CREATIS

Centre de Recherche en Imagerie Médicale

www.creatis.insa-lyon.fr

ABOUT CREATIS LAB

CREATIS is a biomedical imaging research laboratory, located at Lyon (France) with about 200 persons, whose main areas of excellence and international influence are linked to two fundamental problems, namely:

- Identification of major health issues that can be addressed by imaging
- Identification of theoretical barriers in biomedical imaging related to signal and image processing, modelling and numerical simulation.

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CREATIS meets these challenges through a multidisciplinary approach, based on a matrix organization which stimulates interaction between six research teams working in information and communication science and technology, engineering sciences and life sciences.
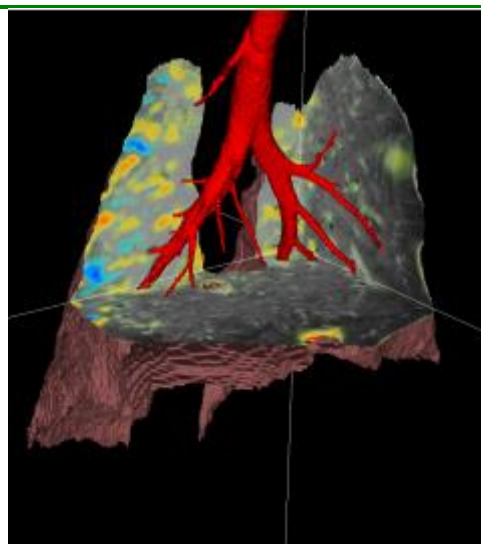
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PROJECT #1
LUNG SEGMENTATION IN 3D CT IMAGES OF SUBJECTS WITH ARDS

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UNIVERSITÉ JEAN MONNET SAINT-ÉTIENNE

BACKGROUND: The acute respiratory-distress syndrome (ARDS) is a severe state of the lungs (mortality 40%) characterized by heterogeneous increase of tissue density. The settings of mechanical ventilation used to maintain the patient alive need to be carefully customized. This could be done based on CT images, but existing methods use manual lung segmentation and don't account for lung motion. We developed a workflow involving image registration and segmentation, devised for studies on animal models of ARDS. This workflow, combining various tools (Matlab, elastix, C++ classes…) was deployed on CREATIS computing cluster and used on images from one study by a PhD student specialized in IT.

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OBJECTIVES: The first objective is to export this processing pipeline from the cluster to a computational grid and make it usable by medical doctors. This requires analyzing the structure of the pipeline and possibly adapting / optimizing it for execution of the grid, as well as developing a simple user-friendly GUI. If the first objective is achieved quickly enough, the trainee will have an opportunity to contribute to the development of new segmentation and/or registration methods based on deep learning.

Site Université Lyon 1 – ESCPE :
Campus LyonTech la Doua – Université Lyon1, ESCPE
3, rue Victor Grignard
69616 Villeurbanne Cedex, France
Tél. : +33 (0)4 72 44 80 84 / +33 (0)4 72 44 80 15
Fax : +33 (0)4 72 44 81 99
e-mail : prénom.nom@creatis.univ-lyon1.fr

Site INSA : CREATIS - Direction
Campus LyonTech la Doua – INSA de Lyon
Bât. Blaise Pascal - 7 avenue Jean Capelle
69621 Villeurbanne Cedex, France
Tél. : +33 (0)4 72 43 82 27
Fax : +33 (0)4 72 43 85 96
e-mail : prénom.nom@creatis.insa-lyon.fr

Site Hospitalier :
Hôpital Louis Pradel,
28 avenue du Doyen Lépine,
69677 Bron Cedex, France
Tél. : +33 (0)4 72 68 49 09
Fax : +33 (0)4 72 68 49 16
e-mail : prénom.nom@creatis.univ-lyon1.fr

SKILLS: The trainee is expected to have good programming skills, both in script and structured languages. Skills in image processing, Matlab, elastix, C++, and computer graphics, as well as in project management, linux, creating image dockers, and possibly in deep learning, will be useful.

LOCATION: CREATIS laboratory, LyonTech la Doua campus, France

SUPERVISORS: scientific – Maciej Orkisz (maciej.orkisz@creatis.insa-lyon.fr), technical – Eduardo E. Dávila Serrano (davila@creatis.insa-lyon.fr) and Frédéric Cervenansky (frederic.cervenansky@creatis.insa-lyon.fr).

PROJECT #2
ANNOTATION WEB TOOL DEVELOPMENT

BACKGROUND: In parallel with the growth of artificial intelligence and the development of new image analysis tools, the continuous increase in the quantity of data (+25% of scanners and +79% of MRIs in 10 years in France) has facilitated the emergence of a new discipline: radiomics. By analogy with other "omics", radiomics consists of converting a medical image into a large space of exploitable characteristics, not identifiable to the naked eye: the radiom. The underlying hypothesis is that changes at various microscopic scales (genetic, molecular, cellular or tissue) caused by a disease can be contained in the image at the macroscopic scale. It provides a source of important information in oncology such as tumour heterogeneity and would allow the identification of key tissue components. Radiomics thus appears as the link between medical imaging and precision medicine. However, it requires the creation of large annotated databases (big data) in order to prototype robust predictive models that can provide answers to current questions in precision medicine. Within the Radiology Department of the Léon Bérard Center, in connection with a project to create an artificial intelligence department, the implementation of an ecosystem to promote the rapid creation of these databases is underway. The deployment of this ecosystem can be achieved through two main axes: The rapid and prospective annotation of images by the radiologist in his daily practice and the storage and management of the data generated.

OBJECTIVES: Initial developments have led to the implementation of an online annotation tool allowing PACS querying and contour saving. However, a certain number of improvements are necessary in order to make the tool usable in clinical routine. This intership focuses on the implementation of an automatic segmentation (2D/3D) of the target lesion, the extension of the type of data that should be visualized and the secure and anonymized export of the segmentation masks to a local data warehouse. This interface will have to be scalable in order

to allow the future implementation of plug-ins, radiom extraction and data sharing with other centres of the UNICANCER network.

SKILLS: The intern must have a good knowledge of programming, and in particular web languages:
- Javascript, React (front-end)
- Yarn, npm, python (back-end)
Knowledge in image processing would be a plus in order to adapt and implement one or more segmentation algorithms in the target language.
Knowledge of medical imaging may allow for greater interaction with stakeholders.

LOCATION: CREATIS Laboratory - Léon Bérard center site (Radiology Department)

SUPERVISORS: Frederic Cervenansky (frederic.cervenansky@creatis.insa-lyon.fr), Benjamin Leporq (benjamin.leporq@creatis.insa-lyon.fr), Helene Ratiney (helene.ratiney@creatis.insa-lyon.fr).