Section: **Qualitätssicherung, Workflow, Ergonomie**

ID: 1

Abstract-Title:
QUALITÄTSSICHERUNG FÜR 3D-NAVIGATIONQUALITY ASSURANCE FOR 3D-NAVIGATION

Authors:
W. Freysinger[1], F. Kral[1], G. Diakov, M.S.[1], Z. Güler, Bakk Techn[1], R. Stoffner[2]
[1] 4D Visualisierung, HNO, Med. Uni Innsbruck
[2] Univ. Clinic of Diagnostic Radiology I, Department of Radiology, Innsbruck Medical University

Abstract-Text:
Purpose
The central problem of 3D-Navigation is to assess application accuracy. It is common practice to quote the root-mean-square error. It is known how to assess the quality of registration, especially rigid-body-registration, for most applications in 3D-navigation. The fiducial localization (FLE), fiducial registration (FRE) and the target relocation error(s) (TRE) provide the deviation between the actual position on a patient and the one calculated in the preoperative images. These three quantities relate to absolute distances. Unfortunately, infinite possibilities exist to combine deviations in the three standard orientations (axial, coronal, sagittal) to a vector with a specific length, namely the TRE as the error responsible for the clinical application accuracy.We to implement a statistic approach to supply this information intraoperatively.Method
After registrating the patient to the preoperative data the probe of the system should be placed on unique locations of the patient that allow estimating the application error / accuracy. The three standard orientations are measured over the whole accessible patient area. 3D-positions of the probe at suitable anatomic locations are read out digitally and fed into the algorithm. Based on a a Student t-Test it is decided, up to a certain user-specified error-probability, whether the data of the small sample (unknown mean and standard deviation) can be described by a specific normal distribution. So the small intraoperative sample can be tested against a normal distribution or a gold-standard. A simple implementation, currently in Matlab, is tested on a large data set that was acquired in the laboratory.Results
The approach is very sensitive to the quality of the data, as an analysis of a the large data set of the gold-standard. For (almost) normal distributed data this approach can be used within the preset level of confidence; failures of the algorithm allow to classify registration as well: non-normal distribution and large standard deviation of the intraoperative sample data. Both cases demand re-doing of the registration. Else, the algorithm comes up with predictions of the application error in the three standard planes with pre-set confidence levels as defined by the surgeon.This approach provides a detailed view of the deviations in space between actual and calculated position of a probe on the patient and in the preoperative data, respectively.ConclusionThe approach to provide an easy approach to assess the quality of an intraoperative patient-to-image-registration is being implemented on an open-source in-house 3D-navigation system and will be evaluated in-depth once this implementation step is positively absolved. The stochastic quality predictor will be an

integral part of this system.Acknowledgment
Parts of this work were financed under project 9318, Jubilee Funds of the Austrian National Bank, Vienna, Austria.