

# Simulating brain shift with soft-embalmed brains

Project Management and Software Development  
for Medical Applications

## General Info

Project Title: Simulating brainshift with soft-embalmed brains

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## Project Abstract

In order to register pre- and intra-operative images in a neurosurgical setting, brain shift has to be compensated. Tissue models that mimic the behavior of brain are needed to test and validate image registration algorithms in this field.

## Background and Motivation

Brain shift occurs when skull and dura mater (part of the meninges surrounding the brain) are opened in order to operate on the brain. This non-linear tissue movement, makes relating pre-operative with intra-operative imaging especially challenging.

In this context, testing and validation of registration algorithms benefits from phantoms (tissue models) that behave close to living brain tissue in terms of deformation and shrinkage over time. Due to their almost lifelike properties, we want to use porcine brains that are embalmed with the "phenol technique" to model brain shift.

The "phenol technique" is a new soft embalming technique that has been reported to conserve gross anatomy and mechanical tissue properties, thus behaving close to freshly excised tissue. Additionally, it overcomes limitations of classical

embalming methods, such as toxicity and alteration of mechanical properties (stiffness).

In this project we want to compare the behavior of fresh and embalmed (classical and phenol technique) porcine brains. To this end we track the surface of the tissue and its deformation and shrinkage over time with an RGB-D camera. The resulting point clouds then need to be registered and their size evaluated.

## Student's Tasks Description

- Understand properties and limitations of different embalming techniques (student can also learn how to embalm tissue if he/she is interested)
- Implement experimental set-up with RGB-D camera for live tissue surface tracking
- Register and compare 3D point clouds to quantify tissue shrinkage
- Generate dataset to be used for further research
- Provide proper documentation of all steps

## Technical Prerequisites

- Matlab, python or C++
- Basic skills in computer vision

Optional (can be acquired during the project):

- 3D point cloud registration
- Working with versioning tools, preferably git

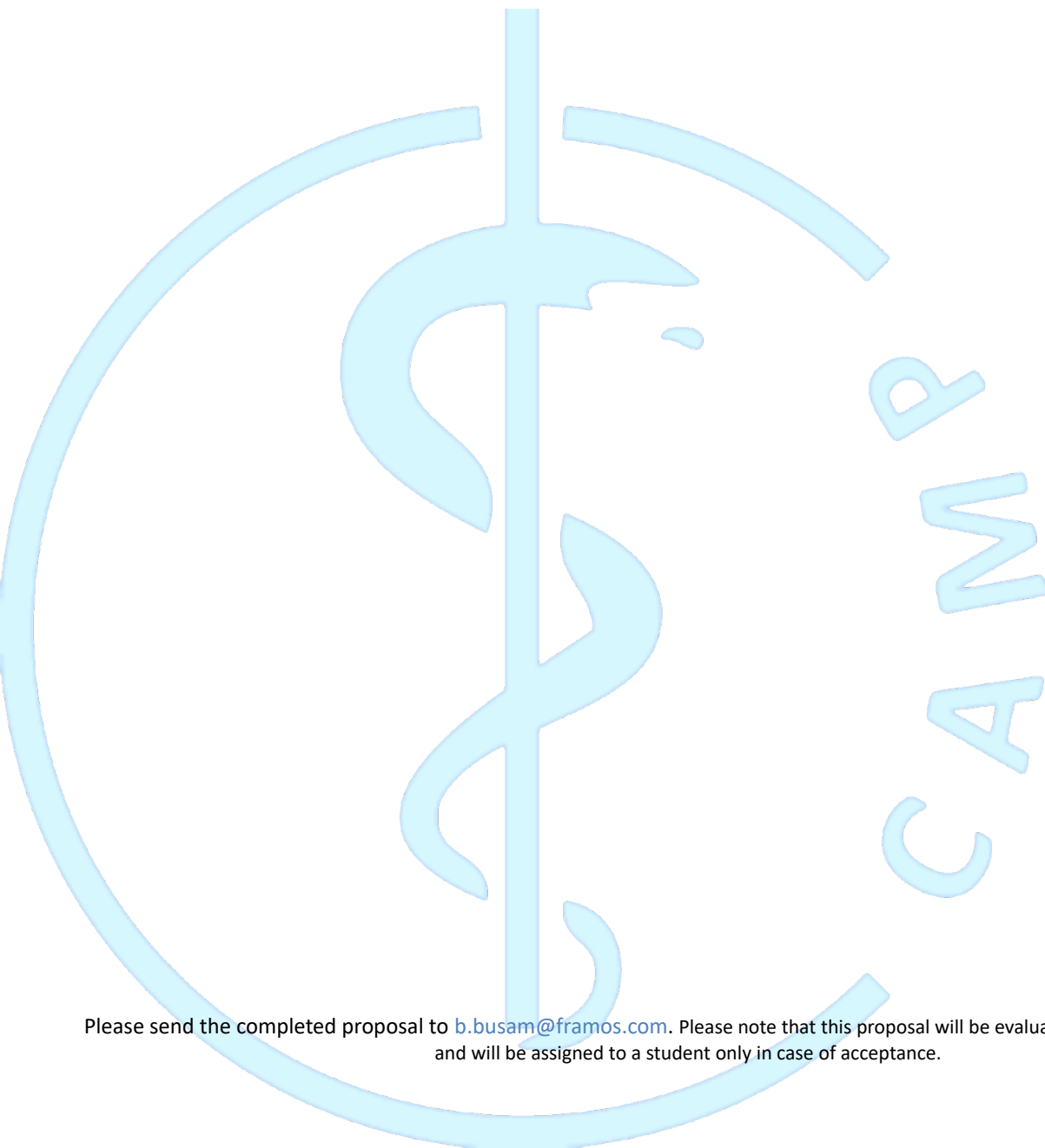
## References

Barton, D.P., et. al: Dissection of soft-preserved cadavers in the training of gynaecological oncologists: report of the \_rst uk workshop. Gynecologic oncology 113(3), 352{356 (2009)



Kim, Youngjung, et al. "Structure selective depth superresolution for rgb-d cameras." IEEE Transactions on Image Processing 25.11 (2016): 5227-5238.

Gerard, Ian J., et al. "Brain shift in neuronavigation of brain tumors: A review." Medical image analysis 35 (2017): 403-420.



Please send the completed proposal to [b.busam@framos.com](mailto:b.busam@framos.com). Please note that this proposal will be evaluated by the BMC coordinators and will be assigned to a student only in case of acceptance.