

SEMI-AUTOMATIC LIVER AND LESION SEGMENTATION IN CT IMAGES

Prasad Pravda J. Ray^{1,2}, Oram Louise¹, Elle Ole Jakob^{1,2}, Kumar Rahul Prasanna¹

¹The Intervention Centre, Oslo University Hospital; ²Department of Informatics, University of Oslo

Liver and lesion segmentation

Primary liver cancer, which consists predominantly of **hepatocellular carcinoma (HCC)**, is the fifth most common cancer worldwide and the third most common cause of cancer mortality. In clinical routine, in-order to make decisions on liver resections, doctors require prior understanding on the **tumor volume and the functional liver volume**. A successful surgical resection of HCC requires complete removal of the tumour including a safety margin while sparing as much healthy tissue as possible. However, due to **technical and clinical difficulties** currently only a relatively low percentage of patients are eligible for **resection**, and the recurrence rate is considerable. **Segmentation** of the liver and tumor is valuable from medical perspective as well as from the point of view of Computer Vision. This is a complex problem as there exist many difficulties for segmentation. The liver has a **highly variable shape** and displays low difference of appearance compared to neighborhood organs. **Intensities** of the adjacent organs and tissues are very **similar** to liver tissue itself. This research work aims in developing a segmentation method that can provide efficient and robust solutions for creating **models for interventional guidance**.

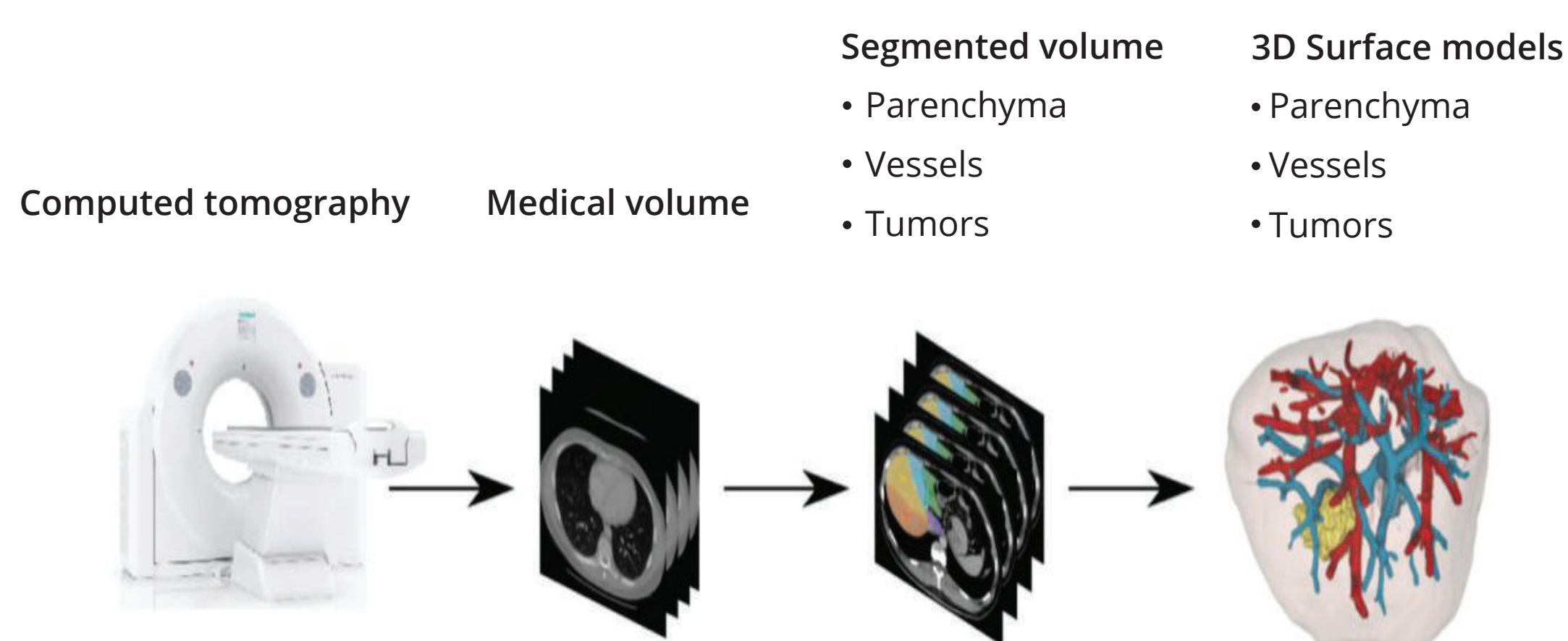


Figure 1: Development of planning system

3D Slicer as a tool

Semi-automatic method for creating large database

Developed in 3D Slicer - an open source platform

Work-flow starts with the user specifying the region of interest

Morphological operations for pre-processing

2D and 3D filtering used for optimal segmentation results

Semi-automatic segmentation results

Interactive approach in 3D Slicer applied to 10 CT datasets

Segmentation results compared with results from an expert

Percent volume error is measured as an average of 1.02%

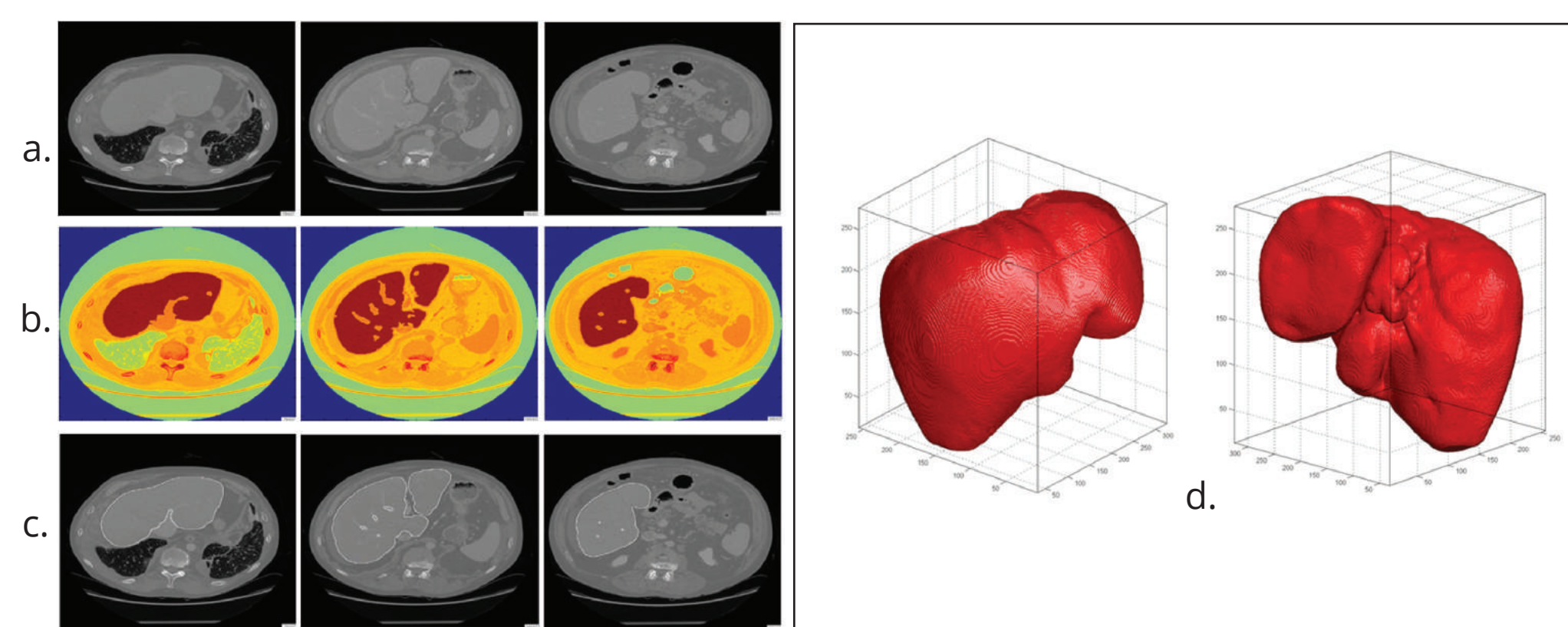


Figure 2: Liver segmentation on CT dataset illustrated in different steps

- a) Three different slices of same liver data
- b) Slices after 2D filtering
- c) Contours of final mask after 3D filtering
- d) 3D rendered views after segmentation

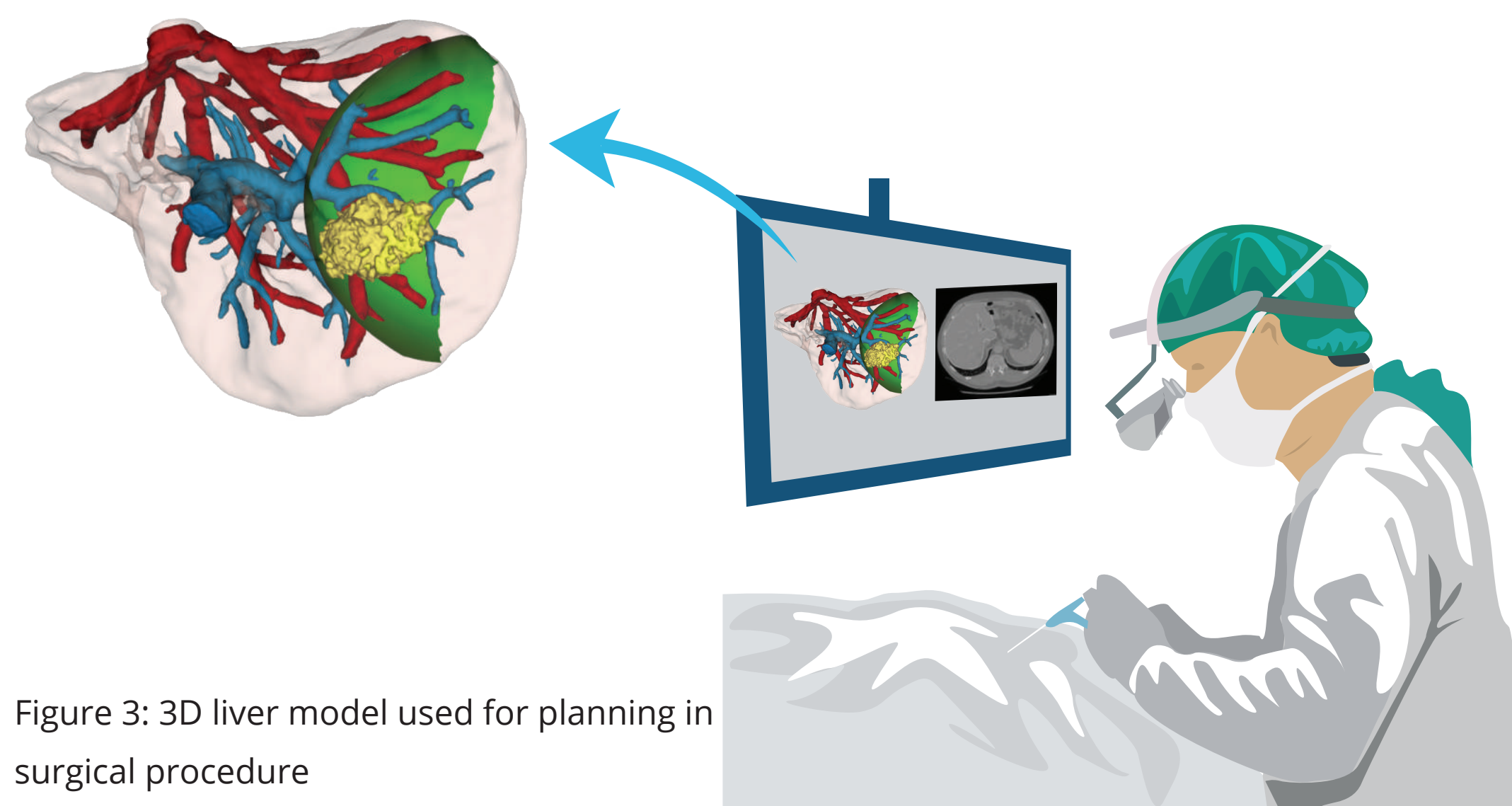


Figure 3: 3D liver model used for planning in surgical procedure

Use this data for CNN network

Validation in larger dataset

Ground truth database development

Use this dataset for CNN training

Fast and accurate automatic Liver segmentation



- [1] Litjens, G. et al. A survey on deep learning in medical image analysis. arXiv preprint arXiv:1702.05747 (2017).
 [2] X. Han, "Automatic liver lesion segmentation using a deep convolutional neural network method," arXiv preprint arXiv:1704.07239, 2017.
 [3] Fedorov A. et.al. "3D Slicer as an Image Computing Platform for the Quantitative Imaging Network", Magnetic resonance imaging. 2012;30(9):1323-1341. doi:10.1016/j.mri.2012.05.001.

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