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Research is Progress

Eye-Tracking and Artificial Intelligence Technology for Enhanced Surgical Training: Assessing the Role of Joint Visual Attention in Resident Competency for Minimally Invasive Surgery

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Introduction: The highly symbiotic relationship between attending and trainee surgeons is crucial for minimally invasive laparoscopic and robotic surgery training because it requires residents to find a delicate balance between managing the high cognitive load of the surgical operation coupled with visuo-spatial coordination with the attending surgeon. We draw on previous efforts examining eye-tracking affordance for assessment and training, known as Joint Visual Attention (JVA - when individuals are looking at a common target jointly). Our hypothesis is that higher levels of JVA can be detected in residents with higher assessment competencies, thus, JVA may be used as a surrogate marker of resident "readiness" or preparedness.

Methods: Residents and attending surgeons at the University of Michigan were asked to wear eye-tracking glasses to record visual attention during Fundamentals of Laparoscopic Surgery (FLS). JVA is measured by computing the number of times that participants' gazes are in the same radius in the scene within a 2 second time window then compared with a scoring system developed to analyze competency of the FLS task performed and resident training logs documenting total number of prior practice attempts.

Preliminary Results: The PI team has done substantial prior work on the project including a series of simulation and operating room observations with eye tracking data collection, and an interview study understanding both surgeons' needs and challenges with intra-operative coordination, teaching, and learning. If validated in the simulation training setting, this technology could further be utilized in a series of minimally invasive surgical procedures.

Next Steps: Our ultimate goal is to improve patient safety and health outcomes by training surgeons around complex real-world team situations by employing innovative technology and novel assessment methods. This has exciting possibilities for surgical education, as the

Figure 1:
A panel of screenshots from the pilot study at the CSC showing overlaid attending point of gaze (green) and residents' gaze.
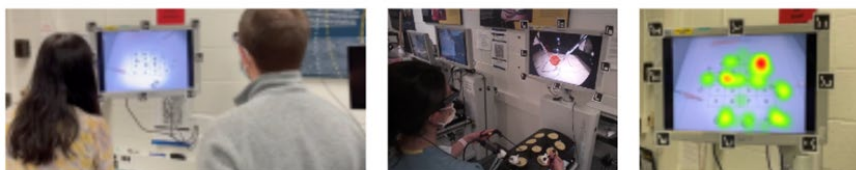
significance of the proposed work comes from its ability to provide quantitative, objective, and reliable data on both individual and interpersonal actions and responses. These will allow for standardized assessment of individual and attending-resident team performance and provide unique opportunities for feedback, practice, and/or remediation.