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**CS 445 - Project 5: Video Stitching and Processing**

Complete the claimed points and sections below.

**Total Points Claimed**　　　　　　　　　**[ 100 ] / 250**

**Core**
1. Stitch two key frames　　　　　　　[ 20 ] / 20
2. Panorama using five key frames　　[ 15 ] / 15
3. Map the video to the reference plane　[ 15 ] / 15
4. Create background panorama　　　[ 15 ] / 15
5. Create background movie　　　　　[ 10 ] / 10
6. Create foreground movie　　　　　[ 15 ] / 15
7. Quality of results and report　　　[ 10 ] / 10

**B&W**
8. Insert unexpected object　　　　　[ 0 ] / 15
9. Process your own video　　　　　　[ 0 ] / 20
10. Smooth blending　　　　　　　　　[ 0 ] / 30
11. Improved fg/bg videos　　　　　　[ 0 ] / 40
12. Generate a wide video　　　　　　[ 0 ] / 10
13. Remove camera shake　　　　　　[ 0 ] / 20
14. Make streets more crowded　　　[ 0 ] / 15


**1. Stitch two key frames**

Include
- Display of image frames 270 and 450 with the red plot lines showing corresponding regions
- Printout of 3x3 homography matrix normalized so that the largest value is 1

**3x3 homography matrix:**
[[-4.89351611e-03 -2.01928808e-04  1.00000000e+00]
 [-6.87225120e-05 -4.60633153e-03  7.81694793e-02]
 [-2.11664383e-06  2.29574321e-07 -3.90566723e-03]]
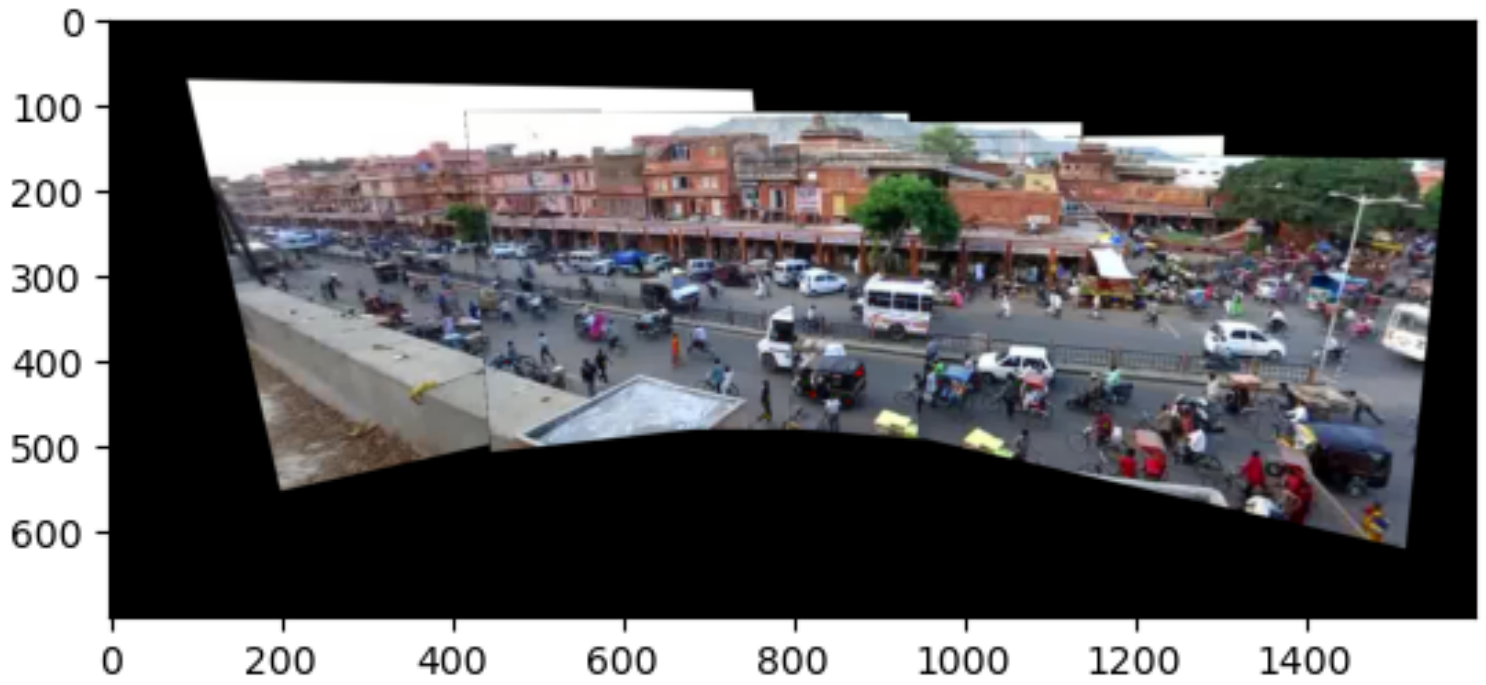
frame 270



frame 450

## 2. Panorama using five key frames

Include your panoramic image



## 3. Map the video to the reference plane

Include:
- Link to your video
- Display frame 200 of your video
- Briefly explain how you solved for the transformation between each frame and the reference frame

**Link to the video:**
https://drive.google.com/file/d/1VyajOLQjln46BhhwhJjNJkxU4VWwUMlc/view?usp=sharing

**Frame 200:**

**Explanation:**
Considering the keyframes [90, 270, 450, 630, 810] and their corresponding homography matrices from part 2, I initially align each frame with the nearest keyframe. Then, I multiply the two respective projection matrices to establish a direct homography matrix between each frame and the reference frame.

**4. Create the background panorama**

Include:
- Picture of the background panorama
- Explain your method of computing the background color of a pixel



For each pixel, I compute the **median** of the **non-zero** pixels of all frames obtained in part 3 as the background color to form the background panorama.

**5. Create the background movie**

Include:
- Link to your video
- Display frame 200 of your video

**Link to the video:**
https://drive.google.com/file/d/1wzscBUEZbjesroUQWPoNfnAICvTNCp3n/view?usp=sharing

**Frame 200:**



**6. Create the foreground movie**

Include:
- Link to your video
- Display frame 200 of your video

**Link to the video:**
https://drive.google.com/file/d/1Yv6txv-x-vqmYG_IL61yhiXHuPvlK0uA/view?usp=sharing

**Frame 200:**



## 7. Quality of results / report

Nothing extra to include (scoring: 0=poor 5=average 10=great).

## 8. Insert unexpected object

Include link to your video.

## 9. Process your own video

Include:
- Background image
- Link to background video
- Link to foreground video

## 10. Smooth blending

Include panoramic image from part 2 with better blending


## 11. Smooth blending

Include panoramic image from part 2 with better blending


## 12. Generate a wide video

Include link to your video


## 13. Remove camera shake

Include link to your stabilized video


## 14. Make street more crowded

Include link to your video


## Acknowledgments / Attribution

List any sources for code or images from outside sources