Master or Semester project

Location: EPFL AVP-CP CIBM-AIT, Bâtiment CH F. / Campus Biotech, Geneva
Dates/Duration: Spring/Autumn 2022/4 – 6 months.

Development of a segmentation tool to measure subcutaneous implant volumes

Reconstructive surgery of the breasts after tumorectomy in cancer patients currently requires an invasive procedure performed under general anesthesia that has to be repeated several times. It consists in re-injection into the breasts of fat that has been collected at another place (lipofilling). Therefore, there is an important need for innovative technologies allowing safe and easy reconstruction. The implant in development is an injectable biodegradable scaffold aiming at restoring the lost volume and allowing soft tissue regeneration for a long-lasting natural looking. After subcutaneous injection in mice, longitudinal follow-up of the implant outcome/performance requires histological analysis to characterize the tissues, as well as MRI scans to measure the volumes over time. Currently, manual segmentation of the implant on all MRI scans is performed, though very time-consuming. Hence, an automatic segmentation procedure, able to speed up the image preprocessing while maintaining a high degree of precision would be desirable.

The aim of the study is: 1) to develop a new segmentation tool to measure the implant volume; and 2) to assess in vivo and longitudinally the implant size and colonization using MRI (T_2 weighted images) and the developed segmentation tool. All the MRI experiments are performed on a 14.1T MRI system.

The project will involve mainly data processing (developing and validation of the segmentation tool). The student involved can also participate during the MRI experiments.

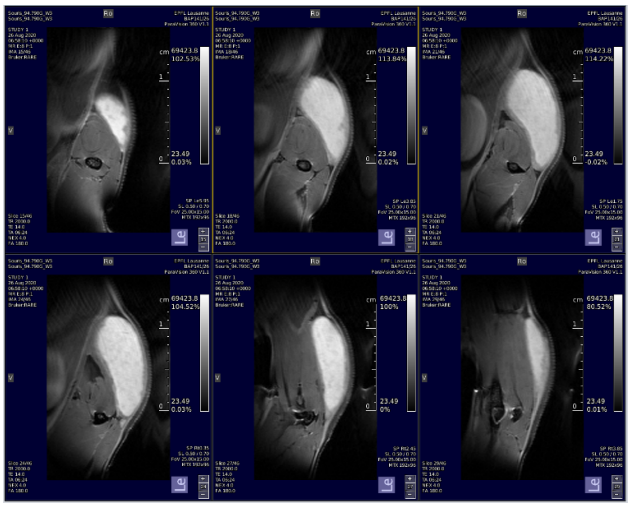

Figure 1: T_2 weighted images of the implant acquired at 14.1T

References

[1] Sharma and Aggarval, Automated medical image segmentation techniques, J Med Phys. 2010 Jan-Mar; 35(1): 3–14.
[2] A Béduer, N Piacentini, et. al., Additive manufacturing of hierarchical injectable scaffolds for tissue engineering, Acta Biomater. 2018 Aug;76:71-79

Supervisor

- **Supervisors:**
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Skills

Qualifications, previous experience and background: This project is suitable for students with a background/knowledge in physics or biomedical physics, signal processing, machine learning or computer science who are interested in biomedical applications of magnetic resonance imaging (MRI), and image processing. Experience in programming (Matlab and/or Python), machine learning & image processing is desirable.

How to apply: Please send your CV and motivation letter: cristina.cudalbu@epfl.ch, maria.preti@epfl.ch,

About CIBM

The CIBM Center for Biomedical Imaging was founded in 2004 and is the result of a major research and teaching initiative of the partners in the Science-Vie-Société (SVS) project between the Ecole Polytechnique Fédérale de Lausanne (EPFL), the Université de Lausanne (UNIL), Université de Genève (UNIGE), the Hôpitaux Universitaires de Genève (HUG) and the Centre Hospitalier Universitaire Vaudois (CHUV), with the generous support from the Fondation Leenaards and Fondation Louis-Jeantet.
CIBM brings together highly qualified, diverse, complementary and multidisciplinary groups of people with common interest in biomedical imaging.

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