Research Grants for PhD students from the China Scholarship Council

Information Form (please read the guidelines carefully on the website www-csc.utt.fr)

Supervisor's name : Delachartre | Given names : Philippe

Status (prof., assistant prof., …) : Professor

Laboratory :	CREATIS	Website address : https://www.creatis.insa-lyon.fr/site7/en
Institution :	INSA LYON	Website address : https://www.insa-lyon.fr/

Scientific competence of the supervisor:

ultrasound signal and image processing, medical imaging, segmentation, machine/deep learning

Two major publications in the field proposed for the PhD :

1. M. Martin, Sciolla, B., Quetin, P., et Delachartre, P., Automatic segmentation of the cerebral ventricle in neonates using deep learning with 3D reconstructed freehand ultrasound imaging, in IEEE International
2. P. Wang, N. G. Cuccolo, R. Tyagi, I. Hacihaliloglu, V. M. Patel, "Automatic real-time CNN-based neonatal brain ventricles segmentation," 2018 IEEE 15th ISBI, Washington, DC, 2018, pp. 716-719.

Website address of the personal page : https://www.creatis.insa-lyon.fr/~phild/

Supervisor's email : philippe.delachartre@insa-lyon.fr

Description of the research work proposed for a PhD ***Topic # (see list) :*** III-3

Title : Deep learning segmentation of premature neonate cerebral structures in 3D ultrasound imaging

Subject :

The clinical practice in the field of preterm newborn follow-up is based on visual inspection of 2D ultrasound brain imaging (cranial ultrasound – cUS). Magnetic Resonance Imaging (MRI) is the gold standard tool but, for reason of cost and accessibility, it is limited to 10% of the preterm infants. This PhD thesis proposes to contribute to the development of a cUS diagnostic brain imaging tool applicable to the entire population of prematurely born children. It is based on an instrumentation component for the reconstruction of images to obtain ultrasound volumes of the brain and a deep learning segmentation part for calculation of the volumes of different brain structures or anomalies to be compared to the measured volume in MRI. 3D brain ultrasound imaging remains a key element for performing quantitative examinations. One of the only ways to obtain resolution volumes compatible with brain structure segmentation is to manually scan the fontanel. We will have little annotated data, which means that we will have to develop and combine supervised and unsupervised methods. Futhermore, the low contrast between structures, the speckle noise characteristic of these images leads to uncertainty about the annotations. For all these reasons, it is important to develop an automated solution whose design choices respect the constraints and conditions of use in the hospital environment.

Keywords :

medical imaging, instrumentation, reconstruction, detection, segmentation, machine learning, deep learning with weak supervision

Expected collaborations :

We expect scientific collaborations with some groups: (1) Ampère Lab for the instrumentation part, (2) Zhengjun Liu, Harbin Institute of Technology for the segmentation part.

Background required from the applicant :

The candidate should ideally have good instrumentation skills and a solid knowledge of deep learning methods. Good programming skills are also required (python and deep learning library) as well as a taste for experimentation on mechatronic prototypes. We are looking for an enthusiastic and autonomous student, highly motivated and interested in multidisciplinary research.

Existence of a PDF file detailing the proposal ("yes" or "no") : yes

(see guidelines on the website www-csc.utt.fr)