Introduction

Morbidity from head and neck cancer is high and a complete removal of lymphatic tissue together with the tumor is often conducted. However, such interventions are unneeded in 70% of the patients. Sentinel lymph node biopsy, based on radioactive tracer liquid injected near the tumor, is a technique to improve staging of the malignancy and to avoid overtreatment.

Based on our previous works [1] we are able to fully reconstruct and visually represent the tracer distribution of a calibration target without the need of SPECT/CT related data [2]. Such information is then made available to the operator on a tablet computer display.

This poster describes a prototype of an augmented reality (AR) device that will be able to support the surgeon to visually identify tracer enriched lymph nodes for the biopsy.

Activity reconstruction

Reconstruction of the tracer activity is achieved by tackling the challenges imposed by the Inverse Problem Formulation.

- The Forward Problem: \( A(\hat{v}) = \hat{y} \)
- The Inverse Problem: \( \hat{y} = A(\hat{v}) \)

where \( A \) is the model, \( \hat{v} \) are the parameters, and \( \hat{y} \) are the measured data.

As the detector image is known \( (\hat{y}) \), a possibly good estimate of the unknown tracer distribution \( (\hat{v}) \) inside the patient can be achieved. Thanks to the design of our multi-pinhole collimator \( (A) \), disparity information is exploited to support a solution to this ill-posed problem.

Results

Augmented video image (orange blob)

Conclusion

An early prototype based on optical markers shows promising results and awaits testing with real experimental data.

Next steps are the development of a calibration scheme to relate the coordinate system with the layout of the detector and the evaluation of 3D-to-3D voxel-based mapping algorithms to improve the visual representation of the activity.

References
