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Monte Carlo simulation to detect the cancer cells at very early stages of breast cancer using CT images

Zaker Salehi Dehyagani
KDU University, Malaysia

Introduction: National Cancer Registry reported that breast cancer is 32% of all female known cancers where only 58% of this cancer can be detected at early stages. The purpose of this study was to develop an image display system to detect the micro-sized cancer cells using a new Monte Carlo simulation method.

Methods: The CT creates was used to convert the Micro-CT images of a typical cancerous breast to its equivalent digitalized file. The converted file includes a database of numbers from 1 to 5 for air, muscle, water, soft fat and dense fat. There were also defined five numbers from 6 to 10 for denser tissues with higher CT numbers (Hounsfield Units) based on the passible densities of breast cancer. The voxel size for this breast phantom was $0.5\times0.68\times0.5\ \mu m^3$. This image conversion was then repeated for the Micro-CT images of three different patients. The CT images of the patients were also observed by radiologists and the results of system's diagnosis were compared with the results of radiologist's observations.

Results: There were 28 suspected locations of cancer cells found by this imaging system for the first breast Micro-CT images. But radiologists could observe only 18 of them with a normal observation. For the second patient, 29 locations were found by this model but 20 locations were found by radiologists and for the third patient, 37 locations were found by the system while just 15 of them were observed by radiologists.

Conclusion: The imaging system of breast cancer was developed to diagnose the Micro-Sized cancer cells based on the conversion of Micro-CT images to a numeric database.

phyzaker@gmail.com