Comprehensive Research Experience for Medical Students (CREMS)

2022 Supervisor and Project Information Form

Please complete and return via email ONLY to crems.programs@utoronto.ca by February 18, 2022.

Supervisor Information

NOTE: CREMS will not support pre-determined pairings of students and supervisors. Supervisors must agree to open their projects to all students and interview all that are interested.

Name: Navneet Singh, MD MPH PhD FRCPC

Email: navneet.singh@mail.utoronto.ca

Department: Medical Imaging

Hospital/Research Institution: Sunnybrook Research Institute & Department of Medical Imaging, University of Toronto

SGS Department(s) (if applicable):

ORCID ID (see https://orcid.org/ - If you do not have an ORCID ID we encourage you to sign up for one):

https://orcid.org/0000-0001-9719-2042

Location of Work:

Sunnybrook Research Institute and remote

Field of Research (up to 4 keywords):

Radiology, oncology, artificial intelligence, radiomics

Student contact time (number of hours per week YOU are available to the student for any concerns or to review progress):

3 hours in person/zoom and additional time up to 5 hours as needed via email/phone/zoom
Project Information

NOTE: If this project is selected, this information will be posted on CREMS website for interested student applicants to view research opportunities.

PROJECT TITLE:
Advanced Analytics—Lymph Node Metastases Detection by Artificial Intelligence Augmented CT Chest Analysis

PROJECT DESCRIPTION:
Including background, aim(s), methodS and significance of the project. Maximum 300 words.
Advanced imaging analysis with radiomics and artificial intelligence (AI) to identify disease imperceptible by current imaging standards is an opportunity to improve detection of nodal metastases on CT chest imaging. Detection of nodal metastases plays a critical role in care including decisions on neoadjuvant chemotherapy. CT chest studies are ubiquitous in cancer care for staging and follow-up of distant metastases, but, by conventional imaging features, have limited diagnostic accuracy for detection of nodal metastases. Radiomics-based features have proven highly successful for disease detection and radiologists’ ability to consider radiomics based features in their interrogation of nodes may enhance their diagnostic accuracy for disease detection. No studies to our knowledge have investigated radiomics for axillary nodal metastases on CT in breast cancer. A radiomics and AI-based approach may improve the diagnostic performance of non-invasive CT chest nodal metastases detection in this population. Furthermore, this approach can be potentially validated and applied to other cancers where biopsy or nodal dissection is not presently the standard of care. Investigation and internal validation of an approach would be carried out on breast cancer cohort as we have an existing clinical research database of patients (n=700) that are carefully followed in our regional academic tertiary cancer center with biopsy data available. External validation and calibration would be carried out in head and neck, esophageal and lung cancer samples with biopsy, PET/CT and multidisciplinary determination of metastases. Development of an advanced imaging radiomics and AI based approach to enable nodal metastases detection is an opportunity for safe, seamless and sustainable care. Overall, the student would be involved in a specific aspect of the proposed investigation towards developing and investigating a tool to improve nodal metastases detection from readily available CT chest studies, mitigate invasive lymph node biopsies, and guide treatment decisions. Please feel free contact me for more information.

Is this project remote-capable (in case of new restrictions) or have an alternative remote option?
☒ Yes, remote capable ☐ No
☐ Yes, alternate remote option. Please specify (100 words max): Click or tap here to enter text.

If human subjects are involved, have the appropriate Research Ethics Board approvals been obtained?
☒ Yes ☐ No ☐ Not Applicable

If yes, please list the application submission date:

Do you expect this work will be published?
☒ Yes ☐ No ☐ Uncertain / Other
Research Environment and Student Roles and Responsibilities

Please be specific as possible. Please describe the research environment, including availability of required facilities/equipment/expertise, supervisor’s experience and mentorship plans. Please clearly outline the student role(s) and responsibilities related to the project, potential educational value, and indicate who will serve as the student’s direct report for daily oversight (PI, PHD student, technician, etc.). Maximum 300 words.

Having graduated from the CREMS programs (Distinction in Research & Scholars Program, 2007-2009), I look forward to the opportunity to mentor and supervise students through this program. The proposed project will primarily be undertaken at Sunnybrook. The environment provides space and infrastructure to collect, anonymize, analyze and store imaging data in accordance with requirements for this REB approved study. The PI is able to provide in-kind supports including computers, encrypted devices/hardware, administrative supplies and imaging processing and statistical software as needed to students involved in the study in-kind. The current team working on this project includes Prof. Naomi Matsuura (Engineering) is currently working with the PI and they are together co-supervisor other trainees including an engineering student and resident physician. Given the project’s overarching aim is to study radiomics and deep learning for CT chest identification of nodal metastases for improving clinical effectiveness including diagnostic accuracy, efficiency and costs, and develop a useful tool for clinical practice, collaborators through this and other associated grants reflect the intersection of expertise in clinical imaging (breast and cardiothoracic imaging), engineering (segmentation, radiomics and artificial intelligence), clinical expertise (medical, anatomic and surgical oncology) and clinical effectiveness (research design, statistics, databases). Each expert will consulted as necessary throughout the project and support the study as needed. This model has proven successful as two papers led by an engineering student and resident physician are currently in progress to be submitted for peer-review. The student will report to the supervisor directly each day who is happy to be available via email or phone as needed. The student will gain skills in image anonymization, segmentation, interpretation and be exposed to tumor boards and other oncologic and imaging physicians, and the project can be refined to ensure it matches the students interest. The student will have an opportunity to be involved in a substudy including data acquisition, collection, organization, anonymization, image analysis, data analysis and writing. The goal of the project will be to submit a research letter, conference presentation and/or full length paper depending on the results with the student as first author.