Our project aims to investigate the extent to which automated analysis and assessment of surgical tool motion recorded from a da Vinci surgical system can be used to enhance learning in a robotic surgical skills curriculum. Our goals for this project are: (1) to develop statistical models, based on machine learning methods, for assessing surgical skills among trainees, (2) to investigate how trainees acquire surgical skill, using validated learning curves, and (3) to investigate methods by which feedback on individualized skill acquisition can be delivered to trainees.

Our project is a unique and truly interdisciplinary collaboration between investigators based at the Laboratory for Computational Sensing and Robotics, Whiting School of Engineering (WSE) and the Johns Hopkins Minimally Invasive Surgical Training and Innovation Center (MISTIC) in the Department of Surgery, School of Medicine. The project builds on our prior research within the “Language of Surgery” project, in which we have developed statistical models to identify surgical gestures and to assess surgical skill.

We envision that our current project will support further interdisciplinary research to understand the acquisition, retention, and attrition of surgical skills, and to develop efficient and individualized programs, based on objective and informative feedback, to train surgeons in providing safe and effective patient care.

Figure 1. Surgical skill is encoded by surgical tool motion. Left, the motion trace of an intermediate trainee performing a four-throw running suture; right, an expert performing the same task. Different colors code surgical gestures.

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