UAEU

جامعة الإمارات العربية المتحدة
United Arab Emirates University

The College of Graduate Studies and the College of Engineering Cordially Invite You to a

Master Thesis Defense

Entitled

Distributed Compressive Sensing Algorithm for Photoacoustic Tomography

by

Maha AbdulWahab Hassan Shehada

Faculty Advisor

Dr. Imad Barhumi, Department of Electrical Engineering

College of Engineering

Date & Venue

11:00 AM

Thursday, 30 May 2019

Room 1164, F1 Building

Abstract

Biomedical imaging techniques are playing an essential role in diagnosing different kinds of diseases, which always motivates the search for improving their sensitivity and accuracy. Photo Acoustic Tomography (PAT) is one of the most powerful techniques. PAT has many advantages as it is less expensive and faster than Magnetic Resonance Imaging (MRI). It combines the advantages of optical imaging and ultrasound imaging as it provides high contrast, high penetration and high resolution images for biological tissues. Also, it uses non-ionizing radiation which is very safe for human health. The main challenge in PAT is that human tissues can be exposed only to a limited amount of radiation, so a full-view of PAT requires many transducers and a great number of measurements. This thesis aims to develop an efficient reconstruction algorithm of Photo Acoustic (PA) images that uses few number of transducers, few number of measurements and offers low computational complexity while maintaining high quality of recovered images. The proposed reconstruction algorithm depends on Compressive Sensing (CS) theory which is a signal processing technique that is capable of forming a full-view PAT images (under certain prerequisites) with few number of measurements. The proposed algorithm solves the CS problem using a distributed and parallel implementation of the Alternating Direction Method of Multipliers (ADMM). ADMM is a well-known method for solving convex optimization problems. A group of local processors that work in parallel with one global processor are used to form the images. The iterative algorithm of ADMM is distributed over local processors in such a way perfect reconstruction of images is possible. Simulation results show that the proposed algorithm is powerful and successful in reconstructing different kinds of PA images with very high quality and significantly reduced computational complexity. Reducing the computational complexity is reflected on a much lower reconstruction time. Also, the algorithm requires lower cost and shorter acquisition time since the CS theory is used which allow the recovery of images from few number of samples and sensors. Although the idea of distributed ADMM has been introduced before in literature but to the best of our knowledge, this is the first work to apply distributed ADMM method in recovering photo acoustic images by distributing the iterative algorithm among multiple processors working in parallel.

Keywords: ADMM, PAT, compressive sensing, BP, distributed implementation, multiple processors.