ABSTRACT

In the modern era of science and technology, medical image analysis has been focused by many researchers for improved diagnosis and decision making. Discoveries of various modalities such as X-rays, Magnetic Resonance Imaging (MRI), Computed Tomography (CT), Positron Emission Tomography (PET) and Single Photon Emission Tomography (SPECT) has further enhanced the research activities for developing computer aided decision making systems. Diagnostic ultra sonography has been found to be the predominant imaging technique for clinical diagnosis due to its non invasive nature. With the technical advancements and more sophisticated image acquiring techniques the ultrasonography has been extended to new fields including angiography, dermatology, obstetrics and gynecology and ophthalmology.

Down syndrome, a chromosomal disorder is caused by the presence of all or part of an extra chromosome in chromosome pair 21. The condition is characterized by a combination of major and minor differences in chromosomal structure. Often Down syndrome is associated with some impairment of cognitive ability and physical growth as well as facial appearance. There are many techniques at present to identify Down’s syndrome. But the present techniques are invasive and cause a lot of pregnancies to be aborted.
Prenatal sonography has been found effective for diagnosing the affected fetus based on the sonographic features using soft computing techniques. The soft markers such as Nuchal Translucency Thickness (NTT), Nasal Bone Length (NBL), Fronto Maxillary Facial angle (FMF) and Naso Frontal Angle (NFA) are expected to provide reliable data to detect the DS fetus. The procedure for semiautomatic diagnosis of DS includes image acquisition, noise suppression, segmentation, feature extraction and decision making.

Ultrasound images of facial profiles of fetuses in the mid-sagittal view are obtained. The speckles present in the images are removed using median filtering. The region of interest has been obtained from the despeckled images for further segmentation. The mean shift analysis has been applied for the ROI and the segmented images are subjected to Canny edge detector for further enhancement of the edges. The contours of the nasal bone, frontal bone, palate and the nuchal translucency region have been obtained. The parameters such as NBL, NTT, FMF angle and Naso frontal angle are measured. The estimated parameters are optimized with the Multi layer Back propagation network (MBPN) technique to improve the maximum classification efficiency, minimum training and testing time. The developed decision making system associated with the neural network concepts is validated with the medical experts to examine the reliability for classifying the DS subjects. The system can be considered as the second opinion for improving the medical image interpretation for efficient diagnostic decision making process.
The research carried out and presented in this thesis provides a MDSS to classify the input Ultrasound fetal images as normal or Down syndrome fetus. This is expected to provide the objective decision and help the medical experts as secondary observer for making an unbiased diagnosis.