

# Advanced image processing methods for automatic liver segmentation

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## ABSTRACT

Nowadays digital image processing and analysis is extensively used in different areas of human activities. One of these fields is medicine, where the enormous amount of data has to be processed. In diagnostic medicine, radiologists use for example computed tomography (CT) or magnetic resonance imaging (MRI) to help diagnose diseases or to perform surgical procedures. Although those high-end technologies are very sophisticated and developed, there is still room for improvements especially in the area of post-processing. For example to plan the liver resection, surgeon will need an accurate 3D model of a liver with its vessel system. To visualize 3D data, volume rendering method is available and can be directly used. Disadvantage of this technique is that it does not provide any other information than 3D models for visualization itself. To obtain models for hemodynamics simulations or even models where volume of certain part of the model could be measured, methods of advanced image processing have to be used.

The keystone of the digital image processing methods is an image segmentation which works with pixel intensity levels. Those techniques are sufficient in cases where different parts of the image have significant differences in intensities of pixels like in cases of bones segmentation. The soft tissues like liver and its vessel system are much more challenging due to low contrast and direct influence of other organs which have the same intensity levels of the pixels.

This paper presents advanced techniques of image segmentation suitable for automatic recognition of the human liver and its vessel system. The comparison of studied techniques is being made in terms of segmentation quality and algorithm speed. The main criterion for quality evaluation of each selected technique is the level of conformity between the automatically recognized boundary and reference boundary specified by experienced user. For all the tests sequences of CT and MRI images were used.

## REFERENCES

- [1] M. Sonka, V. Hlavac, R. Boyle, *Image Processing, Analysis and Machine Vision*, Thomson, 2006, ISBN 978-0-495-24428-7.
- [2] E. Neri, D. Caramella, C. Bartolozzi, *Image Processing in Radiology*, Springer, 2008, ISBN 978-3-540-49830-8.
- [3] Terry S. Yoo, *Insight into Images: Principles and Practice for Segmentation, Registration, and Image Analysis*, A K Peters/CRC Press, 2004, ISBN 978-1568812175.
- [4] S. Luo, X. Li, J. Li, *Review on the Methods of Automatic Liver Segmentation from Abdominal Images*, Journal of Computer and Communications, 2014, 2, 1-7. doi: 10.4236/jcc.2014.22001.