

Medical Robotics and Devices Lab

Safer Surgeries Through Smarter Tools

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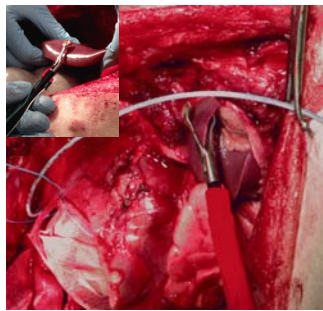
Motivation:

- Surgical errors are responsible for 32,000 deaths annually in the United States.
 - Among the top fifteen causes of death in the US[1][2][3].
 - Surgery is extremely common, 50 million per year in US
 - The average American will have 7 surgeries in their lifetime[4].

Projects:

- Smart Tools
 - Online identification of tissue *in vivo*
 - Auto prevention of Grasp Injury
- Quantifying Surgical Skill
 - Fundamentals of Robotic Surgery
 - Cloud-based skill evaluation via HMM's
- Machine vision to track tools
 - Object detection
 - Depth from stereo
- CORVUS: Intelligent Surgical Robot

Smart Tools

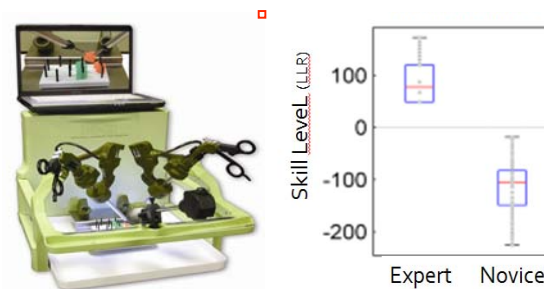


In vivo Training

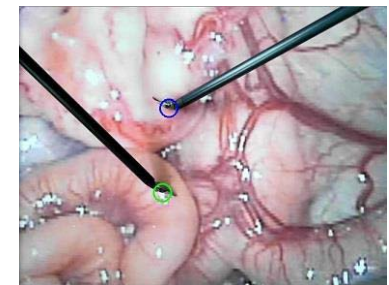


Real-time Use

Surgical Skill Eval



Tool Tracking



[1] Linda 376 T Kohn, Janet M Corrigan, Molla S Donaldson, et al. To Err is Human: Building a Safer Health System, volume 627. National Academies Press, 2000.

[2] Sherry L Murphy, Jiaquan Xu, Kenneth D Kochanek, et al. National Vital Statistics Reports. National Vital Statistics Reports, 60(4):1, 2012.

[3] Chunliu Zhan and Marlene R Miller. Excess Length of Stay, Charges, and Mortality Attributable to Medical Injuries During Hospitalization. *Jama*, 290(14):1868{1874, 2003.

[4] Atul Gawande. Two Hundred Years of Surgery. *New England Journal of Medicine*, 366(18):1716-1723, 2012.

- The CORVUS Arm
 - Complete Operating room Robotics for Virtually Unassisted Surgery
 - A two arm, 6 DOF robot
 - Attached to an operating room table
 - Workspace covering the entire patient
 - Optical encoders in each joint
 - End-effector sensors & actuators
 - Force gauges
 - Stereoscopic IR cameras
 - Time of Flight depth cameras
 - Detachable wristed tools & print-heads
 - Currently being used as a testbed for surgical robotics research to evaluate soft tissue tracking, registration, and semantic labeling



- The goal of this work is to realize safer surgeries through automated prevention of errors in robotic surgical procedures.
- Major Project:
 - Advance non-contact soft tissue identification and tracking algorithms
 - Avoid blood vessel injury in real time

