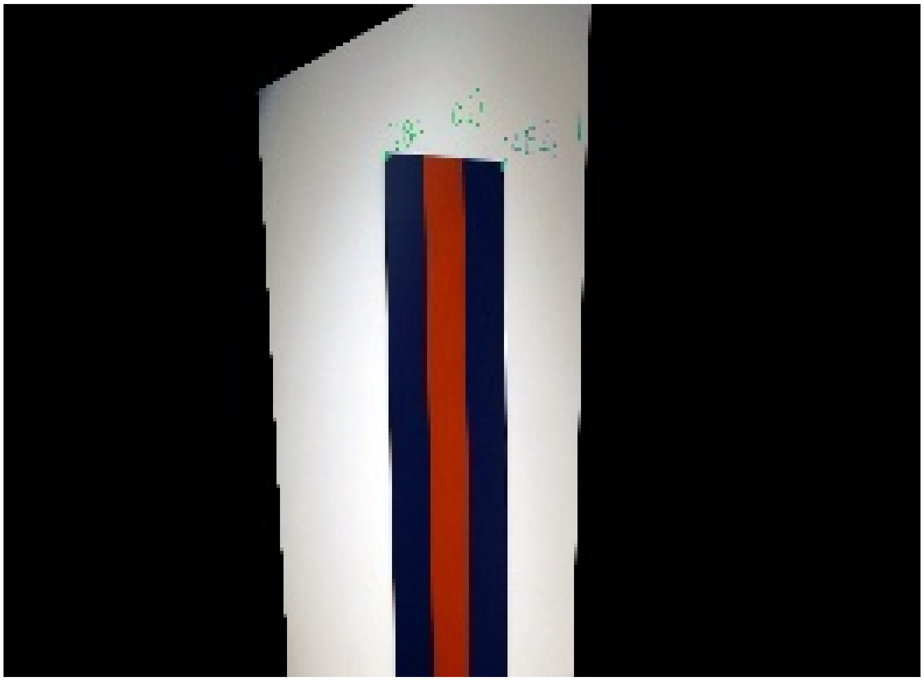




Side original

Far transformed to side



Side transformed to far 

# 3 Code

Code can be found at https://github.com/rajansaini691/homography