ENPM673 Project 1

Prannoy Namala (pnamala)

March 2021

Problem 1(a)

The problem involves detecting April tag from a given frame using Fast Fourier Transform. The frame is first transformed into frequency domain using FFT. The frequencies are shifted so that lower frequencies are in the center. The lower frequencies are filtered using a high pass filter. The frequencies are distributed back and the frame is transformed back to spatial domain. This transformed image now consists of the contours in the pre-filtered image. The result is in figures 1, 2, 3 and 4

Problem 1(b)

In this problem, a function has been coded which returns the orientation, value, orientation of the tag in frame. The code follows guidelines given in the question document. For the figure 5, the program outputs the value as 15 an the direction as upright.

Problem 2(a)

In this problem, the tag from video has been has been replaced by the the testudo image. One such example image is in figures 6 and 7. For achieving this, the tag is warped from the video frame to a known plane. After warping, the value and orientation are taken. The orientation is used to determine the orientation of the superimpoosed image. Figure 6 and 7 are an example of the image superimposed on the tag in an upside down manner.

Problem 2(b)

This problem deals with superimposing a 3D cube on the AR tag. The problem requires us to determine projection matrix mapping the real world coordinates of the object to the camera plane. AN implmentation example is shown by comparing figures 6 and 8.

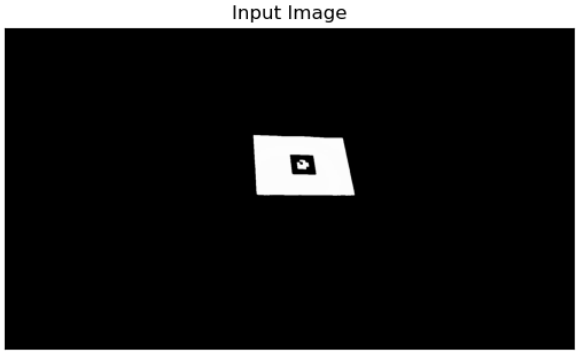

Figure 1: Input image converted to Binary and background removal

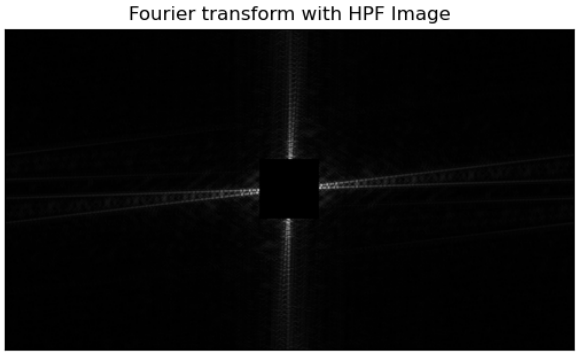

Figure 2: Fourier Transform with HPF

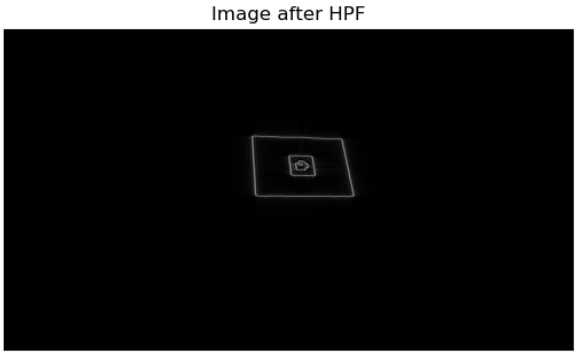

Figure 3: Inverse transform of filtered picture

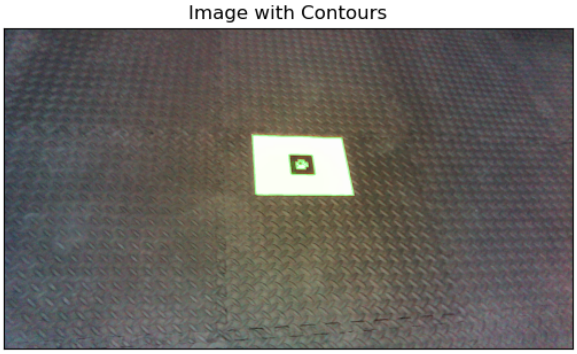

Figure 4: Green Contours on the tag which are extracted from the Inverse fourier transform

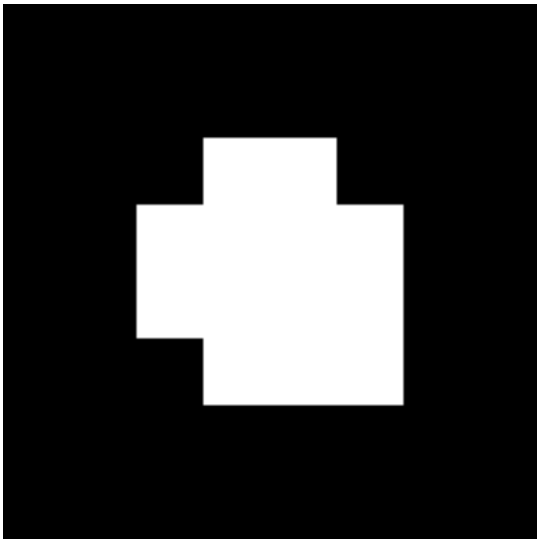

Figure 5: An example April Tag

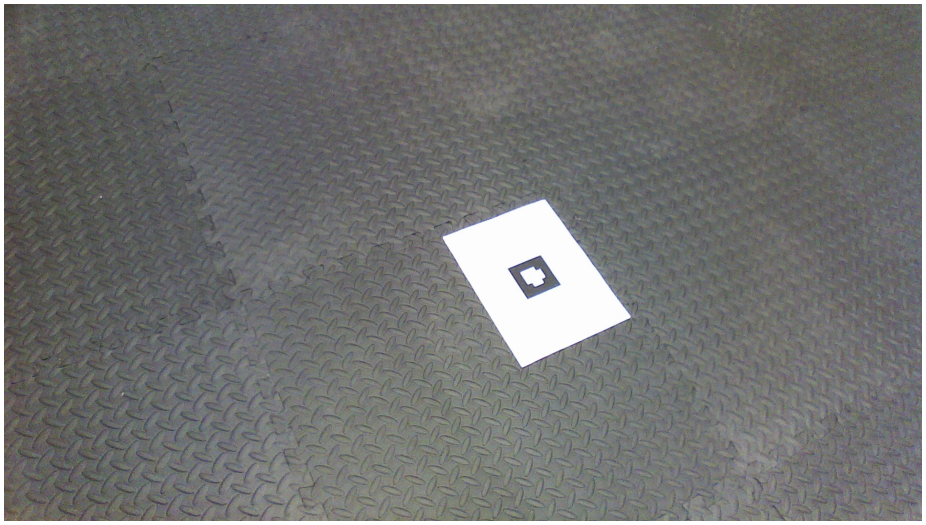

Figure 6: Figure with before testudo superimposotion or cube projection

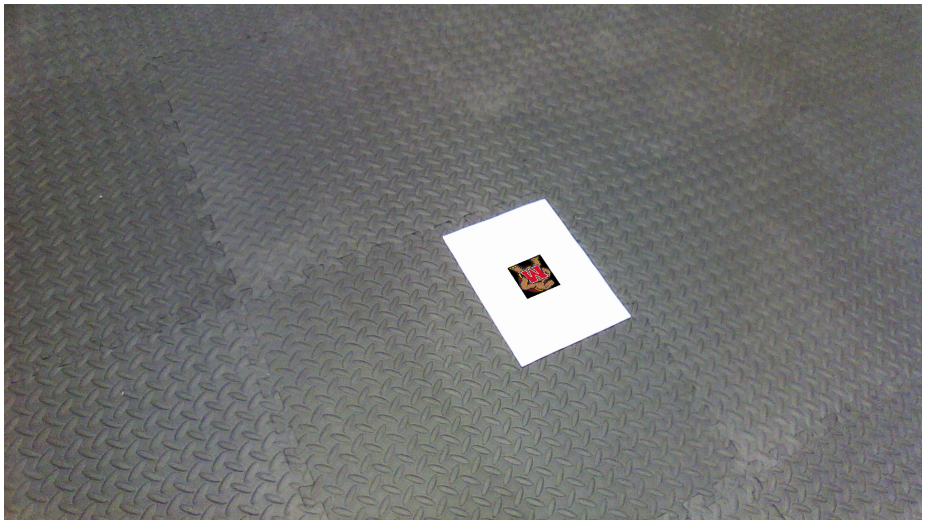

Figure 7: Figure with after testudo superimposotion

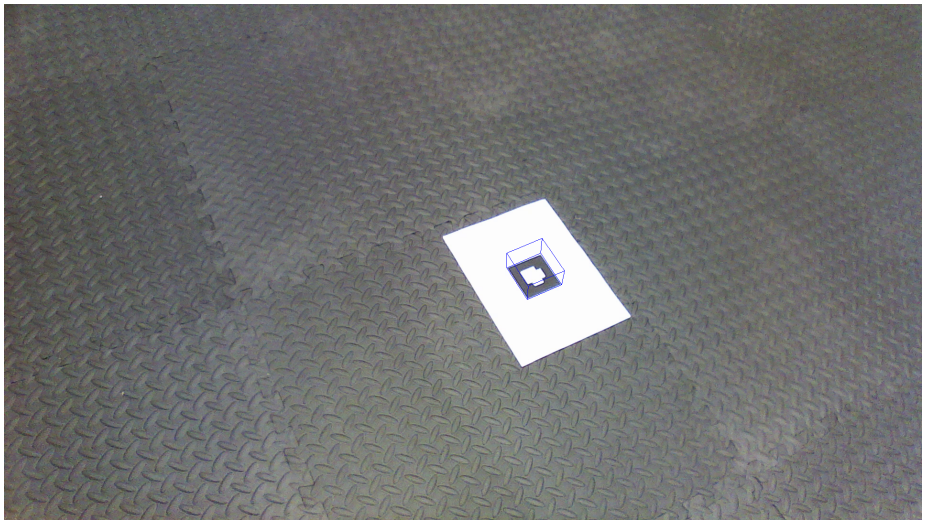

Figure 8: Figure with after testudo cube projection

Video Links

Multiple Tags - https://youtu.be/Yp_d4yBlAPo
- Tag 0 - https://youtu.be/no8qU7EF-HU
- Tag 1 - https://youtu.be/Gm33zuLyRA4
- Tag 2 - https://youtu.be/ejemqyD5rt0