Statement of Interest

"The mind is not a vessel to be filled, but a fire to be kindled". I believe a Doctoral education in the ECE department, University of British Columbia can provide an everlasting experience that will be significant enough to sustain my passion as an academic. From its exceptional scholars, massively funded state-of-the-art research facilities and picturesque campus setting, the Vancouver campus of University of British Columbia truly is a "place of mind". I am particularly interested in the Biomedical Signal and Image Computing Lab (BiSICL) where I may learn and create answers to challenges of medical imaging in disease diagnosis; an aspiration I picked up watching a vast proportion of my own countrymen suffering from undiagnosed and misinterpreted diseases.

My research proposal titled "Particle Swarm Optimization for Transducer Probe Positioning in Breast Lesion Diagnosis with Ultrasound Imaging" is a proposed effort to eliminate costs incurred from operator-skill-dependence. Skilled operators are required to position ultrasound transducers over patients having varying shapes with lesions at varying positions. In the Biomedical Signal and Image Computing Lab, Abugharbieh et al [1,2] are working on automatic bone localization and fracture detection from volumetric (3D) images. A similar detection and localization can be studied for breast lesion characterization from 3D ultrasound scans. However as an extension, if the need of real-time imaging is not crucial (as in tissue characterization without elastography imaging) then a single 2D ultrasound transducer can be used in adaptively changing positions/orientations thereby reducing cost while having the advantage of using central shadowing in tissue-characterization. Particle swarm optimization algorithm can be used to provide ultrasound transducer positioning with minimum operator skill dependence with inherent adaptive optimizing features by continuously updating values of particles (different instances of UT positions) via fitness function. The resulting diagnosis system can guide an operator to locate the lesion and thereafter finding the optimum angle and focus of the transducer array. Such a scheme is almost skill-independent of an operator with consequent cheaper cost per diagnosis, can be expanded to home use, and eventually promote routine self-check. To integrate to this proposal, my current work regarding quantification of follow-up checkups can be used to provide a fitness function in context of disease monitoring. However, what truly fascinates me is the prospect of expanding my research horizons, not limited to this research proposal, while working with the brilliant scholars of BiSCL.

"Genius is one percent inspiration and ninety-nine percent perspiration". This is what my undergraduate and graduate studies in IUT have been all about. We were exposed to rigorous mathematics, physics, signal processing, core areas of Electrical and Electronic Engineering, and well designed labs. I have published my works in two conference papers, one journal, and two thesis works, while gaining invaluable collaborators for my current works. I firmly believe that my past academic experiences and my growing aspiration for an education in University of British Columbia will guide me to successful completion of my Ph.D. degree.

In conclusion, my education in the University of British Columbia will boost up my efforts in implementing robust medical ultrasound imaging modalities with higher levels of operator independence, particularly regarding breast and prostate cancer diagnosis. The economic feasibility from automation will enable more densely placed ultrasound imaging devices resulting increased number of routine diagnosis. This has already proven to have reduced mortality rates from breast/prostate cancers, since at an early stage they are virtually curable.

There are many ways to live an academic life; developing tools that save lives one great way to live it.

References

[1] B. Ng, M. J. McKeown, R. Abugharbieh. "Group Replicator Dynamics: A Novel Group-wise Evolutionary Approach for Sparse Brain Network Detection". IEEE Transactions on Medical Imaging (TMI), March 2012, volume 31, issue 3, pp. 576-585.

[2] I. Hacihaliloglu, R. Abugharbieh, A. Hodgson, R. Rohling. "Automatic Bone Localization and Fracture Detection from Volumetric Ultrasound Images Using 3D Local Phase Features". Ultrasound in Medicine and Biology (UMB), 2012, volume 38, issue 1, pp. 128–144.