Preface

3D modeling of cirrhotic liver surfaces based on laparoscopic videos will render possible the quantification of fibrosis in almost real-time. Up to now, qualitative and verbal descriptions as well as video documentations had to be used.

Origin was the research of Dr.-Ing. Jan Marek Marcinczak, who has been supervising and supporting Mr. Painer's Master Thesis. During his PhD research Mr. Marcinczak has estimated the camera motion and the geometry of the organ surface based on complete video sequences [13]. His methods work off-line and non-causal. Based on this work, Mr. Painer has developed a causal method, which basically works on-line and in real-time.

Mr. Painer parallelized the algorithms and proved the performance of his implementation. He adjusted the methods for the complete reconstruction, consisting of a sparse reconstruction via Structure from Motion and a dense reconstruction via a variational approach, and embedded these into a software framework designed entirely by himself.

The computationally intensive dense reconstruction has been parallelized by Mr. Painer using CUDA and a self-designed class library to be executed on the graphics card. This class library takes care of clearing resources after usage to prevent resource leaks in the context of CUDA. The implementation takes only 55 seconds for the reconstruction of 30 frames consisting of sparse and dense reconstruction. Previous, non-causal algorithms required 30 minutes for the reconstruction.

Mr. Painer's Master Thesis has been awarded the Fokusfinder Preis 2015 of Initiative Bilderverarbeitung e.V. and the Karl H. Ditze Preis 2015 of Hamburg University of Technology.

The topic was motivated by Prof. Dr. Ansgar W. Lohse, Medical Director of I. Department of Internal Medicine of Universitätsklinikum Hamburg-Eppendorf (UKE). The cooperation has been accompanied by PD Dr. Ulrike Denzer, Dr. Julian Holzhüter and Dr. Tobias Werner of UKE. We cordially appreciate their cooperation.

Mr. Painer has skillfully solved all mathematically sophisticated difficulties during his Master Thesis and provided a scalable concurrent implementation, which can basically be executed in real-time on an adequate hardware platform. The result paves the way for supporting the clinicians both on-line during video capturing and for quantitative documentation. The feedback during the intervention can help improving the quality of the videos and the subsequent reconstructions. I hope for a positive response and a broad audience of this work.

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