Radiotherapy (RT) is the treatment that involves the use of high energy radiations to destroy cancer cells in order to shrink tumours. Its effectiveness is achieved by damaging the tumour cells' DNA so that these are unable to reproduce themselves. Contouring, also referred to as delineation or segmentation, is an important step in RT workflow where objects of interest are isolated from the background in order to plan a treatment with accurate dose to the tumour and aiming to spare the surrounding tissues.

Literature study indicates that the contouring task is the weakest link in the search for accuracy in radiotherapy. Errors introduced in the contouring task, either from the machine or by human, lead to systematic errors which cannot be eliminated in the subsequent steps. Generally, there are three different ways of performing medical image segmentation: automatic, semi-automatic and manual. Among those methods, semi-automatic methods, i.e., interactive segmentation methods, are potentially the most promising approach as a well-designed semi-automatic method is able to combine the state of the art image analysis with physicians’ expertise to contribute to the effectiveness and efficiency of the segmentation method. Effectiveness and efficiency of an interactive segmentation method depends on the proper combination of physicians’ expertise and the capability of the image analysis method. The goal of this thesis is to

Propose effective and efficient HCI designs for the interactive segmentation.

By summarizing the findings in the literature study and field research, we set our focus in designing: 1) an user input approach and HCI tools and 2) HCI input devices to improve the effectiveness and the efficiency in interactive segmentation. From the results, we understood that, with the development of technology, computational algorithms may gradually take over the initial segmentation tasks. We expect that interactive segmentation is moving towards a correction task rather than a creation task. However, the necessity of physicians’ review and possible corrections in the post-processing is the rule rather than an exception. Future studies should focus on making the post-processing corrections faster instead of focusing on creating the contour.