MSc Project: Image-guidance of a needle positioning robot for safe and accurate lung biopsies

Background: Lung cancer is the leading cause of cancer-related deaths, with 1.8m deaths worldwide and a 5-years survival rate of a only 29%. After a suspicious lesion is detected, a tissue sample – or "biopsy" - is needed to confirm whether it is cancerous (the diagnosis). At early stage, however, only an estimated 52% of the CT-guided tissue biopsies (Figure 1) are successful. This low success rate leads to unnecessary and suboptimal treatment. We are working on the development of a CT-guided robotic system that the interventional radiologist can use to accurately position biopsy needles in the lung, thereby making early diagnosis and life-saving treatment possible. A crucial aspect of this system includes the pre-procedural path planning and the path guidance during the intervention to ensure the needle safely and accurately reaches the target position.

Figure 1 – CT-guided lung biopsies performed by the interventional radiologist. A CT scanner is used to visualise the needle, and the radiologist manually adjust the position.

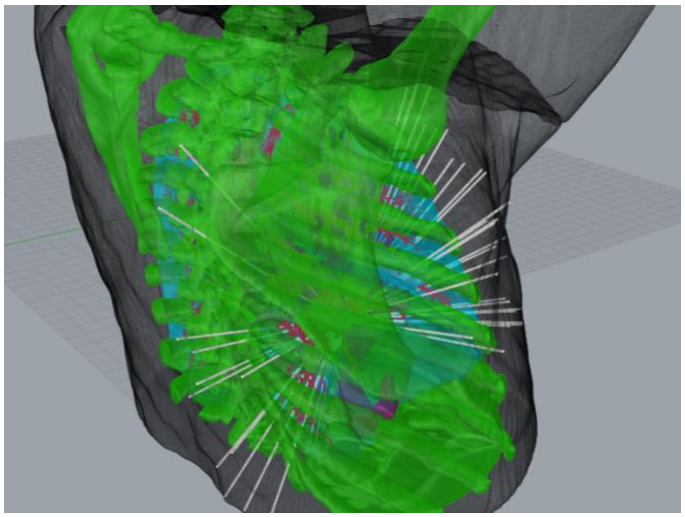

Figure 2 – A preliminary path planning model has been developed to understand straight pathways to a target. This project continues on prior work in this regard.

Project: The image-guidance is an essential component to ensure success. Within this project you will focus on developing and validating key aspects of the path planning system. A first preliminary model has been developed (Figure 2), however, this model does not include key aspects such as the influence of breathing, segmentation accuracies, needle bending etc. As this project is continued in development, we would like to explore together with you how your skills could contribute the best to the project. You will be supervised by researchers at the IMAG/e group for medical image analysis and Control Systems Technology group.

Your skills: We are looking for a MSc student with a background in either medical imaging analysis or computer science for optimization (incl. artificial intelligence). Experience in (or an interest to learn) Python is strongly preferred. Students with a Mechanical Engineering background are also invited to get in contact to explore how their skills can contribute to making lung biopsies more accurate.

Want to know more about the project? Please get in contact with Joric Oude Vrielink (Control System Technology, t.j.c.oude.vrielink@tue.nl) or Prof. Josien Pluim (IMAG/e group, J.Pluim@tue.nl).