Mini gamma cameras for intra-operative nuclear tomographic reconstruction.

Abstract:
Nuclear imaging modalities like PET or SPECT are in extensive use in medical diagnostics. In a move towards personalized therapy, we present a flexible nuclear tomographic imaging system to enable intra-operative SPECT-like 3D imaging. The system consists of a miniaturized gamma camera mounted on a robot arm for flexible positioning, while spatio-temporal localization is provided by an optical tracking system. To facilitate statistical tomographic reconstruction of the radiotracer distribution using a maximum likelihood approach, a precise model of the mini gamma camera is generated by measurements. The entire system is evaluated in a series of experiments using a hot spot phantom, with a focus on criteria relevant for the intra-operative workflow, namely the number of required imaging positions as well as the required imaging time. The results show that high quality reconstructed images of simple hot spot configurations with positional errors of less than one millimeter are possible within acquisition times as short as 15s.

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