

Appel à manifestation d'intérêt - Chaire Inserm

Fiche projet type

Établissement/organisme porteur : Inserm

Nom du chef d'établissement/d'organisme : Gilles Bloch

Site concerné : Laboratoire de Traitement de l'Information Médicale (LaTIM)

Région académique : Grand Ouest

Établissements/organismes partenaires envisagés : *UBO, IMT-A*

Nom du projet : 2DISurg - Data Driven Intelligent Surgical Procedures

Mots-clés : Computer Assisted Surgical Interventions, Connected and personalized medical implants, Surgical Navigation and Management systems, Augmented/Virtual Reality, AI and multimodality data analysis and modeling

Durée visée : 5 years

Scientific domain : Healthcare technologies, Data-driven surgical and interventional procedures, Data Science

Section (s) CNU/CoNRS/CSS correspondante (s) : CNU 61 (secondaire 27), CSS7 INSERM

Strategy of the host institution: *(15 lignes maximum)*

INSERM is the leading healthcare research institution at a European level and one of the best worldwide. One of its major fields of activity concerns that of healthcare technologies and INSERM has the ambition of accompanying through the development of top level research programs the numerical transformation of patient management within the hospital environment and beyond. Amongst these domains affected by this numerical revolution is that of the personalization of surgical interventions and the development of the operating block of the future. The development of multimodality technologies and data science is at the heart of this process and INSERM ambitions to be one of the leading research institutions in this field.

Strategy of the host laboratory : *(15 lignes maximum)*

LaTIM's research is focusing on Multimodal Technologies and Data Science in Healthcare, aiming for the optimisation of overall patient management from prevention to diagnosis, therapy and follow-up. Within this context one of its main pillars of activity is in the field of surgical interventions where over the past two decades the laboratory has gained national and international recognition through large scale research projects and the creation of several start-ups. Different clinical applications include the musculoskeletal system, vascular, ophthalmology but also oncological diseases. The objectives are to design key technologies enabling personalised surgery, including (i). planning with the integration of multimodal information for patient modelling and design of customised implants, (ii). intervention through development of new surgical navigation and monitoring systems integrated within hybrid operating blocks, and (iii). patient follow-up via novel connected implants and monitoring of different physiological processes. Through these technologies, big data is acquired and analysed through artificial intelligence algorithms during each of

the pre-, per-, and postoperative phases. The proposed position is therefore part of this strategy of integrating new sensors and data processing using AI for personalized surgical procedures.

Summary of the scientific project : 15 lignes maximum

The scientific project will be part of the "Data-based surgical management" axis of the team IMAGINE and will aim at leading the development of new interventional environments. In particular, research will be carried out on the integration of multimodality patient-specific data into the surgical process in order to guide pre-operative planning, through the development of novel implanted sensors and new multimodal intraoperative navigation systems to personalize the surgical intervention and optimize patient follow-up. The objective will be to subsequently exploit the acquired heterogeneous and multimodal data using artificial intelligence approaches to improve the overall surgical procedure and associated workflow (pre-, per- and post-operation) by identifying new signatures and multimodal indicators for the personalization of patient management during these different phases of an operation. Several clinical applications will be targeted, in the field of orthopaedic, oncology (mainly neurosurgery, gastrointestinal surgery) and vascular surgery. The evaluation, optimisation and validation of the various developments will be based on the PLATIMED platform (<https://platimed.fr>) and the state of the art hybrid operating blocks of the CHU Brest with a view to facilitating technology transfer.

Summary of the teaching project : 15 lignes maximum

The training of doctors, engineers and computer scientists working in the field of health care must take into account the technological and organisational transitions that are currently taking place within the hospital environment. It is therefore necessary to develop new educational programmes in these fields, such as for example developing courses that provide a dual competence in medicine and engineering. The recruited researcher will provide such new training courses, covering for example, areas such as Computer-assisted medical and surgical procedures, medical devices & sensors, connected medical devices, AI and multimodality healthcare data analysis within the context of multiple educational programs available within the partner institutions of the LaTIM (double diploma medicine-engineering from UBO and IMT-A and the Master 2 course on Signal and Image in Biology and Medicine at the UBO Faculty of Medicine). An original teaching project implementing problem solving skills combining theory and practice as well as system design and implementation is expected.

Funding :

ANR package	200k€
Co-funding*	100k€ (lab's internal funding / FHU TecSan)
Total project	300k€

*source et montant

Scientific communication and dissemination : The policy of the LaTIM is to publish in the best journals and conferences in our discipline. The recruited researcher is expected to publish regularly as principal author but also as co-author. The target journals are : Medical Image Analysis, IEEE Transactions on Medical Imaging, IEEE Transactions on Biomedical Engineering. Several presentations at international conferences (MICCAI, IPCAI, International Society for Computer Assisted Radiology and Surgery (CARS), International Society for Computer Assisted Orthopedic Surgery (CAOS), Surgetica) will be part of the expected contributions.

Open Science : In view of the industrial potential for this work, major innovations will systematically combine patent filling followed by scientific publications, in open access. All the published articles will be on HAL in their integral version. As for the data collected and prepared for research, they will be made available to the community as soon as possible, after a possible embargo period. Participation in the creation of challenges in the field will allow further enhancing the value of the proposed developments and their recognition in the wider international community.

Science and society : The LaTIM participates every year in the Fête de la Science and the Nuit des Chercheurs. The recruited researcher will be expected to actively participate in these events and communicate with the general public. Depending on his or her current situation, he or she may also be interviewed by journalists from the general or popular science press.

Indicators :

Teaching

Supervisory activity: 3 PhD theses (encadrement ou direction in the period of 5 years)
Development of pedagogical innovations in line with the teaching carried out

Research

> 10 publications in the best journals of the speciality ;
> 3 patent or software declarations
Obtain as a PI at least an ANR program over the period of 5 years
Applying for an ERC
Participation as a WP leader on at least 2 european programs

Knowledge transfer

> 2 participations in international challenges
> 10 oral presentations over the 5 year period in international conferences
> 2 session organization over the 5 year period in international conferences
> 5 participations over the 5 year period in national conferences (including participation in the organizing committees)
> 4 participations in the Fête de la Science and the Nuit des Chercheurs
Active participation in the laboratory's seminars