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Tomographic System Prototype Dedicated To Breast Cancer Detection And Sentinel Lymph Node Identification

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Extended Abstract

Currently, there are numerous techniques for the diagnosis of breast cancer. However, in many countries, especially middle-income countries, mammography is still widely regarded as the gold standard for detecting malignancies, even though an array of new or improved technologies are now on the horizon (Martei, Pace, & Brock, 2017). Early and accurate cancer detection, which allows partial or complete remission is essential for effective treatments. To determine if the spread of breast cancer has occurred, it is essential to examine the sentinel lymph node by providing additional information from imaging studies about the cancer stage (Dillekås, Rogers, & Straume, 2019). Therefore, in this work, a nuclear imaging tomographic system prototype is proposed, to identify breast cancer and the sentinel lymph node. This prototype seeks to identify breast and sentinel node lesions using a combined mechanical structure that integrates a cylindrical robot and a series manipulator device. These devices carry detectors for photons emitted from radionuclides that are potentially attached to cancerous tissue. Integrated electronic instrumentation enables the detection of emitted photons using a three-dimensional reconstruction based on the Radon transformation.

The signals from the gamma photon detectors were acquired to perform a 3D reconstruction (Popov, 2011) of some geometric figures. Thus, it would be possible to provide a complete study in which it is possible to diagnose breast cancer and check if the migration of cancer cells through the lymph has occurred. This work aims to develop a diagnostic scintimammography prototype with a hybrid system for breast cancer in the prone position to perform molecular imaging studies with a complementary tool that allows the identification of the metastatic sentinel node in the same study session. The proposed system would allow to determine the cancer stage and if it has migrated to other body parts through the lymphatic system. This system requires the patient to be in a prone position; since this anatomical position is adopted in some equipment and offers comfort, tissue compression is unnecessary. It is possible to detect tumors close to the chest wall (Koolen, Vogel, Vrancken, & Loo, 2012). Prototype construction involves detectors or compact gamma cameras dedicated to breast cancer detection and sentinel node identification, which are moved by independent robotic systems.

The main contributions of this research are to provide a diagnostic scheme based on a robotized scintimammography prototype that allows the user to feel comfortable and to determine the cancer disease status using the imaging information acquired from the robotized scintimammography prototype.

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