

Medical image registration methods focused on the problem of missing data

Preludium 15 – General Public Summary

The problem of image registration with missing data is a fundamental problem for a calculation of a correct deformation field, and in a consequence, the correct registration of the source and the target image. The problem of missing data is an extremely common problem in the process of medical image registration. It can be a consequence of, e.g. a tumor resection, a mass loss, or the structure of interest volume change during the therapy. The most challenging case of missing data problem happens when the structure of interest is completely missing in the source or the target image. The problem is still unsolved and the state-of-the-art algorithms are unable to determine the correct deformations.

The project importance can be illustrated by statistics about the cancer incidence in Poland and worldwide. They clearly show that the trend is growing. Usually, after a resection of cancer, a supportive therapy is necessary which requires medical image registration of the image before acquired before surgery to the image acquired after surgery. It is a classical problem of medical image registration with missing data. Therefore, the increase of knowledge about medical image registration with missing data can lead to further medical research about the increase of the supportive therapy quality.

The project aims to increase the knowledge about medical image processing and analysis by the development of algorithms dedicated to medical image registration with missing data.

During the project, the research using the artificial phantoms, the mechanical phantom, and the real, medical data will be performed. The real, medical data will include patients before and after the surgical resection of breast cancer (Figure 1.). Novel algorithms dedicated to the medical image registration with missing data will be proposed. What is more, new quantitative evaluation methods will be introduced which will take into account the missing data problem. The proposed methods will be compared to the state-of-the-art methods using both quantitative methods, as well as the qualitative evaluation by medical experts.

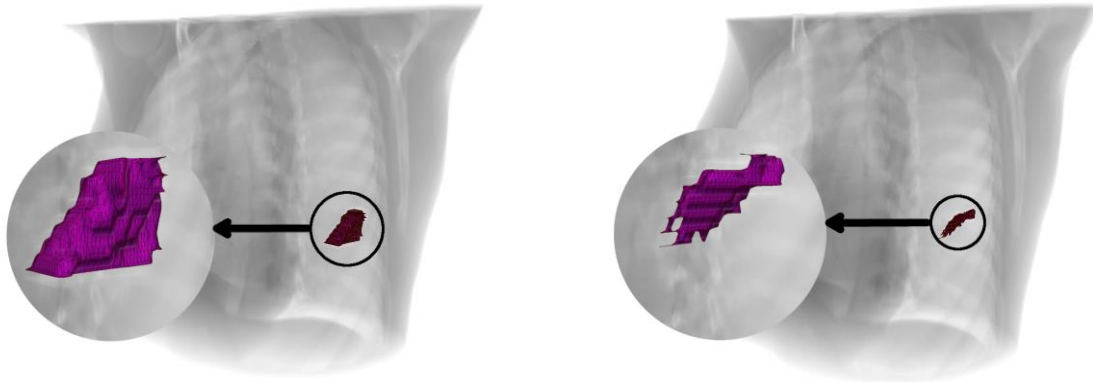


Figure 1. An example of medical image registration with missing data dedicated to tumor bed localization problem. On the left the tumor before resection and on the right the deformed tumor after the image registration are shown. The visualization presents that the image registration calculated the deformation field incorrectly. [Wodzinski et. al. *Improving Oncoplastic Breast... Phys & Med. & Biol*, 2018].