

VIRTUAL BIOPSIES: NON-INVASIVE MOLECULAR DIAGNOSIS OF CANCER

Our expanding knowledge of the genetic basis and molecular mechanisms of cancer is beginning to revolutionize the practice of clinical oncology. Increasingly, molecular biomarkers of prognosis and treatment response are being used to classify tumors and direct treatment decisions. Advanced medical imaging platforms such as MRI, PET, and CT provide incredibly detailed images of tumors that reflect their structure, biochemistry, physiology and perhaps genetics. Studies by the Imaging Informatics Lab at the University of Calgary, and others, show that information about a tumor's molecular phenotype can be obtained by using novel algorithms and computational tools to more fully analyze tumor images. Such "virtual biopsies", performed by applying these image-processing and machine learning techniques to routine diagnostic images (e.g. MRI, PET or CT), could be a rapid and powerful means of assaying important cancer biomarkers. If successfully validated, and proven to have suitable sensitivity and specificity, the use of non-invasive imaging-based molecular diagnostic tests could be a valuable complement to conventional surgical biopsies. For example, virtual biopsies could be important in the context of large heterogeneous tumors, multiple metastases, surgically inaccessible tumors, and settings where disease progression needs to be monitored frequently over time.

Virtual biopsy research lies at the intersection of molecular imaging, medical imaging physics, and biocomputation, and is highly complementary to these areas. This presentation will cover key enabling technologies behind virtual biopsies, and discuss some recent progress in this research.

Dr. Ross Mitchell is an Associate Professor in the Departments of Radiology and Clinical Neurosciences, an Adjunct Professor in the Department of Computer Science, and the iCORE/CSI/UofC Industrial Chair in Medical Imaging Informatics, at the University of Calgary. He is a scientist in the Alberta Ingenuity Center for Machine Learning, the Alberta Ingenuity Bioventure Center for Biomedical Engineering, and an Alberta Heritage Foundation for Medical Research Senior Scholar. He is also the Founding and Chief Scientist of Calgary Scientific Incorporated.

Dr. Mitchell has received numerous awards for his research including: the Berlex Canada MS Research Award; Best Paper Awards from the Canadian Association of Radiologists and the International Organization for Medical Physics; First Prizes from the International Congress on Computer Assisted Radiology and from the International Society for MR in Medicine; two Awards of Merit from the Radiological Society of North America; and, the Roger Bauman Award from the Society for Imaging Informatics in Medicine.

Dr. Mitchell has a proven research track-record comprising 90 reviewed publications (15 patents, 75 journal articles), 90 invited presentations, and 170 published abstracts. Dr. Mitchell supervises a research team investigating space/frequency analysis, medical image processing, segmentation and visualization technologies.

