An agent-dependent enhanced optical projection tomography-guided system for lymph- node images reconstruction to optimize cancer detection

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I.ABSTRACT

The purpose of this work is to provide a system that regenerates images in a short amount of time while minimizing any existent noise in the model. An agent-dependent enhanced optical projection tomography-guided (ADEPT-GUI) system, utilized filtered back-projection (FBP), is created to perform the iterative reconstruction of lymph node images.

II.INTRODUCTION

Cancer continues to be one of the leading causes of death worldwide. As of 2020, 1,806,590 new cancer cases and 606,520 cancer deaths are recorded in the United States1. As a result, it is critical to develop techniques/technologies to assist surgeons in making fast and accurate decisions of whether to do more removal of tumor-draining lymph nodes while operating cancer surgeries. The agent-dependent enhanced optical projection tomography (ADEPT) system is a technology combining advancements in two areas. First is the optical projection imaging. The second is the "paired-agent" molecular imaging2. These attained images are transferred to the ADEPT-GUI system subsequently to reconstruct images. Physicians can then quickly check the tumor-draining lymph nodes and conclude whether to continue the operation.

III.METHODS

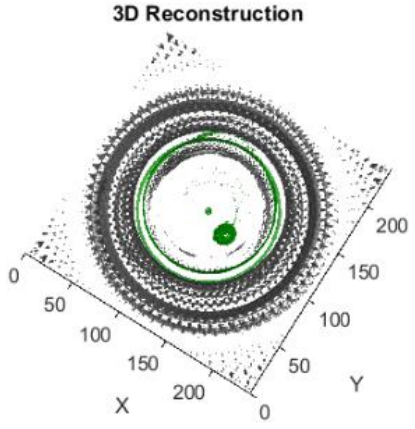
3.1 Filtered back-projection (FBP)

FBP is a common analytical reconstruction method that helps regenerate an object's image while decreasing embedded noises. The process is comprised of two parts, the filtered phase and the back-projection phase. Back-projection is the act of smearing different obtained 2D images at their taken angles. The images are then filtered to sharpen the results. Lastly, the sinogram will be inversed back through the built-in MATLAB iradon() function. The reconstruction operation is completed.

3.2 Maximum-likelihood expectation-maximization algorithm (MLEM)

MLEM is the algorithm frequently used in reconstructing images. Usually, there is an initial estimated image to start off the reconstruction. However, the computation is inherently slow. Therefore, our system has integrated FBP as the initial point of the MLEM technique to accelerate the reconstructing procedure. This combination enhances both the speed of the system and the quality of the images.

Figure 1: 3D reconstruction of a lymph node using the ADEPT system



powerful multivariate algorithm that builds efficient models for predicting the future values by maximizing the covariance between the past and future data.

IV.RESULTS

The ADEPT-GUI's ability to reconstruct a clear and sharp image of a lymph node contained in a tumor is seen in Fig 1. Although FBP is an excellent tool for image reconstructions, it is not clear enough for physicians to determine whether there is an artifact or a tumor. MLEM, on the other hand, has improved the image's quality so that the surgeons can make reliable decisions.

V.CONCLUSION

Compared to the MLEM technique, adding FBP into the procedure strengthens the system's ability. The ADEPT-GUI system shows a strong image reconstruction capacity and will be developed to optimize cancer detection.

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VIII. REFERENCES

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