Job Position	
Job title	**Postdoc: Prediction of response to treatment of stroke patients using a deep learning approach**
Employer	**Université Claude Bernard Lyon 1 (UCLB) – Laboratoire CREATIS**
Context and objectives of the post-doc	The general objective of the proposed post-doct falls within the framework of the **RHU BOOSTER** (*Brain clOt persOnalized therapeutic Strategies for sTroke Emergent Reperfusion*; PI: Pr Mikael Mazighi, RHU 2019) and more particularly of **work package 2** (WP leader, Tae-Hee Cho). The goal of RHU BOOSTER is to develop personalized, emergency management of ischemic stroke. The aim is to refine the prognostication of patients' evolution and response to therapy from baseline clinical and radiological characteristics with machine learning (deep learning). Specifically, we aim **to develop and validate predictive algorithms of (1) the voxel-wise risk of infarction and (2) of clinical outcome following standard and novel reperfusion strategies**. The work to be carried out as part of the post-doctorate will consist in meeting the following **three objectives**: 1) **Transfer learning**. The host team has published early work based on T2-FLAIR MRI ground truth [1-5], however the RHU project database tends to develop mostly on CT ground truth. This implies the need to transfer knowledge of the previously constructed model from MRI to CT. For this, different approaches could be considered (methods of adapting domains or different types of GAN). 2) **Integration of heterogeneous data**. The host team developed its first models solely on the image database based on the voxel [1-4] or the complete image [5], but it is known that clinical or biological data also have a weight. in the therapeutic decision. This implies the need to merge heterogeneous data in the same model where different approaches (late, early or in cascades) could be considered and tested. 3) **Prediction of clinical outcome**. Our team has so far developed predictive models of tissue outcome (extent and location of the final infarct) [1-5] but clinical outcome is a central objective. This requires that the model be taught a regression task (according to a clinical score) and not a classification task. For this, different types of architectures, encoding (integer, one hot encoding) and loss will be considered. The post-doctoral fellow will work in conjunction with clinical research professionals (clinical studies technician, neurologists and radiologists) researchers and partners in relation to data (image bank and data collection / upload) in order to meet the objectives of the RHU program. The various studies will be based on clinical, biological and imaging data available thanks to the RHU BOOSTER partner teams.
Tasks	• Development and realization of machine learning models in line with the research objectives of the RHU; drafting of statistical processing reports and co-writing of manuscripts for scientific publications associated with the work carried out and submission of abstracts to international congresses. • Assistance in the deployment of the biomedical data warehouse within the scope of the RHU, including the establishment of procedures for standardizing and uploading data within the warehouse. • Participation in the promotion and training of the RHU teams in the use of developed and existing machine learning models.
Candidate profile	<u>Knowledge and know-how:</u> • Doctorate in data science • Knowledge of biomedical databases and repositories • Mastery of Python, SQL, Matlab, R programming environments • Mastery of one or more deep learning machine learning libraries: Caffe, Tensorflow, PyTorch • An interest in the field of health or biology is essential • English (written, read, spoken)

	Skills • Rigor in data management and analyzes • Ability to write and communicate the results of the analyzes produced • Autonomy and ability to take initiatives and make proposals. • Ability to work in a team
Line managers	Pr Tae-Hee CHO, Pr David ROUSSEAU, Dr Carole FRINDEL
Place of employment	CREATIS - Site INSA Léonard de Vinci Bâtiment Léonard de Vinci (401, 2ème étage) 21 avenue Jean Capelle 69621 Villeurbanne cedex FRANCE
Remuneration	According to UCBL grid and experiences
Type of contrat	12-36 months post-doctoral contract
Starting date	As soon as possible
Contact	tae-hee.cho@chu-lyon.fr, david.rousseau@univ-angers.fr, carole.frindel@insa-lyon.fr,
References	1. Debs, N., Giacalone, M., Rasti, P., Cho, T. H., Frindel, C., & Rousseau, D. (2018). Perfusion MRI in stroke as a regional spatio-temporal texture. In *Joint Annual Meeting ISMRM-ESMRMB 2018*. 2. Giacalone, M., Rasti, P., Debs, N., Frindel, C., Cho, T. H., Grenier, E., & Rousseau, D. (2018). Local spatio-temporal encoding of raw perfusion MRI for the prediction of final lesion in stroke. *Medical image analysis*, *50*, 117-126. 3. Debs, N., Decroocq, M., Cho, T. H., Rousseau, D., & Frindel, C. (2019, October). Evaluation of the realism of an MRI simulator for stroke lesion prediction using convolutional neural network. In *International Workshop on Simulation and Synthesis in Medical Imaging* (pp. 151-160). Springer, Cham. 4. Debs, N., Rasti, P., Victor, L., Cho, T. H., Frindel, C., & Rousseau, D. (2020). Simulated perfusion MRI data to boost training of convolutional neural networks for lesion fate prediction in acute stroke. *Computers in biology and medicine*, *116*, 103579. 5. Debs, N., Cho, T. H., Rousseau, D., Berthezène, Y., Buisson, M., Eker, O., ... & Frindel, C. (2021). Impact of the reperfusion status for predicting the final stroke infarct using deep learning. *NeuroImage: Clinical*, *29*, 102548.