

INFORMATION SPEAKERS & ABSTRACTS

MRI Imaging - 26th of September

Alexandre VIGNAUD, Alexandre.vignaud@cea.fr

CEA Neurospin, Paris- Saclay, FRANCE.

UHF MRI, the field of dreams

MRI is a prodigious everyday tool for medical diagnosis. More confidentially, it is also one of the best devices at our disposal to probe the brain in activity. How is it possible that thanks to the magnetic properties of the nucleus of the atom, we can manage to read our most intimate thoughts? To answer this question, I offer you a foray into the history and physics of nuclear magnetic resonance, on which MRI relies to function and map our thoughts. We will also see how increasing the power of these devices, an area in which the CEA is investing, should allow us to deepen this dive into the intricacies of our cognition and perhaps one day see the content of our dreams.

Key-Words: fMRI, ultra-high field, dream

Nikolaï AVDIEVITVH, nikolai.avdievitch@tuebingen.mpg.de

High-Field MR Center, Max Planck Institute for Biological Cybernetics, Tübingen, GERMANY

New Technology in Designing Head MRI RF Coils at UHF: Dipole Antennas

No Abstract

Key-Words: Ultra-high field MRI, dipole antenna, MRI array, Signal-to-noise ratio (SNR), specific absorption rate (SAR); transmit efficiency

Patrick COZZONE, patrick.cozzone@univ-amu.fr

CRMBM-CEMEREM, UMR 7339, CNRS, Aix-Marseille University, Marseille, France

The Bioimaging Consortium in Singapore

The Singapore Bioimaging Consortium (SBIC) has operated until 2021 as a Research Institute of the Biomedical Research Council under the Agency for Science, Technology and Research (A*STAR) in Singapore, at the heart of Biopolis, Singapore’s premier international Research and Development hub for Biomedical Sciences. As a National Consortium, SBIC harnessed and coordinated existing imaging expertise and capabilities across Singapore, bringing together substantial strengths in the physical sciences and engineering with those in the biomedical and clinical sciences. With a multidisciplinary team of biologists, physiologists, chemists, physicists, electrical/ electronic engineers, computer scientists and clinicians, SBIC has investigated human diseases that are of major public health issues, using advanced bioimaging tools and molecular physiology, in a translational and pivotal mode working with the medical community and industrial partners (MNCs and SMEs). In 2022, SBIC and the Institute of Bioengineering and Nanotechnology (IBN) have formed a new entity, merging their respective capabilities and strengths into a new augmented Institute of Bioengineering and



Bioimaging (IBB).

Key-Words: Bioimaging, Bioengineering, industrial transfers, translational imaging

Marc DUBOIS, marc@multiwaveimaging.com

MULTIWAVE Imaging, Marseille, FRANCE.

MRI for All – Ultra-Portable Low Field MRI scanner

More than 2/3 of the world population does not have access to an MRI. The need to improve access and affordability of healthcare is unprecedented. Multiwave wishes to make MRI both affordable and accessible, whether in a hospital setting, in both emergency and intensive care units, general practitioners office, in sports centers or directly in a patient’s home. In this presentation, we will cover the research and development activities done at Multiwave Imaging in order to improve access to MRI.

Key-Words: MRI, Ultra-low field, Mobility, Accessibility



Our partners

Artificial Intelligence & Processing - 27th of September

Carole LARTIZIEN, Carole.Lartizien@creatis.insa-lyon.fr
CREATIS Medical Imaging Research center, Lyon, France

A 45 min tour of deep learning for medical image analysis

Medical imaging data is one of the richest sources of information about patients, and often one of the most complex. Combing through multi-modality, high-resolution 3D images can be challenging even for the most experienced clinical professional. In recent years, artificial intelligence (AI), especially deep learning, has received a lot of attention to explore and structure multidimensional imaging data. This covers a wide variety of tasks ranging from low level processing of time consuming and repetitive tasks to reduce the clinician workload to the design of high-level diagnosis, prognosis and risk identification models to assist him during his clinical practice. The purpose of this seminar is to provide an overview about AI-based modelling for medical image analysis. I will start by re-warming some basic knowledge about the main mechanisms of deep statistical modelling. Then, I will present current state of the art in some domains such as segmentation, image synthesis or diagnosis models. Finally, I will cover current and future challenges, including those related to privacy preserving and explainability.

Key-words: artificial intelligence, deep learning, medical image analysis, diagnosis and prognosis models

Guillaume DARDENNE, guillaume.dardenne@univ-brest.fr
Laboratoire de Traitement de l'Information Médicale- LaTim UMR INSERM 1101, Brest, France

FollowKnee : an innovative workflow for Total Knee Arthroplasty

Knee replacement surgery — also known as knee arthroplasty — can help relieve pain and restore function in severely diseased knee joints. It is one of the most common orthopaedic procedures performed, representing approximately 60% of all replacements, both in volume and in cost. With a growth projection by 673% up to 3.48 million procedures in the USA by 2030, the demand for Total Knee Arthroplasty (TKA) will also become more and more important in Europe. This increase is based on three main factors: (1) The ageing population due to the Baby Boom generation, (2) The increased obesity prevalence which will concomitantly lead to osteoarthritis, and subsequent TKA rate rise in the next decades, and (3) the young population demand, more active and who refuse to live with pain which make them getting knee replacements at younger ages (<65 years old). To face these great challenges which will significantly pressure the healthcare system, the goal of the FOLLOWKNEE project is to propose a totally innovative workflow in Knee replacement surgery as an answer to the changes in the demographic population for the next 20 years. It aims at defining a set of technological solutions to decrease the number of revisions: a personalized implant design



adapted to each patient anatomy, the use of augmented-reality in the operating room to optimize the surgical techniques, and the integration of a new generation of sensors in the implant to improve postoperative follow-up.

Key-words: Orthopaedics, Total Knee Arthroplasty, patient-specific implant, mixed reality, connected implant

Cyril DI GRANDI, cyril.di-grandi@avicenna.ai

AVICENNA.AI, La Ciotat, France

Avicenna.ai - l'AI Factory - entrepreneuriat et technologie.

Pour répondre aux défis actuels du secteur de la santé, l'Intelligence Artificielle propose des solutions, qui améliorent la relation médecin-patient et facilitent le travail des professionnels de santé. Fondée en 2018, Avicenna.AI est une start-up qui offre aux radiologues des outils d'Intelligence artificielle leur permettant de déterminer quels patients nécessitent une prise en charge d'urgence, afin de les traiter plus rapidement.

Arrivée comme challenger dans la cour des grands, cette IA Factory a su se différencier et prendre sa place en misant sur une équipe pluridisciplinaire compétente et motivée, à des partenariats clés dans un secteur très concurrentiel et à des produits technologiques répondant exactement aux besoins actuels des médecins.

Key-words: Intelligence Artificielle, Radiologie

Lorenzo CARUSO, cyril.di-grandi@avicenna.ai

INTRADYS, Brest, France

First Work Experience at INTRADYS: High Challenges, High Opportunities.

Presentation of startup work environment focused on challenges and opportunities from my Junior point of view. Examples of several issues INTRADYS is tackling with AI for interventional neuroradiology.

Key-words: Interventional neuroradiology; startup; deep learning; medical image processing; mixed-reality



Raphael LA GRECA, raphael@lagreca.fr
PYTHEAS NAVIGATION, Marseille, France

Imaging in medical devices: application examples

After 15 years of Research & Development in the Medical Device industry, I will share my experience through the presentation of some applications I worked on. From diagnosis to assisted surgery going through therapy, the Medical Devices development is a very large topic and there is a huge gap between a research prototype and an industrial product that can be commercialized in several countries. For each introduced project, I will explain the clinical need and describe the related technical locks to solve in order to be able to create an industrial Medical Device which may respect the expected regulatory requirements.

Key-words: Medical device, diagnostic, therapy, assisted surgery, regulatory

Ludovic DE ROCHEFORT, ludovic.de-rochefort@univ-amu.fr
VENTIO, Marseille, France

Ventio, digital health startup – valorization of innovative brain imaging biomarkers – secure image processing on the cloud

No Abstract

Key-words: cerebral Imaging, imaging biomarkers, innovation

SYMPOSIUM - Climate Impact of Deep Learning

Anne-Laure LIGOZAT, anne-laure.ligozat@lisn.upsaclay.fr
Laboratoire Interdisciplinaire des sciences du numérique (LISN) - Université Paris-Saclay, CNRS, ENSIIE, Orsay, France

Carbon footprint of deep learning

In this talk, I will explore the environmental impacts of artificial intelligence systems, and in particular deep learning ones, focusing on the carbon footprint. In particular, I will present the life cycle assessment approach, and the impacts of each phase of machine learning approaches.

Key-words: carbon footprint - environmental impacts - machine learning - deep learning - artificial intelligence



OPTICAL Imaging - 28th of September

Cathie VENTALON, cathie.ventalon@bio.ens.psl.eu

Institut de Biologie de l'Ecole Normale Supérieure (IBENS), Paris , FRANCE

High-speed recording of neuronal activity in freely-behaving mice using confocal fluorescence imaging

A longstanding goal in Neuroscience is to unravel the neural basis of perception, memory formation and behaviors. To address this goal, it is useful to record and manipulate neuronal activity within specific brain regions of an animal (for example, a rodent) while it is performing various behavioral tasks. Thanks to the recent development of new fluorescent reporters and optogenetic actuators, recording and manipulation of neuronal activity can be performed with optical methods. Nevertheless, applying these methods in freely-behaving mice is challenging due to severe miniaturization constraints.

In this talk, I will first show that miniature conventional widefield microscopes and miniature 2-photon microscopes have allowed measuring neuronal activity of hundreds of cells simultaneously in freely-behaving mice. Yet, these methods are limited respectively by a strong out-of-focus background and by relatively low acquisition rates (<40Hz), and they have not been coupled with targeted photoactivation of optogenetic actuators.

I will then present a new fiberscope that allows high speed (100Hz) line-scanning confocal imaging of neuronal activity on a field of view of 230 μm in unrestrained mice. The device is compatible with targeted photoactivation. Using this fiberscope, we recorded neuronal activity in the hippocampus of unrestrained mice at 100Hz for 1.5h, while the mouse alternated between periods of rest and navigation in a linear track. These sessions were reproduced every week for one to two months. The first analyzes showed that we are able to follow the activity of 50 to 100 place cells in each mouse. Therefore, the fiberscope should be a useful tool to study dynamical coding in the hippocampus.

Key-words: Fluorescence imaging, fiber optic, calcium imaging, freely-behaving mice, confocal microscopy

Aymeric LERAY, aymeric.leray@u-bourgogne.fr

Laboratoire Interdisciplinaire Carnot de Bourgogne, Université de Bourgogne Franche Comté, Dijon, France

Fluorescence lifetime imaging microscopy for quantifying molecular interactions by Förster resonance energy transfer (FRET)

In this talk, I will introduce existing techniques for acquiring the fluorescence lifetimes and present innovative strategies for analyzing these data with non-fitting methods. These FLIM measurements will be applied mainly on FRET experiments for quantifying molecular interactions in living cells.

Key-words: FLIM, FRET, non-fitting methods



Amaury BADON, amaury.badon@universite-paris-saclay.fr
Laboratoire Photonique Numérique et Nanosciences, Bordeaux, France

Label-free deep imaging of biological samples

In optical imaging, light propagation is affected by the inhomogeneities of the sample which can strongly degrade the image resolution and contrast. Here, I will present strategies to mitigate these effects in order to observe non-invasively biological samples deeper than conventional microscopic techniques.

Key-words: Scattering, interferometry, optical coherence tomography

Nicolas BOURG, nbourg@abbeliht.com
ABELIGHT, Cachan, FRANCE

Breaking the diffraction barrier using Single Molecule Localization Microscopy

The diffraction barrier of an optical microscope limits the spatial resolution of around half of the fluorescence wavelength. Typically, we can reach ~200 nm spatial resolution with the best confocal microscope. In 2014, the inventors of nanoscopy methods which break the diffraction barrier was awarded by the Nobel Prize of Chemistry. I will introduce one of these methods, called Single Molecule Localization Microscopy (SMLM) and present all the work around the latest of abbelight company, which I have co-founded after my PhD thesis.

Key-words: Fluorescence, nanoscopy, single-molecule, biophotonics

Paul DORVAL, paul@kaerlabs.com
KAER LABS, Nantes, France

Wavefront shaping and photomodulation of neuronal activity

Presentation of the advantages of in-vivo imaging in the SWIR region. Review of recent achievements in the field and further perspectives.

Key-words: In-vivo / SWIR / fluorescence imaging



NUCLEAR MEDICINE Imaging – 29h of September

Mikael BOURGEOIS, bourgeois@arronax-nantes.fr

CHU de Nantes / CRCI2NA (Nantes-Angers Cancer & Immunology Research Cancer ERN, Nantes, FRANCE).

Theranostic approaches in nuclear medicine: exploration of the cancer phenotype for tailored therapy

Recent advances in molecular characterization of tumors allowed a significant step forward for targeted therapies. Molecular imaging and nuclear medicine modern tools bring a promising approach to individualized patient management. Where is nuclear medicine now and what can we expect in the coming years ?

Key-Words: Theranostic, Cancer, PET, Nuclear medicine

Laurent TANGUY, ltanguy@pmb-alcen.com

PMB-ALCEN, Peynier, FRANCE.

Automated microfluidic production of radiotracers for personalized medicine

iMiGiNE is a product family that has been designed to facilitate access to a wide range of radiopharmaceuticals that molecular imaging and theranostics could benefit from. It facilitates drug development for the R&D centers by using novel development methods, based on universal microfluidic functions. It facilitates multi-centric clinical studies by offering process control and reproducibility across the various centers, and because it is remarkably compact and fully automated, it makes onsite GMP production reliable and easy. This allows clinical centers to get access to a variety of tracers, otherwise hardly available, to ultimately deliver better patient treatment.

Key-Words: Microfluidic, Automated, Theranostic, GMP, PET imaging

Cédric MALICET, cedric.malicet@vect-horus.com

VECT-HORUS, Marseille, FRANCE.

From Bench to Clinic

VECT-HORUS est une société experte reconnue dans le domaine du ciblage et de la délivrance de molécules visant à améliorer la distribution d'agents thérapeutiques ou d'imagerie dans différents organes. La société développe des molécules “vecteurs” (peptides ou nanobodies/VHH) qui sont conjugués à des cargos d'intérêt, permettant le passage de barrières biologiques et leur distribution dans des organes cibles. Le ciblage et le transport des conjugués se fait par l'intermédiaire de récepteurs cibles, présents à la surface des cellules et impliqués dans les processus de “Receptor - Mediated Transport/Transcytosis “ (RMT). VECT-HORUS collabore notamment avec le CERIMED pour explorer dans différents cancers le potentiel de ses vecteurs dans des approches théranostiques, combinant le diagnostic par imagerie TEP, et la radiothérapie. VECT-HORUS a notamment développé un agent théranostique ciblant le récepteur au LDL, qui permet de visualiser en TEP des glioblastomes et des tumeurs du pancréas, et d'envisager leur traitement par radiothérapie. Cet



agent est en essai clinique Phase 1 diagnostique en collaboration avec la société américaine RadioMedix.

Key-Words: Theragnostic, GBM, peptide, LDLR

MULTIMODAL Imaging - 30th of September

Benoit LARRAT, benoit.larrat@cea.fr
CEA, Paris, France.

Title

No Abstract.

Key-Words :

Claude COHEN-BACRIE, Claude.cohen-bacrie@e-scopics.com
E-SCOPICS, Aix-en-Provence, France.

Title

No Abstract.

Key-Words : Ultrasound, Innovation

Alexis VRIGNAUD, Alexis.vrignaud@deepcolorimaging.com
DEEPCOLOR SAS, Nantes, France.

High resolution photoacoustic tomography – Optical ultrasound detection opens new perspectives

Photoacoustic tomography imaging allows optical contrast imaging, at centimetric depths, but has been so far hindered by poor resolution. DeepColor introduces high resolution photoacoustic tomography, enabled by high-performance optical ultrasound detection. The presentation will show first results and clinical translation perspectives.

Key-Words : Photoacoustic optical imaging ultrasound clinical

Pierre FAU, michael.unser@epfl.ch
Institut Paoli-Calmettes, Marseille France.

MRLinac the complex combination

No Abstract

Key-Words : Radiotherapy – MRI – Linac – soft tissue

