Fijs van Leeuwen

Short Biography:

Fijs van Leeuwen is professor of radiology where he is director of the research theme 'molecular imaging and image guided therapy'. He also co-directs the LUMC-wide image-guided surgery program. Since 2006 his research tries to generate clinical impact by helping advance the field of image guide surgery, a field wherein his team pursues the translation and clinical validation of innovations in chemistry and engineering. His team efforts have recently also started to include artificial intelligence as analytical tool.

Abstract:

The pace at which new image guided surgery technologies are being introduced in clinical care is staggering. While these translational successes create a potential for growth, they also pose new challenges. The most essential being the lack of short-term performance measures that help assess how, and to what degree, the new technologies impact on the surgical decision making. Measures that would compliment traditional outcome and complications measures, which, by the way, are only scarcely available in this maturing field. Two application that have shown clinical outcome improvements are sentinel node and prostate-specific membrane antigen (PSMA)-targeted procedure in prostate cancer surgery. To enable the execution of these procedures in a robotic setting a so-called tethered 'drop-in' gamma probe technology was introduced. While both procedures rely on the probes ability to trace accumulation of 99mTc-isotopes, the lesions vary in signal intensity and have different signal-to-background ratio's (SBR). A feature that clearly reflected on the surgeon's target perception. The surgeons interaction with patient as established by custom computer-vision algorithms, helped objectify the impact on surgical decision-making. Specifically, neural network-based software was used to digitize probe trajectories from 44 clinical videos. The digitized trajectories were subsequently used to extract multiparametric kinematic metrics and generate decision-making scores. Analyses that indicated that the more challenging PSMA-targeting procedure saw a five-fold increase in targeted identification time and number of probe pick-ups. Thereby negatively affecting the surgical decision-making score. Interestingly, these finding indicate that the surgeons interaction with the patient directly related to signal intensities in preoperative SPECT-CT scans, intraoperative probe readouts, and SBR. Thus helping to indicate which aspects of image guidance need to be improved to enhance the surgical proficiency.

The role that AI can play now is to assist radiation oncologists in performing tumor contouring for radiotherapy treatment planning. Thus, it is necessary for future research to be oriented towards uncertainty-aware deep learning models. Yet, it is equally important that the next generation of imaging work towards the development of high-sensitivity and high-resolution scanners, resulting in a concurrent mitigation of artifacts [1] [11].