University of Basel
Department of
Biomedical Engineering

University of Basel, Department of Biomedical Engineering, Gewerbestrasse 14, 4123 Allschwil

Master of Science – Biomedical Engineering
Thesis Proposal

Improving spatial resolution in micro computed tomography of human tissues and medical implants

High-resolution hard X-ray micro computed tomography (µCT) allows for the non-destructive, three-dimensional visualization of objects with resolution down to the nanometer scale. Our team utilizes µCT to image human tissues in health and disease. Based on these unique imaging data, anatomical atlases of partial or entire organs with (sub-)cellular details are generated.

Currently available detector arrays are composed of several thousand pixels each of the two orthogonal directions. Therefore, we are faced a trade-off between imaged volume and spatial resolution. Image stitching techniques are one approach to overcome this limitation, but often lead to artefacts because of the cone-beam geometry. An alternative is to implement a ***super-resolution*** technique, where a higher resolution image is reconstructed from a series of images with lower spatial resolution.

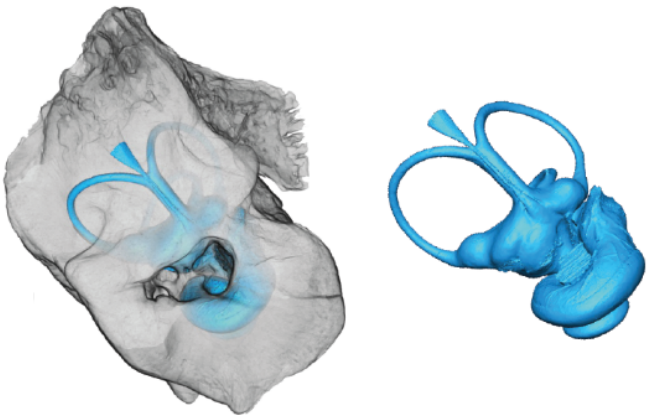
The goal of this thesis project is the implementation of a super-resolution approach into the nanotom m µCT system. The project consists of three main tasks:

1. Implementation of a customizable data processing and tomographic reconstruction pipeline,
2. Development of a super-resolution acquisition protocol and reconstruction algorithm,
3. Experimental validation and quantification of the super-resolution µCT system.

These developments will be used to visualize human tissues rivaling the gold-standard approach achieved with histological processing. This technique should be also applied for the imaging of unique objects.

Nature of the Thesis

Experimental: 40%
Programming: 30%
Documentation: 30%



Specific Requirements

Basic programming experience is highly beneficial.
Experience with MATLAB is a plus.
Experience with image processing or CT is a plus.

Supervisor

Dr. Georg Schulz or Prof. Dr. Bert Müller
Biomaterials Science Center

Collaborators

Griffin Rodgers, PhD Student

Contact

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