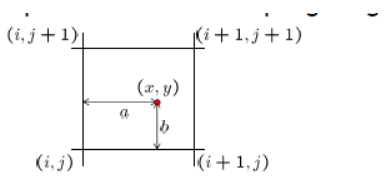
Homography calculation and point normalization were done as expected. For interpolation, I used the method in Figure 1 at first. However, it was not efficient. Therefore, I used remap function in the openCV library to interpolate.



$$
\begin{aligned}
f(x,y) = \; & (1-a)(1-b) & f[i,j] \\
& +a(1-b) & f[i+1,j] \\
& +ab & f[i+1,j+1] \\
& +(1-a)b & f[i,j+1]
\end{aligned}
$$

Figure 1

Blending: First, I used the pixel that has the maximum intensity. However, when the pixel that has maximum intensity was used, images were not correctly overlapped. It was hard to read texts(Figure 2). Therefore, I decided to add the left and right images and then put the middle image on the center of the canvas. There was a problem that the blackness of the previous picture remained. I used the np.maximum to solve the problem. The result with this blending method has more edge effect than taking maximum.

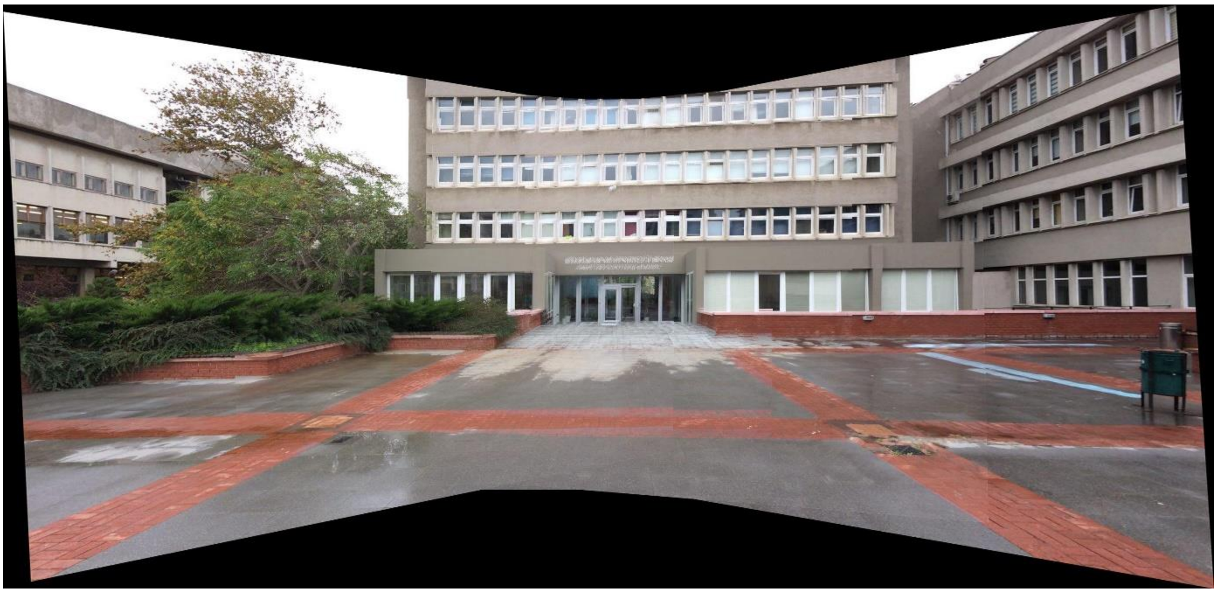


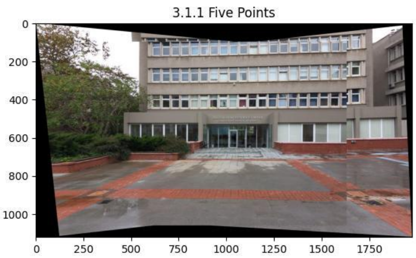
Figure 2

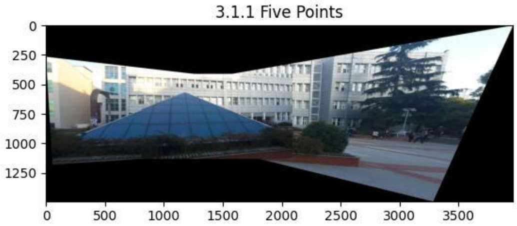
Wrong Point Selection: A random numbers were added to coordinates.

To run the script: Images should be in the folder cmpeBuilding or northCampus. It can be selected by changing the index of photoNameList on line 9.

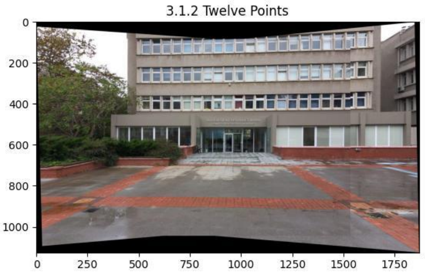
Experiments:

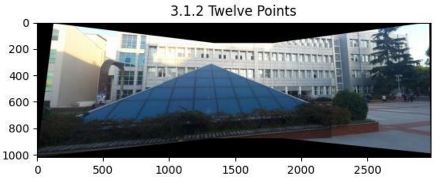
3.1.1: Five Points



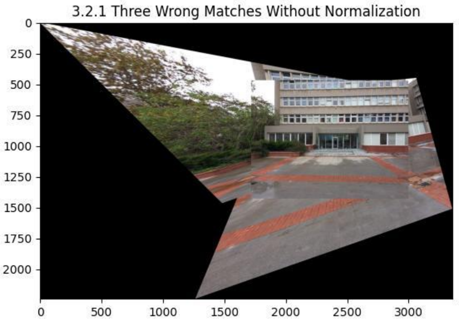


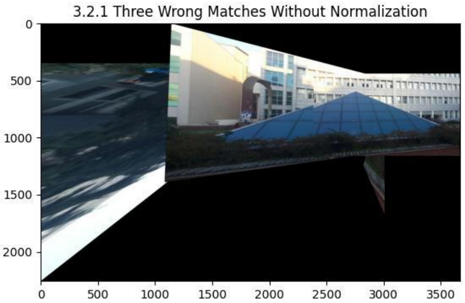
3.1.2: Twelve Points


3.1.2 Twelve Points

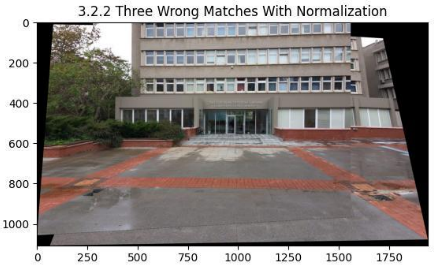

3.1.2 Twelve Points

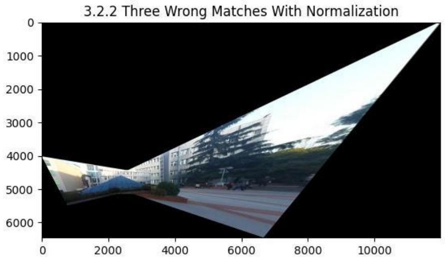
3.2.1: Three Wrong Matches Without Normalization


3.2.1 Three Wrong Matches Without Normalization

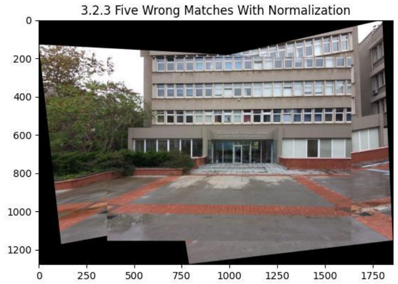

3.2.1 Three Wrong Matches Without Normalization

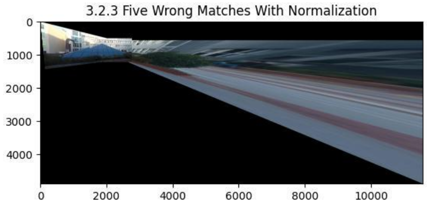
3.2.2: Three Wrong Matches With Normalization


3.2.2 Three Wrong Matches With Normalization


3.2.2 Three Wrong Matches With Normalization

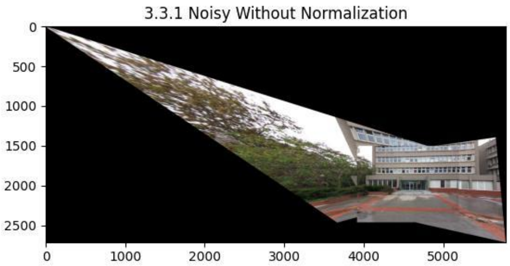
3.2.3: Five Wrong Matches With Normalization

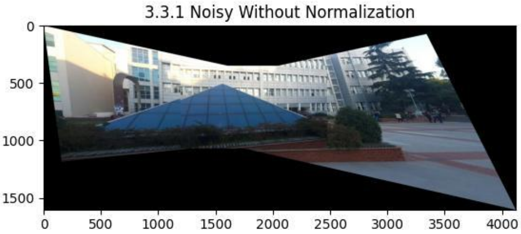

3.2.3 Five Wrong Matches With Normalization


3.2.3 Five Wrong Matches With Normalization

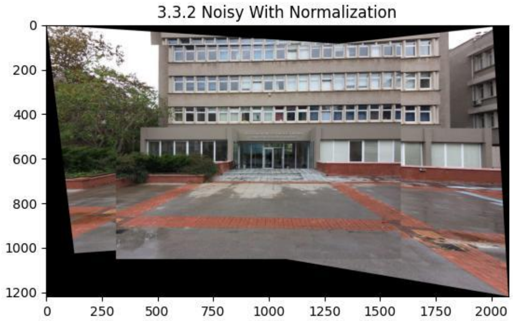
It can be said that normalization gives better results in case of wrong points.

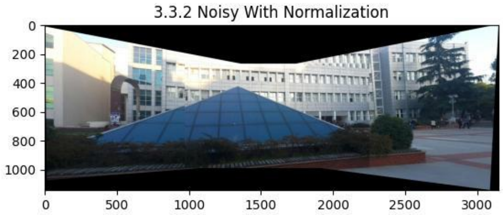
3.3.1: Noisy Without Normalization





3.3.2: Noisy With Normalization





Stitching with normalization is more tolerant to noise. I think the effect of noise is reduced by normalization

3.4: Panorama