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4 authors, including:


Filip Andric
University of Kragujevac


Milena Zivkovic
University of Kragujevac


Marina Svicevic
University of Kragujevac, Kragujevac

Advancements in Mammographic Simulation: The MAMOVOX Optimization Approach

Filip Andrić*, Milena Živković, Dragana Krstić, Marina Svičević
Faculty of Science, University of Kragujevac, Serbia
email: filip.andric@pmf.kg.ac.rs

Abstract

In this study, we introduce an innovation in the simulation of depth dose distribution in mammography using gamma rays, achieved through the optimization of input data in the Monte Carlo-based MAMOVOX program (author R.Ilić). By focusing on a gamma ray beam of 8x6 cm^2 with an energy of 12 MeV, and conducting simulations with 100,000 gamma rays, we have significantly improved the efficiency and accuracy of dose distribution predictions. The optimization process not only involved refining the parameters and configurations within the MAMOVOX program but also enhancing the methodological approach to how simulations are executed. This innovative approach reduced the simulation time to approximately 4 minutes, substantially quicker than previous benchmarks, without compromising the quality of the results.

The optimization strategies applied in the MAMOVOX program open new horizons for application well beyond mammography, providing a framework to boost simulation efficacy across diverse sectors of medical physics and radiology. By streamlining the process of depth dose distribution analysis through refined input data and methodological enhancements, this innovation has the potential to revolutionize diagnostic imaging practices. It provides a foundation for developing more precise and less time-consuming simulation models, which could be pivotal in designing safer and more effective radiation therapies and diagnostic techniques. Furthermore, the principles of this optimization could be adapted to improve computational simulations in other scientific domains, such as nuclear medicine, radiation safety, and even environmental radiation monitoring, demonstrating a significant technological potential for wide-ranging real-world applications.

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