Preface

Image processing has been a challenging and multidisciplinary research area since decades with continuing improvements in its various branches especially Medical Imaging. The healthcare industry was very much benefited with the advances in Image Processing techniques for the efficient management of large volumes of clinical data. The popularity and growth of Image Processing field attracts researchers from many disciplines including Computer Science and Medical Science due to its applicability to the real world. In the meantime, Computer Science is becoming an important driving force for the further development of Medical Sciences.

The objective of this study is to make use of the basic concepts in Medical Image Processing and develop methods and tools for clinicians’ assistance. This work is motivated from clinical applications of digital mammograms and placental sonograms, and uses real medical images for proposing a method intended to assist radiologists in the diagnostic process. The study consists of two domains of Pattern recognition, Classification and Content Based Retrieval. Mammogram images of breast cancer patients and placental images are used for this study.

Cancer is a disaster to human race. The accuracy in characterizing images using simplified user friendly Computer Aided Diagnosis techniques helps radiologists in detecting cancers at an early stage. Breast cancer which accounts for the major cause of cancer death in women can be fully cured if detected at an early stage. Studies relating to placental characteristics and abnormalities are important in foetal monitoring. The diagnostic variability in sonographic examination of placenta can be overlooked by detailed placental
texture analysis by focusing on placental grading. The work aims on early breast cancer detection and placental maturity analysis. This dissertation is a stepping stone in combing various application domains of healthcare and technology.

Chapter 1: Introduction describes the work presented in this thesis. The motivation of the work, significance, objectives and major contributions are outlined.

Chapter 2: Digital Mammograms and Placental Sonograms - An Overview of the Background discusses the basics of cancer, diagnosis measures, importance of digital mammography and need of automation. Also a brief description of the significance of placental grading and the importance of automated grading are given.

Chapter 3: Literature Review presents survey of the related work done in the classification and retrieval of digital mammograms and placental sonograms. The first part lists major works reported in the classification of mammogram images and placental images preceeded by the historical developments in each area. The second part briefs developments in CBIR techniques.

Chapter 4: Preprocessing and Feature Extraction chapter begins with the description of databases used in this study. The major preprocessing techniques used to improve the quality of both mammogram and placenta images are described and a new algorithm is proposed for removing the speckle noise in ultrasound images. Finally, the feature extraction techniques used in this study are explained.
Chapter 5: Classification Using Supervised Learning Algorithms discusses the use of four machine learning classifiers and the use of ensembles for performance improvement. The novelty in the classification process is the use of ELM for classifying placental images and the identification of best suited feature set combination. The use of Principal Component Analysis helps to reduce the dimensionality of feature set.

Chapter 6: Multiple Image Query System for Medical Image Retrieval presents the basic theory of CBIR technologies. An algorithm based on multiple image queries is proposed herewith for CBIR systems. This chapter evaluates the retrieval performance of mammogram and sonogram images using single image queries and multiple image queries.

Chapter 7: Conclusion and Future Works summarizes the thesis and mentions the possible extensions of the current work.