# Machine Learning Developer

**Relevant Specialties:** Software Engineering, Computer Science, Electrical & Computer Engineering, Clinical/Biomedical Engineering, Systems Design Engineering

**Eligible Candidates:** Undergraduate students (3rd or 4th year), graduate students, or recent graduates

**Location:** St. Michael's Hospital (downtown Toronto), with occasional meetings at the University of Toronto

**Approximate Salary:** $3800 per month

**Contract Duration:** September to December 2018 (full-time)

**Submission Deadline**: Interested applicants are asked to submit a resume/CV, a cover letter, and links to relevant projects to Mark Fan (mark.fan@nygh.on.ca) by August 17, 2018. Only applicants selected for interview will be contacted.

**Job Summary**

The International Centre for Surgical Safety at St. Michael's Hospital is seeking a senior student or a recent graduate with a strong interest in machine learning, human factors, and healthcare applications. You will be working closely with a team of human factors specialists (https://goo.gl/E3iw7S) who have identified cues for when uncertainty occurs during laparoscopic surgery. You will be responsible for developing a machine learning algorithm to detect these types of cues from audio recordings of laparoscopic surgery. However, any experience you have with detecting video/image-based cues will be advantageous.

This position is funded by a grant from the Ontario Centres of Excellence to support the Operating Room Black Box (OR Black Box®). The Operating Room Black Box project seeks to improve patient safety and enhance technical and non-technical skills education (e.g., communication and problem solving during stressful situations) in operating rooms. The OR Black Box® is a platform that can collect video, audio, vital signs, and laparoscopic view of the patient during laparoscopic surgeries. Manual review of the OR Black Box® videos is time consuming. As a result, we seek to improve the efficiency of data analysis via machine learning so that feedback can be quickly reported back to the surgical team. The machine learning algorithm is intended to automatically flag transitions from routine work to uncertain situations, where the surgical team may be unclear about the current situation, the best choices, and future outcomes of the surgery. The results of your work will ultimately improve patient safety and quality of care in operating rooms by directly improving the data analysis efficiency and allowing the surgical team to quickly get feedback and improve their performance.

This position is ideal for you if you are interested in gaining experience with machine learning and human factors research in the context of health care. The role will provide you with real-life, challenging problems for you to make practical contributions with your research and programming skills. You will get to work and interact with people from a wide variety of backgrounds (e.g., surgery, nursing, engineering, human factors, and patient safety). The experiences gained in this position will be applicable to developing machine learning applications and conducting research in general.

**Required Documents:**

Please provide a resume or CV, and a cover letter describing your interest in the position. Please also provide links to your relevant projects (e.g., GitHub or your personal website).

**Job Responsibilities**

- Setup development environment and get familiar with surgical activities and human factors methods
- Exploring and selecting machine learning algorithms to detect uncertain situations in **audio** recordings of surgeries
- Select and experiment with the feature set to be used in the machine learning algorithm
- Develop the machine learning algorithm to automatically flag uncertain situations
- Integrate the algorithm output into the data analysts' analysis tool for them to view the flagged instances of uncertainty
- Assist with other research activities (e.g., present project progress and write manuscript for research findings)

**Required Qualifications**

- Deep learning foundations, including theories, models, and algorithms
- Deep learning libraries and platforms, e.g.  TensorFlow, Caffe, etc.
- Audio signal processing
- One or more general purpose programming languages including but not limited to C/C++ or Python
- Hands-on experience with setting up and using deep learning libraries and machine learning development environment
- Hands-on experience with deep learning algorithms and audio data
- Prior experiences in researching algorithms and implementing algorithms from research papers, theories, and/or pseudocode
- Familiar with Linux
- Strong independent learning skill
- Ability to work independently and as part of a team
- Proven communication and interpersonal skills

**Preferred Qualifications**

- Computer vision, image processing and mathematics
- Sequence modeling, including applications to natural language processing
- Unsupervised learning and learning from unpaired data
- Computational linguistics, language data processing and working with multiple languages
- Previous experience and strong interest in conducting research
- Previous experience in human factors methods
- Previous experience in healthcare (e.g., patient safety and quality improvement)


For more information about the project leaders and the OR Black Box®, please see below:

- http://ihpme.utoronto.ca/faculty/patricia-trbovich/
- http://stmichaelshospitalresearch.ca/researchers/teodor-grantcharov/
- https://www.youtube.com/watch?v=O4gP6JkJ2YI