Augmenting Scintigraphy Images with Pinhole Aligned Endoscopic Cameras: A Feasibility Study

ConferencePaper (Artikel, die in Tagungsbänden erschienen sind)

ID 3786380
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Year 2016
Title Augmenting Scintigraphy Images with Pinhole Aligned Endoscopic Cameras: A Feasibility Study
Editor(s) Zheng, Guoyan; Hongen , Liao; Jannin, Pierre; Cattin, Philippe; Lee , Su-Li
Book title (Conference Proceedings) Medical Imaging and Augmented Reality
Place of Conference Bern
Publisher Springer
Place of Publication Cham
ISSN/ISBN 978-3-319-43774-3 ; 978-3-319-43775-0
Morbidity of cancer is still high and this is especially true for squamous cell carcinoma in the oral cavity and oropharynx which is one of the most widespread cancers worldwide. To avoid spreading of the tumor, often the lymphatic tissue of the neck is removed together with the tumor. Such neck dissections are inherently dangerous for the patient and only required in roughly 30 % of the patients as has been shown by studies. To prevent overtreatments, sentinel lymph node biopsy is used where the first lymph node after the tumor is probed for cancerous cells. The lymphatic tissue is then only completely removed when tumor cells are found. This sentinel node is localized by means of detecting a radioactive tracer that is injected near the tumor. Its uptake is then measured and observed. State-of-the-art support for the specialist is a 1-dimensional audio-based gamma detection unit which makes it challenging to detect and excise the true sentinel lymph node for an effective histologic examination and therefore correct staging.This feasibility study presents the working principles and preliminary results of a scintigraphy device that is supported by augmented reality to aid the surgeon performing sentinel lymph node biopsy. Advances in detector- and sensor technology enable this leap forward for this type of intervention. We developed and tested a small-form multi-pinhole collimator with axis-aligned endoscopic cameras. As these cameras and the pinholes provide the same projective geometry, the augmentation of the gamma images of tracer enriched lymph nodes with optical images of the intervention site can be easily done, all without the need for a 3D depth map or synthetic model of the surgical scene.
Series title Lecture Notes in Computer Science
Number 9805
edoc-URL http://edoc.unibas.ch/54839/
Full Text on edoc No;
Digital Object Identifier DOI 10.1007/978-3-319-43775-0
ISI-Number INSPEC:16335359