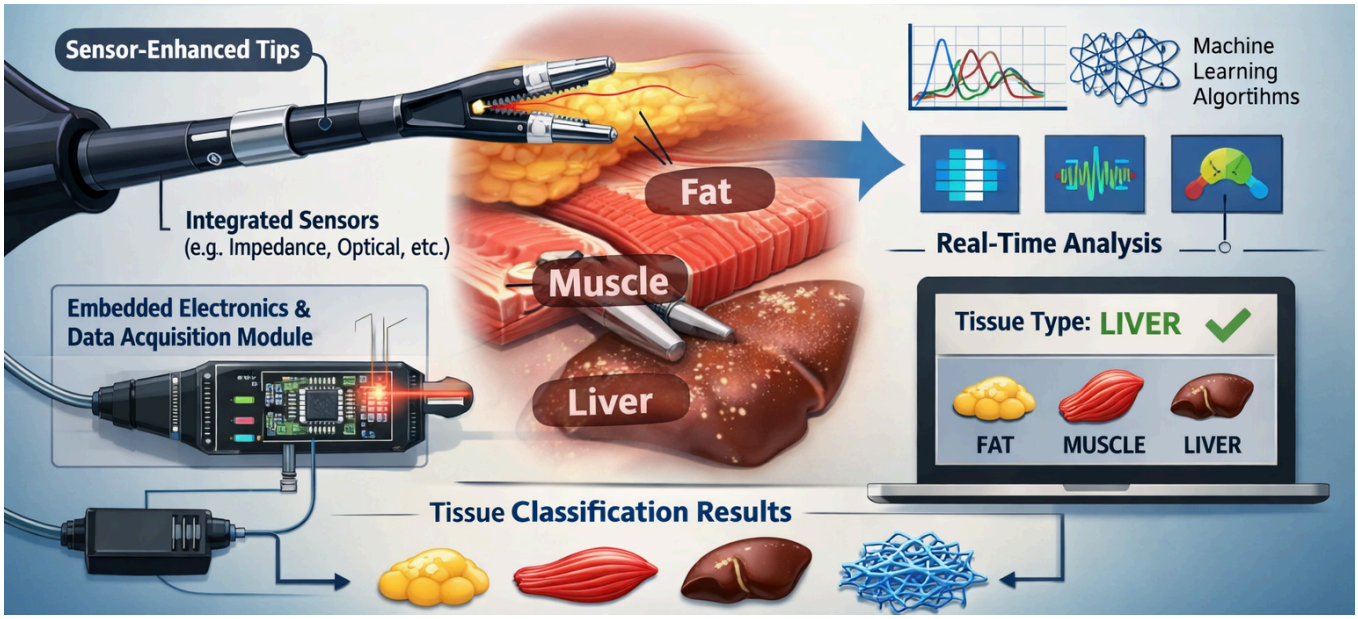
SYSC 4907 M6

Design and Development of an Instrumented Laparoscopy Forceps for Real-Time Tissue Classification



AI-generated image illustrating the concept

This project has already been assigned and is no longer available. It is posted for administrative purposes only.

Group size: 4-5 students.
Suitable for: Biomedical, Mechanical, and Electrical Engineering Students
Desired background: CAD, Mechatronics, Instrumentation, Signal Processing
Supervisor: Prof. C. Rossa: carlosrossa@cunet.carleton.ca
Lab information: https://www.biomechatronics.ca

Project Description: In this project, students will design, develop, and experimentally validate an instrumented laparoscopic forceps capable of classifying tissue at the tip in real-time during manipulation in minimally invasive surgery. Conventional laparoscopic instruments provide limited quantitative feedback, requiring surgeons to rely primarily on visual cues with minimal tactile information. The objective is to augment a standard laparoscopic grasper with embedded sensing (e.g., electrical impedance or laser-based sensing) to measure relevant tissue properties and apply machine learning to identify the tissue being manipulated. Students will first evaluate sensing modalities that can be integrated within the geometric, sterility, and biocompatibility constraints of laparoscopic instruments, and select a suitable modality. The chosen sensor will be integrated into the jaws and/or shaft of the forceps, coupled with an embedded data acquisition system to capture and transmit signals for real-time processing. Signal processing and machine learning algorithms will be developed to extract features and perform tissue classification. The complete system will be validated through controlled experiments using biological tissue samples or tissue phantoms.

Anticipated deliverables: A functional prototype integrated into a laparoscopic tool with accompanying real-time classification algorithm.