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BME 4910

Week 8 Report: 3/15 – 3/21

WORKS COMPLETED:

For this week, I’ve worked mainly on setting up the camera. I’ve finally resolved the issue with the camera communicating with LabVIEW. Through contacting the manufacturer and installing and uninstalling the camera driver, I’ve figured out that the DirectShow driver for the camera was missing and thus, LabVIEW could not detect the camera. Finally, I downloaded a new DirectShow driver for the camera from the manufacturer’s website, installed the driver into the computer, and installed IMAQ through USB. Finally, the camera was able to be detected through LabVIEW.

Aside from resolving the camera-LabVIEW communication issue, I also used the camera’s application software to test the image quality of the camera. I found out that the camera is very sensitive to light and focal distance. Also, the image quality of the camera is highly dependent on the contrast, brightness, gamma, and exposure time.

Using the CCD camera and the software, I obtained a test image to process the image for flexure rigidity. I used a piece of paper and used a pen to mark several dots on the paper. The image of the dots on the paper was obtained using the CCD camera. Figure 1A below shows the raw image of the paper and the dots using the camera. As can be seen, the image is not sharp and not focused. However, because the dots were dark, they were easy to make out. After the image was captured, it was processed in Vision Assistant. The following functions were written into script to process the image: Brightness was set to 255, contrast to 60, and gamma to 0.8. A color plane was extracted to turn the image into an 8 bit image. The image was filtered and the details in the image were highlighted. Threshold was set to track dark objects at around 200. Advance morphology was used to fill holes. Convex hull was also used to make the holes more circular. Finally, small objects and border objects were removed. Figure 1B show the processed image. As can be seen, the dots were isolated from the rest of the image and appeared as red. These red dots will be tracked during testing. In addition, the particle analysis function was used to obtain the position of each dot in pixel. The position is in terms of x and y in pixels.

Our team had a meeting with Dr. Sun to discuss the progress of the project. One of the tasks Dr. Sun asked us to do was to perform a transmural strain pilot study using the current
CCD camera to verify whether or not the camera can resolve small markers. I set up and installed the camera and DirectShow drivers into the computer upstairs in the lab. Eric prepared the tissue and put markers on the tissue. First, we used graphite powder and put the powder on the tissue. By using the camera, we saw that the graphite powder appeared all smeared on the image and the camera could not make out any dots. Then, instead of graphite powder, we used blue ink from a pen and used a toothbrush to apply the ink on the tissue. The camera was able to resolve several dots on the tissue. However, because the ink was very light, the dots did not appear very clearly on the image. Finally, we used black ink instead of blue ink. This time, the camera was able to make out dots on the image. As a side note, a 10 mm spacer had to be installed onto the camera in order to resolve very small dots. The focal distance, however, was very small when using the spacer. Figure 2 below shows the raw image obtained from the pilot study. As can be seen, by using the toothbrush, there were small dots scattered around the tissue. In addition, there were also big blobs of ink.

The image was processed using Vision Assistant. A separate script was written to process the image to track only small, separate ink dots. Figure 3 below shows the processed image of the tissue when it was undeformed (i.e., no stress was applied to it). Figure 4 below
Fig. 2 – Raw image obtained from pilot study

Fig. 3 – Processed image in the undeformed stage
Fig. 4 – Processed image in the deformed state

shows the processed image of the deformed tissue. As can be seen, by using the same script, it was difficult to track the markers from the undeformed to deformed state. This problem will need to be resolved in the near future.

FUTURE WORKS:

Future works in the next couple of weeks include processing images and converting Vision Assistant scripts into working LabVIEW codes and adjusting these codes such that they can track dots on all different types of images. Works in the next month include finishing up the LabVIEW program for testing and integrating this program with the Matlab program in order to output the necessary calculations.