Post-doctoral fellowship proposal

Part 1: Scientific sheet	
title	**CHRONOS: Evaluation of the Motor Functional Age. How old is your Muscle?**
Grant	EU EIT HEALTH Innovation By Idea Project (H2020), Gross salary: 2372 euros/month, financed by UPMC.
Research laboratory	Biomechanics and Bioengineering Laboratory BMBI UMR 7338 UTC web site: www.utc.fr/bmbi
supervisor(s)	Dr. Sofiane BOUDAOUD, HDR, C2MUST Team, BMBI, UTC Dr. Kiyoka KINUGAWA, MCU, AP-HP, Charles Foix Hospital, UPMC
Fields	Computer science and information technologies Biomedical and health sciences
Research work	The age is often considered as a factor in assessing a person's loss of motor skills or locomotion. Yet, there may be a discrepancy between a person's age and his functional abilities. This is translated into everyday life by little phrases such as: "He still sports at his age" or "he is older than his age" or "in 6 months it seems to have taken 10 years! ". These observations are often qualitative and subjective and subject to great inter-subject variability. Indeed, chronological age, taken solely, is rarely a reliable index of an individual's ability to perform specific physical task. Recently, the project EU CHRONOS (UPMC, lead, UTC, co-lead) has been funded for one year by EIT Health to address this ambitious goal of designing a system for estimating the motor functional age in order to detect early motor decline. The project bears on a strong and complementary consortium of 7 EU partners. The originality of the project consists in combining biomedical data allowing evaluating the capacity of muscular activation as well as the kinematic information according to the chronological age of the subject. Concretely, we envisage a decision system support for the estimation of the functional age, able to learn, enriching itself from fusion of heterogeneous data on a cohort of adult subjects of different chronological age categories. This will provide an assessment of the Motor "Functional Age", a new concept we introduced, which will not necessarily correspond to the actual age of the subject. The quantitative identification of this motor functional age will make it possible to adapt the level of physical activity, specific therapy, or functional rehabilitation of the subject with the objective of catching up the age differential (functional versus chronological) in a specialized institution (geriatric service, EHPAD, rehabilitation center). The indicators envisaged in this project are classified into two categories: indicators of muscle activation capacity (using a recent innovative high-resolution electromyographical technology: HD-sEMG signals) that provides with muscle activation image (8x8 or 4x8 channels). The second category is related to kinematic indicators from inertial station (IMU), according to an identified daily live exercise and in collaboration with Prof. F. Marin and K. Lepetit, PhD student, UTC. Through the proposed post-doctoral fellowship, it is planned to participate in the design of an innovative device, by testing and combining data allowing to assess the muscular activation capacity using recent electromyography technique (HD-sEMG) with kinematic data (accelerometry) as a function of the chronological age and clinical data in order to propose a functional age prediction tool. It is also envisaged to carry out the constitution of the database and the clinical test of the tool developed on a

	large scale over several age categories trough a comparison with classical motor aging scores under the supervision of the clinical partner (Dr Kiyoka Kinugawa, Charles Foix Hospital, AP-HP, UPMC, project leader). The recruited researcher will have as principal task to develop the software (signal processing and machine learning by multimodal data fusion) for estimating the Motor Functional Age. This work will be done in strong collaboration with a recent recruited Ph.D student (L. Imrani) that will give support for the signal processing, instrumentation and clinical recording tasks of the project and a CNRS research engineer (J. Laforêt) for the computer science aspects. The candidates are expected to be **highly qualified, independent and highly motivated.** The postdoc candidates are required to have a Ph.D. in signal processing or computer science with ideally applications in biomedical engineering. The postdoc candidates should have no more than 2-3 year postdoctoral experience. Essential qualifications include demonstrated experience and autonomy in programming (Python, Matlab), Machine learning algorithms, and signal processing. Previous knowledge on electrophysiological data/neuromusculoskeletal system should be highly appreciated. The deliverable at the end of the CHRONOS project, is the design of a user-friendly software that estimates the Motor Functional Age, after data recording using an existing device (TMSi Mobita 32 channels) using a specific standardized protocol, and that has been validated through comparison with classical functional aging clinical scores. Even if the working site will be at the BMBI lab at UTC, Compiègne, regular displacements and meeting are planned with UPMC/AP-HP partners at Paris.
Key words	Motor functional age, Neuromuscular system, signal processing, machine learning, HD-sEMG, Sarcopenia, Kinematic data, motor decline
Requirements	Biomedical signal processing and Machine learning Programming (Python and Matlab ideally) Instrumentation (sensors) Electrophysiology (notions)
Starting time	01/01/2018 (12 Months)
Location	C2MUST team, BMBI lab., UTC, Compiègne, France

Part 2: Job description	
Duration	12 months
Additional missions available	EU project report redaction/ project meeting participation
Research laboratory	Biomechanics and Bioengineering Lab UMR 7338 CNRS UTC
Material resources	Office + computer
Human resources	Ph.D Student and graduate students
Financial resources	Budget for software development, scientific dissemination (conferences) and journal publication
Working conditions	Regular meetings with the respect of a task diagram
Research project	CHRONOS: Evaluation of the motor functional age. How old is your muscle? EIT Innovation By idea Project 2018

National collaborations	Institut Charles Foix, AP-HP, UPMC, France
International collaborations	EU partners within CHRONOS Project
International cosupervision (cotutelle)	No
Contact	Dr. Sofiane BOUDAOUD Maître de conférences (61ème Section) Habilité à diriger les recherches Responsable de la filière biomédicale Laboratoire Biomécanique et Bioingénierie UMR 7338 Université de technologie de Compiègne Centre de Recherches de Royallieu CS- 20529 - 60205 Compiègne Cedex - France Mél: sofiane.boudaoud@utc.fr Tél: +(33) 03 44 23 79 29

To apply: Please provide us with a complete CV (diploma, publications, etc..) and 2 recommendation letters.