# Visualization tool for the evaluation of medical image registration

Project Management and Software Development
for Medical Applications

## General Info

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## Project Abstract

Medical image registration is an important step in many medical imaging pipelines and subject to intensive research. The quantitative evaluation of registration algorithms is not a trivial task, because typically a ground truth does not exist, and surrogate measures must be used. Qualitative assessment is an essential part in the evaluation. In this project, the student will design and develop a visualization platform for image registration to facilitate the evaluation and comparison of algorithms for 2D and 3D medical images and potentially also allow for manual annotations, quantitative evaluation, and other features.

## Background and Motivation

Medical image registration is the process of spatially aligning two or more images, so that corresponding voxels describe the same anatomical position [1]. Typically, a ground truth – the true spatial deformation between anatomical structures – is unknown, and the quantitative evaluation is performed using surrogate measures. Qualitative evaluation is often essential. However, typical visualization platforms, such as MITK [2], ITK-snap [3], are not designed especially for image registration and lack some desired functionalities. Many researchers implement their own visualization scripts, but an independent, lightweight, and easy-to-use solution would be desirable.

The outcome of this project will be a free open-source visualization tool for facilitating the evaluation of medical image registration algorithms.

## Student's Tasks Description

The student will design and develop a visualization platform for 2D and 3D medical image registration. For this, the student will need to identify the required features, such as different visualizations of the registered images, and visualizations of the deformation fields. Additional features could potentially include manual annotations, quantitative evaluations, and baseline registration algorithms.

The student will implement the software in C++ using Qt and/or Python.

## Technical Prerequisites

The student should be familiar with Python and C++.

Basic knowledge of computer vision and medical image processing is required.

## References

[1] Rueckert, Daniel, and Julia A. Schnabel. "Medical image registration." *Biomedical image processing*, 131-154, 2010.

[2] https://www.mitk.org/wiki/The_Medical_Imaging_Interaction_Toolkit_(MITK)

[3] http://www.itksnap.org