Section: **Segmentierung, Registrierung**

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Abstract-Title:
INTRAINTERVENTIONELLE REGISTRIERUNG VON 3D-ULTRASCHALLDATEN AUF GEFÄßBAUMMODELLE DER LEBERINTRAINTERVENTIONAL REGISTRATION OF 3D ULTRASOUND TO MODELS OF THE VASCULAR SYSTEM OF THE LIVER

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Abstract-Text:
Purpose
Regarding the Radiofrequency Ablation (RFA) used in the therapy of primary liver tumours and liver metastases, specific problems occur. Conventionally, the ablation needle is placed in the tumour under the guidance of an imaging method, such as CT or ultrasound. In our opinion ultrasound is the best intrainterventional imaging method, because it keeps the patient\'s exposure low and it is the low cost alternative. However, it is often desired to integrate preinterventional image data (CT, MRT) to overcome well known limitations of ultrasound, especially in case of hardly to depict lesions.We develop the represented method for a 3D ultrasound guided navigation system (LOCALITE SonoNavigator). The ultrasound probe is optically tracked, providing 3D ultrasound data in the patient\'s coordinate system. A rough registration of preinterventional data to the patient can be performed using anatomical landmarks. Because of tissue shift and different positioning during CT scanning and intervention the achieved accuracy is not optimal. Our aim is to incorporate 3D ultrasound to improve the registration quality. Problems arising thereby are for example gaps in the 3D ultrasound image emerging from the preparation of the 3D dataset and the impossibility of a direct mapping of grey values in US to MR or CT because of the different grey value distribution in the different modalities.

Method
Embedding as much previous knowledge as possible seems to make sense to ensure a registration that, despite all problems mentioned above, is accurate and fast enough. The introduced multimodal registration method is in contrast to most common methods not limited to the use of grey value information, but makes intensive use of model information of the vascular system gained from the preinterventional MR or CT image. Input to our method is a model of the patient\'s vascular system of the liver, comprising several information such as the position of branch points, thickness of vessels, their length and direction as well as neighbouring branches. This model is prepared beforehand by MeVis GmbH, Bremen. The model is used to guide the recognition of the tree structure in the ultrasound volume via a neural net approach and with this the registration process. By using this method disturbances as vessel structures, that in the ultrasound volume seem to be disconnected because of bigger gaps or special kinds of noise, can be overcome. Because of using previous knowledge the process is supposed to be very fast. The method can be classified as top-down or model-driven, it corresponds with the human

recognition process. Inspired by this it is self-evident not to look for anything, but to look for something that has a topology corresponding to the vascular model that is given by the MR or CT.

Results

First results are promising regarding the efficiency and matching accuracy. Further results are expected in the near future.

Conclusion

The presented method provides the registration of an intrainterventional captured 3D ultrasound image to a preinterventional taken CT or MR scan using vascular model information in extend to grey value information. It is supposed to be a major key to a significant improvement of speed and accuracy of intrainterventional registration processes. Using this method information gained from the preinterventional imaging could easily be integrated into the intervention process, resulting in a better reliability of the RFA.