ACS 2022 Surgeons and Engineers: A Dialogue on Surgical Simulation Meeting

Research In-Progress

Automated Surgical Skills Evaluation Using RGB-D data in a Longitudinal Study

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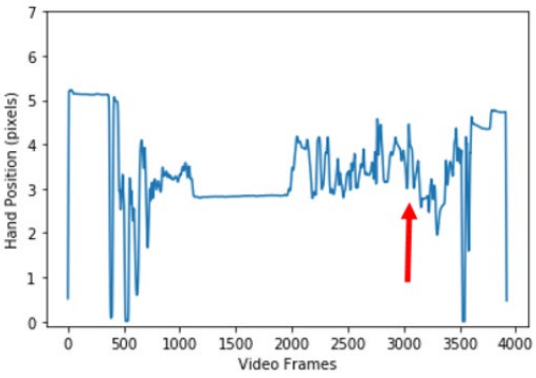
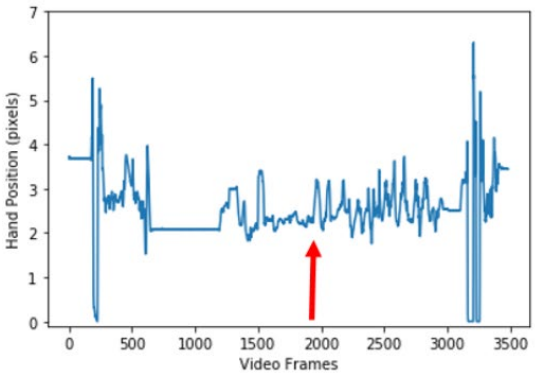
Introduction: Excellent surgical and microsurgical skills are critical to avoid morbidity and mortality in high stakes surgical patients. Gaining surgical skills requires significant practice and mentorship, yet opportunities to gain on-the-job surgical training are scarce. While administrative, legal, and ethical pressures understandably preclude exposure of surgical patients to novice surgeons on the steepest part of the learning curve, surgical training is negatively impacted. In addition, fewer medical training programs use live animal models in the delivery of medical education due to humane concerns and societal pressures and perceptions. As a result, development of non-living models and simulations is critical to advancement of surgical training in medical education. Evidence suggests that many highly technical skills may be acquired and refined outside of the operating arena through use of surgical simulations. Validation of any surgical simulation system is needed to ensure skills transfer to real-life surgical situations.

Methods: In this work, a validation methodology is presented based on examining how hand kinematic features are commensurate with experience level. A cohort of sixteen 2nd-year veterinary students participated in a longitudinal study, during which data were collected on completion of the 1st, 3rd, and 5th weeks of a suturing course. An RGB-D camera recorded participants' lower arms during performance of suturing and knot tying tasks on a high-fidelity synthesized tissue model.

Preliminary Results: A less noisy hand position with more clear hand position cycles, indicative of better hand control, is observed after week 5 for 3 participants. The attached image shows hand position along the x-axis for one participant performing a suturing task. The arrows demonstrate snapshots of the corresponding frames.

Next Steps: Data from all participants will be analyzed using statistical methods to reveal correlations between kinematic features; i.e. instantaneous position, speed, and acceleration; and practice level.

Week = 1	Week = 5
 Hand Position (pixels) Video Frames	 Hand Position (pixels) Video Frames