Tumors are one of the most fatal diseases in first world countries. Currently, every fourth death in Germany is accounted to malignant tumors. Especially, tumors of the central nervous system show very low five-year survival rates of $\approx 21\%$ after treatment. The treatment of cerebral tumors consists of a combination of resection, and chemo-, and radiation therapy. The success of this treatment is highly dependent on the extent of the resection and the remaining parts of the tumor. Identifying the exact tumor borders is crucial for good resection results. Especially in brain tumor surgery no safety margin can be considered, due to high likelihood of the loss of functionality of the surrounding brain areas. Therefore, intraoperative support for the performing surgeon in identifying a suitable resection extend is crucial for a patients survival.

Intraoperative imaging has become an important addition to pre-operative MR imaging. Contrast enhanced ultrasound imaging enables the surgeons to assess the perfusion, and vascularization of tissues. Thus, a distinction of tumor and non-tumor tissue in real-time, without moving the patient or prolonged interruptions of the surgery is possible. However, the visual assessment of the imaging data is a demanding task and highly dependent on the experience of the surgeon.

To improve the image assessment, and subsequently the resection results, an automated classification of the contrast enhanced ultrasound data is proposed in this work. The approach applied model functions to describe the contrast agent bolus time course of each pixel of intracranial contrast enhanced ultrasound recordings. The recordings were obtained during resection surgery of 13 glioblastoma patients. In addition, spatial features were calculated to incorporate local differences in perfusion evoked by the chaotic growth of blood vessels induced by the tumor. Support vector machines, the state of the art machine learning algorithm for classification, were trained on model function param-
eters to differentiate tumor and non-tumor tissue. The classification results were used to evaluate the different model functions for their feasibility in this task as well as segmenting the imaging data, in order to obtain a comparison to the human performance.

The results of the classification showed a significantly increase in performance with the model functions which were developed in this work compared to three commonly used model functions. The combination of pure contrast agent time courses and spatial features performed best with a mean classification error of 5.85% on the 13 patient data sets.

The trained classifier was used to segment the data sets into tumor and non-tumor tissue. These segmentations were found to be almost identical to the segmentations obtained by an experienced neurosurgeon (accuracy 0.92).

Thus, the proposed approach for an automated classification was found to be a suitable method for the assessment of intracranial contrast enhanced ultrasound recordings of glioblastomas. It provides an additional source of information for resection decisions during surgery. In a next step the method has to be evaluated in a surgical setting in order to enable a direct comparison to other imaging technologies and to investigate the feasibility of the approach for resection control.