Evaluation of an Interactive Segmentation Algorithm using Ultrasound Images of Pancreatic Cancer Liver Metastases

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Introduction

Metastatic pancreatic cancer has a poor over all survival of less than 7% of patients surving 5 years after the initial diagnosis. New chemotherapeutic strategies prolong the time of these patients during palliative treatment and thus the number of staging examinations [1,2]. Patients with solely in the liver localized pancreatic cancer metastatic disease are in general followed up using abdominal ultrasound during palliative treatment. Liver metastasis are segmented manually during the regular staging examinations. The results of these measurements often differ from one examiner to another. Additionally the measurement is time-consuming. In this work, we present the evaluation of a semiautomatic algorithm for segmentation of liver metastases originated from pancreatic cancer.

Methods

We retrospectively identified ultrasound images of pancreatic cancer liver metastasis (pancreatic adenocarcinoma and neuroendocrine neoplasms) that are not masked by markers or text. After removing all details, like name of the patient and date of the examination, two experts were asked to manually segment the borders of the metastasis. They have never seen the images bevore. After five weeks the two experts were offered a training including ten images to learn how to use the algorithm. Afterwards , they performed the semiautomatic segmentation of the metastasis, which were randomly distributed (**Figure 1**).

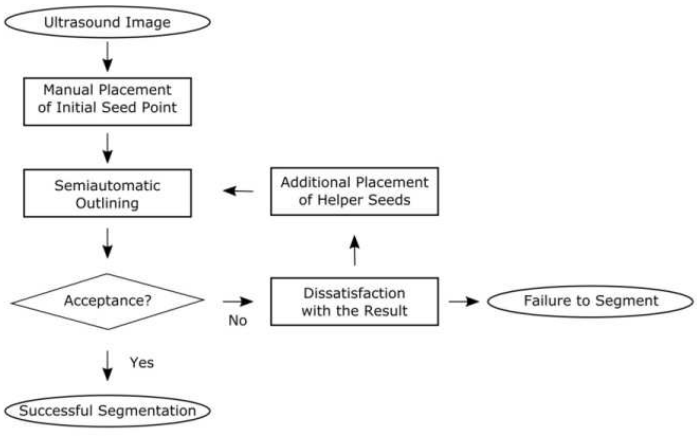

Figure 1: Flow chart of the segmentation algorithm

Results

105 images of pancreatic cancer metastasis were included in the analysis. The median lesion size was 20 mm. The examiners were satisfied with the segmentation result in up to 90% of the cases (examiner 1 in 92 cases and examiner 2 in 94 cases). The algorithm performed well with a dice similarity score of median up to 84%. Additionally both examiners performed the semiautomatic segmentation in median faster than the manual segmentation (**Figure 2 and 3**)

Figure 2: Semiautomatic segmentations marked as satisfied (left) and not satisfied (right) by both examiners. Manual segmentation is resembled by the red line and semiautomatic by the yellow line.

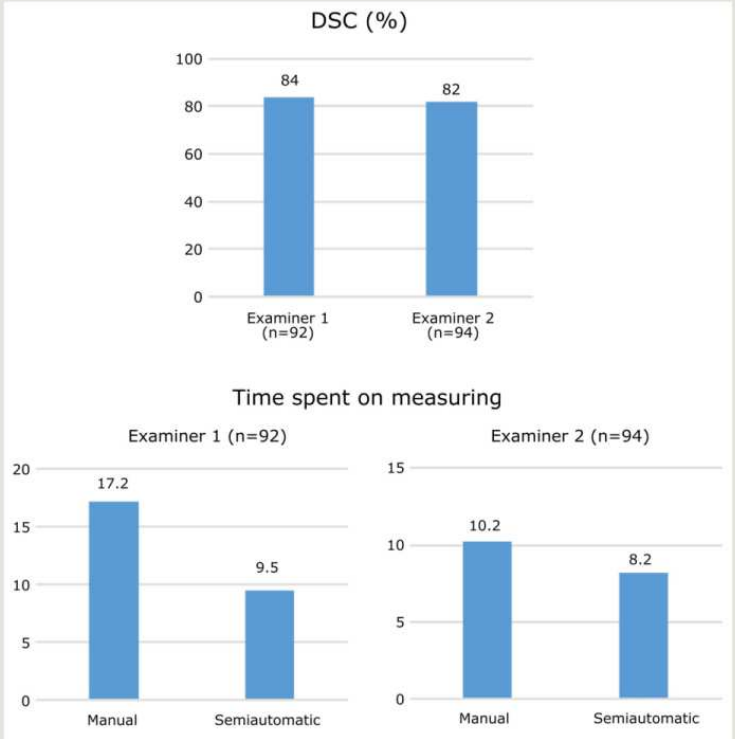

Figure 3: Median dice similarity scores (DSC) (resembling the overlap of manual and semiautomatic examination) are displayed in the upper diagram. The lower diagram displays the median time the examiners spent on performing segmentations per metastasis. Only segmentations marked as satisfied were included

Conclusion

In conclusion, this algorithm facilitates fast and accurate segmentation of liver metastases that could simplify this measurement in daily practice.

References

[1] Hann A, Bohle W, Egger J, Zoller W. „Feasibility of alternating induction and maintenance chemotherapy in pancreatic cancer." Sci Rep. 2017 Jan 31;7:41549.

[2] Hann A, Bohle W, Egger J, Zoller W. "Improvement in advanced pancreatic cancer survival with novel chemotherapeutic strategies - experience of a community based hospital." Z Gastroenterol. 2016 Oct;54(10):1138-1142.

No conflicts of interest. Contact: Alexander.Hann@uniklinik-ulm.de