Bernoullis Tafelrunde

Graduate Student Seminar

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Seminarraum 05.002, Spiegelgasse 5

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MOONSTAR - Sentinel Lymph Node Fingerprinting

Abstract

Background: When locating Sentinel Lymph Node (SLN), surgeons use the state-of-the-art imaging devices, such as a 1-dimensional gamma probe or less widely spread a 2-dimensional gamma camera. These devices project the 3D subspace onto a 1D respectively 2D space, hence losing accuracy and the depth of the SLN which is very important, especially in the head and neck area with many critical structures in close vicinity. Recent methods which use a multi-pinhole collimator and a single gamma detector image try to gain a depth estimation of the SLN. The low intensity of the sources together with the computational cost of the optimization process make the reconstruction in real-time very challenging.

Results: We use an optimal design approach to improve the classical pinhole design, resulting in a non-symmetric distribution of the pinholes on the collimator. This new design shows a great improvement of the accuracy when reconstructing the position and depth of the radioactive tracer. Then, we introduce our Sentinel Lymph Node Fingerprinting (SLNF) algorithm, inspired by MR-fingerprinting, for fast and accurate reconstruction of the tracer distribution in 3D space using a single gamma detector image. As a further advantage, the method requires no pre-processing, i.e. filtering of the detector image. The method is very stable in its performance even for low exposure times. In our ex vivo experiments, we successfully located multiple Technetium 99m (Tc-99m) sources with an exposure time of only one second and still, with a very low relative L_2-error.