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**Title:**

Semantic segmentation on medical images   
**Supervisors:**

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**Abstract:**

With the development of advanced medical imaging equipment (CT or X-ray), huge medical images are generated daily. Although medical doctors and radiologist can manually diagnosethe abnormal cases based on these images, intelligent algorithms on image processing that can pre-inspect these medical images might be necessary to help doctors and radiologistdo the diagnose more efficiently and accurately.

Among these algorithms, semantic segmentation algorithm is fundamental but plays a key role to support the machine based automated image analysis. Refer to recent medical imaging systems, such as Siemens imaging machine, they integrate segmentation algorithms but only use basic image processing algorithms like OSTU for body part segmentation and help doctors in medical diagnosis, However, with the development of medical image sensing technologies, the medical imaging systems are enhanced. For example, we can acquire high resolution 3D CT images. The doctors require more intelligent algorithms that can automatically highlight important regions in the medical images so that doctors can do the diagnose more efficiently and accurately. This brings the challenge about how to precisely conduct semantic segmentation on medical images. In this project, Two PhD students will be required to apply deep neural network technologies to deal with the above-mentioned problem. The first student will focus on applying deep learning algorithm on general medical images for lesion segmentation and disease diagnosis. The second student will focus on integrating MRI images and MRI low-level signal (K-Space signals) using deep learning for getting more accurate segmentation and diagnosis outcome.  
In the past several years, the deep neural network has achieved advanced performance on the image feature learning and been widely used in various vision tasks like object detection, image classification, semantic segmentation, captioning etc., which are highly related to the proposed project. Recent studies have confirmed that deep neural network-based models can contribute performance improvement on the semantic segmentation for medical images (in Medical Imaging conference MICCAI 2018, the two key words this year are “deep learning” and “segmentation”). The goal of this project is to explore new directions and technologies of the neural network-based model to harvest the abundant information existed in the recent medical images from recent medical hardware and utilize them to solve the semantic segmentation problem. After that, they can contribute the medical image related applications such as medical diagnosis. Working with MRI manufactures and combining both MRI images as well as low-level signal information, we aim to get more accurate segmentation and diagnosis outcome.   
Both UTS -- A/Prof Jian Zhang’s group and SUSTech -- Prof Jiang Liu’s group have the expertise in medical image processing, computer vision and pattern recognition, especially to adopt the deep neural network technologies for semantic image segmentation. The collaboration among these two research groups will bring new breakthroughs in the research domain.  
Project Plan:  
The detailed plan will be discussed between Prof Zhang and Prof Liu. The future UTS/SUSTech Dual PhD students will further boost the progress of the project effectively.