NYU | TANDON SCHOOL OF ENGINEERING

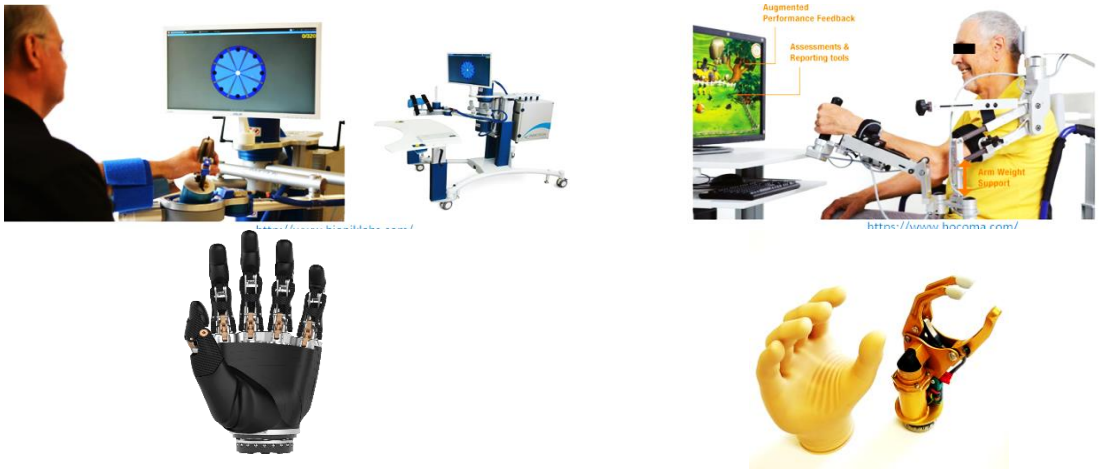
ECE-9283 AND MAE-7863

Interactive Medical Robotics

Spring 2020 Wednesday 6:00-8:30 pm

Instructor: S. Farokh Atashzar

from: Medical Robotics and Interactive Intelligent Technologies (MERIIT@NYU Lab)



Instructor:

Atashzar is an Assistant Professor of ECE and MAE at New York University. His research interests include areas of Intelligent Robotics, Wearable Technologies, Neuro-rehabilitation Robotics, Surgical Robotics, Human-Robot Augmentation, High-density Bio-signal Processing, and Computational Neuroscience. Prior to joining NYU, Atashzar was a senior postdoctoral scientist at the Department of Bioengineering, Imperial College London, UK.
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Introduction

In this course, we will investigate the application, functionality, and theoretical aspects of the state-of-the-art interactive robotic technologies in medicine. The focus of the course will be on surgical and neurorehabilitative robotic systems. Technological aspects, such as instrumentation, actuation, mechanisms, imaging, and signal acquisition, will be introduced. Also, theoretical aspects related to control, dynamics, kinematics, stability, passivity, human-robot interaction, teleoperation, machine learning will be discussed in the context of medical robotic systems. MATLAB programming will be used. Knowledge related to the two out of four following topics would be useful: signal processing, dynamics, control, robotics. No clinical/medical background is needed. One guest speaker may be invited as part of the course.

Description:

The topic of medical robotics has attracted a great deal of interest during the last decade. Several major medical and non-medical companies (e.g. Google, Philips, J&J, Medtronics, Stryker, Intuitive Surgical, etc) have invested significantly in this field as it has shown great potential to revolutionize diagnosis and treatment, and eventually the quality of healthcare services. The course is new, is transdisciplinary, and is designed to train engineers and allowing them to enhance their theoretical and technological knowledge to address the unified transdisciplinary problem in the medical industry. This course provides students (mainly ECE, MAE, and possibly BME) with an opportunity to learn about a special area of robotics, while augmenting, connecting, and mobilizing their engineering training toward an active area of applied science, i.e., Computer-Assisted Medical Intervention (CAMI), and to help them with their future career.

Prerequisites

Instructor or Advisor Admission
Or any of ECE-GY 6253, ME-GY 6703; or ME-GY 6923; or Equivalent.

Project

There is a plan to give 2 projects to the students to help them in learning about current research related to the topic of the course and to augment their knowledge regarding the current activities in the field. A short project presentation and a report will be taken. Students will receive feedback about the reports and presentations. Students can discuss the topic of projects with the instructor.

Tentative Schedule **(registered students will receive the updated version)**

Week 1: Introduction to Surgical Robotics

Week 2: Introduction to NeuroRehabilitative Robotics

Week 3, 4: Instrumentation and Imaging in Medical Robotic Systems

Week 5, 6: Telerobotic Architectures: Control and Application in Medicine

Week 7, 8: Haptics-enabled Medical Robotics (Stability Analysis and Safety Control Synthesis)

Week 9: Midterm Project Presentation and Report Submission

Week 10: Kinematics and Redundancy in Medical Robotics

Week 11: Inverse Dynamics and Impedance/Admittance Control in Medical Robotics

Week 12: Multi-port Human-Robot Interaction in Medical Robotic System

Week 13,14: Human-machine Interfacing and Machine Learning in Medical Robots & Prostheses

Week 15: Final Project presentation

Grading Policy

- HomeWorks 30%
- Project #1 and Report 20%
- Project #2, and Report 20%
- Final Exam 20%
- In-class Quizzes 10%