ABSTRACT

Registration issues in medical image processing techniques are much more important than those of other image processing techniques. The main criterion of registration is to fuse the sets of data with the variations if any or with their similarities into a single data. These sets of data are acquired by sampling the same scene or object at different times or from different perspectives, in different coordinate systems. It is used in computer vision, medical imaging, military automatic target recognition, and compiling and analyzing images and data from satellites. Registration is necessary in order to be able to compare or integrate the data obtained from these different measurements. Such data is very essential in medicine for doctors to plan for surgery.

Medical image registration has advanced at a fast pace during the last ten years, creating new applications and opportunities. In addition, the number of clinical applications of image registration is increasing. Special attention has to be given to quality in order to perform image registration efficiently. In the past, entropy based methods were used. The registration solution is complicated as there may be misregistrations. This does not produce the required registered images. Brain image registrations using

transforms are automatic and have a number of interesting features that can simplify the clinical applications. A number of other image registrations methods have been introduced, but registration using transforms remains the method that offers most of the optimal and user-friendly features and benefits. Thus more research on enhancing the performance of these image registration methods is the need of the day.

In this research, the focus is to perform monomodal and multimodal brain image registration using Fast Walsh Hadamard Transform (FWHT) to enhance the performance of image registration and apply modifications in image registration techniques, and optimize few image registration schemes for better registration.

Image registration using FWHT is implemented and the algorithms are investigated through simulations. The performance of the modified algorithms are studied and compared with the existing algorithms. Two fast computation techniques are deployed to improve the performance of monomodal and multimodal brain image registration and speed. A monomodal and multimodal brain image registration using Modified Adaptive Polar Transform (MAPT) and Wang Landau Adaptive Monte Carlo technique (WLAMC) is also implemented.

Comparison of the performance of the modified algorithm with the existing algorithms using Walsh Transform (WT), Adaptive Polar Transform (APT) and Adaptive Monte Carlo technique (AMC) are done based on the performance metrics namely Mutual Information (MI), Correlation Coefficient (CC), Computed Time of Registration (CTR), Normalized Sum of Squared Intensity Differences (NSSD) and Ratio of Image Uniformity (RIU). Fast computation technique such as FWHT is used to improve the performance of image registration and to reduce the computation time.

The image registration algorithm with FWHT, MAPT and WLAMC techniques are implemented using MATLAB and the performance of the algorithms are analyzed. This thesis also explores the performances of optimized image registration using FWHT technique.

First monomodal and multimodal brain image registration using FWHT is implemented and compared with existing WT. Second brain image registration using MAPT is performed and compared with existing APT and FWHT. Third, monomodal and multimodal brain image registration using WLAMC is implemented and compared with existing AMC, MAPT and FWHT. The effectiveness of the algorithms is compared based on accuracy and robustness. Finally, monomodal optimized image registration is implemented using Genetic Algorithm.