



# Breast segmentation in MRI images

Project Management and Software Development  
for Medical Applications

## General Info

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## Project Abstract

Breast MRI imaging is heterogeneous and noisy. In this project, we will focus on the breast segmentation task, isolating and extracting each breast from different MRI sequences.

## Background and Motivation

Breast MRI is a 3D imaging intended to detect breast pathologies and the signs of breast cancer, in particular. Breast MRI exam generates multiple sequences to depict different aspects of the tissues. For example, we can find fat-saturated and non-fat-saturated sequences or pre- and post-contrast sequences [1]. That leads to heterogeneous and noisy 3D images and their analysis by a human operator, or software is not obvious. Segmenting and extracting breast objects from MRI sequences will be a clue for effective processing of such data, for example by computer-aided detection systems.

## Student's Tasks Description

In this project, you will build a software that shall allow to segment breasts in MRI sequences. That is, from a given input 3D sequence, the software shall generate two 3D outputs of the left and right breast. The software shall be able to process different MRI sequences (e.g., a non-fat saturated T1-weighted sequence, a fat-saturated gradient

echo T1-weighted pre-contrast sequence). You will have an opportunity to explore complex 3D medical images and write Python code to accomplish the task. You will also have a chance to work with deep-learning techniques to process the images [2].

## Technical Prerequisites

You need to be comfortable with Python, its dependencies (e.g., pip or conda), and IDE (e.g., PyCharm). Ideally you need some knowledge in image processing and related libraries (e.g., SimpleITK, scikit-image)

## References

- [1] Saha et al. A machine learning approach to radiogenomics of breast cancer: a study of 922 subjects and 529 DCE-MRI features.
- [2] Hirsch et al. Radiologist-Level Performance by Using Deep Learning for Segmentation of Breast Cancers on MRI Scans <https://pubs.rsna.org/doi/10.1148/ryai.200231>

Please send the completed proposal to [ardit.ramadani@tum.de](mailto:ardit.ramadani@tum.de), [lennart.bastian@tum.de](mailto:lennart.bastian@tum.de) and [tianyu.song@tum.de](mailto:tianyu.song@tum.de). Please note that this proposal will be evaluated by the BMC coordinators and will be assigned to a student only in case of acceptance.