Medical Robotics and Devices Lab
Safer Surgeries Through Smarter Tools

John O’Neill
Tim Kowalewski
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](image1)

![Real-time Use](image2)

Surgical Skill Eval

![Skill Level Chart](image3)

Tool Tracking

![Tool Tracking](image4)

---

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