CMPT 340 - D100 Biomedical Computing

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Calendar Objective/Description:
The principles involved in using computers for data acquisition, real-time processing, pattern recognition and experimental control in biology and medicine will be developed. The use of large data bases and simulation will be explored.

Instructor's Objectives:
Biomedical computing is a rapidly emerging area that is revolutionizing medicine and biology. It focuses on the use of computational and mathematical techniques to accelerate scientific discovery and to improve diagnosis, treatment, and understanding of diseases. The general objectives of the course are: To give the student breadth in the topics related to the use of computers in biology, medicine, and healthcare, in both theory and application. To enable the student to converse knowledgeably with radiologists, physicians, and MDs about these topics and related technologies. To learn the technical basis of many aspects of the use of technology in biomedicine (e.g. data acquisition, biosignal/image processing and visualization, feature representation and extraction, data interpretation and machine learning), current and future trends, and their benefits and limitations. Read more here: http://www.cs.sfu.ca/~hamarneh/340.html

Prerequisites:
Completion of 60 units including one of CMPT 125, 126, 128, 135 or (102 with a grade of B or higher).

Topics:
- Biosignals and signal analysis: The properties of different types of biosignals (e.g. EEG and ECG) and the techniques used for processing and analysis of biosignals (e.g. frequency domain filtering).
- Medical imaging and image processing: The acquisition of different medical images (e.g. magnetic resonance imaging and X-ray computed tomography) and the techniques used for processing, analysis, and visualization of medical images (e.g. image segmentation and registration).
- Medical knowledge and decision support: The representation of medical knowledge and the computational methods used to assist in decision-making (e.g. Boolean and fuzzy logic, artificial neural networks, and decision trees, flowcharts, and tables).
- Biostatistics: Statistical reasoning methods in medicine (e.g. hypothesis testing, multivariate analysis).
- Databases in Medicine: Computer-based patient records and the standards for storage, retrieval, and electronic communication of medical data (e.g. DICOM, PACS, SNOMED)
- Case studies, recent advancements, future trends: These may include: Computers-assisted and robotic surgery, computer-aided diagnosis, tele-medicine, biometrics, radiotherapy, human modelling, security in medical information systems, micro-array data analysis, computers for drug design, and more.

Grading:
Grading to be announced during the first week of classes.

Reference Books:
Information Technology for the Health Professions, L. Burke and B. Weill, Pearson Prentice Hall, 9780132897648, 4th Edition
Neural Networks and Artificial Intelligence for Biomedical Engineering, D. L. Hudson, M. E. Cohen, Wiley, 1999, 9780780334045

Handbook of Medical Informatics, J. Bemmel, M. Musen, Springer Verlag, 1997, 9783540633518, 1st Edition

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