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**Institution:** University College London

**Host Institution:** Department of Cellular Pathology, Royal Free London NHS Trust/University College London

**Title of Project:** 3D Reconstruction of Pig Liver Following High Intensity Focused Ultrasound (HIFU)

Through the JSPS studentship I was able to participate in research being done at the Department of Cellular Pathology at the Royal Free Hospital under Prof. Alberto Quaglia. The focus of my project was on producing a 3D reconstruction of a liver biopsy following ultrasonic treatment. By producing a 3D model we would then be able to visualize the appearance of the structures in the sample (such as the blood vessels, collagen and capsule) in 3D and the effects of the ultrasonic treatment. This was very exciting as it was not something that had been done previously and gave me the opportunity to learn the principles and technical aspects relating to image processing and analysis.

Day to day I was supervised by Mr. Andy Hall, a liver research scientist, who from the beginning managed to involve me in the process of producing the 3D model. I was able to help prepare the slides cut from the biopsy, photograph and segment the images before registering them and finally producing the final model in MATLAB. We’ve generated a few versions of the model both with and without the lesion and are currently hoping to print it in 3D and write up the results of our findings. An example of one of the models we produced is below.

1a. b.





Fig 1a. (left) is an image of the .stl file produced from the annotated blood vessels. The 3D reconstruction allows us to visualize the relationships and courses of vessels. Fig 1b. (right) is an image of the .stl file produced from the annotated collagen. Note structures pictured above are not in the positions related to one another

Through this project I was able to gain numerous benefits. Including an insight into image segmentation and analysis both relating to the technical aspects and also general principles behind these. I am about to begin my Cardiovascular Science BSc research project involving image segmentation of cardiac structures in congenital heart disease. Having previously come across many of the concepts in this pathology project has made it easier to integrate with the work being done for my BSc. Through this project I understood that science is far from perfect, mistakes happen and problems arise at any moment. Being a novel project that had not been done at this scale the problems that came up had not been previously encountered. This often required myself with the help of my supervisor to come up with solutions as we went along. Reflecting on each step, mapping out where the problems arose and occasionally having to go back to repeat the steps. Despite the occasional setbacks being able to see the 3D model reconstructed first-hand was a truly satisfying experience.

The supervision I received was exceptional both from Prof. Quaglia and Mr. Hall. Without fail, both would always be willing to answer my many questions and teach me a thing or two whether it was related directly to the project or research in general. Being able to hear firsthand from their own years of experience truly made the summer one to remember.

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