ABSTRACT

Advancements in medical imaging techniques have led to the development of novel strategies for improving healthcare services and addressing the complexities inherent in medical diagnostics. This thesis focuses on the innovative application of infra-red (IR) thermal imaging in the non-invasive monitoring and screening of critical human ailments, such as diabetes, breast cancer, and oral cancer. Intricate nature of medical measurements and the complexity involved in managing patient diagnostics, shows that there is need for research to find robust and intelligent imaging systems in medical practice.

The study validates the novel infra-red imaging techniques through meticulous research conducted in various medical settings and climatic conditions in India, incorporating an enhanced software version tailored to accommodate diverse populations and environmental variations. The thesis highlights the significant contributions made towards establishing IR imaging as a valuable screening tool, emphasizing its non-invasive nature and intelligent processing capabilities are expected to make it widely acceptable in medical diagnostics.

Integral to the research is the development of an IR image acquisition and analysis system, featuring automatic image segmentation for precise Region of Interest (ROI) selection. This system incorporates a statistical analysis algorithm, capturing essential parameters from the extracted ROI, which subsequently serve as discriminating features in a machine learning algorithm. Notably, the study showcases the efficacy of a modified IR pattern recognition system and advanced machine learning techniques, facilitating accurate diagnosis and treatment assessment based on IR imaging.

The research also presents a novel approach for breast cancer screening, incorporating rotational thermography and dynamic temperature measurements. The work has further considered the transformative impact of infra-red imaging in diabetic condition diagnosis, stress assessment and the early detection of oral cancer, demonstrating its versatility in a multitude of medical applications.

It is believed that the research findings make a significant contribution towards the development of infra-red imaging techniques providing a comprehensive framework for enhancing medical diagnostics and targeted patient care.