DIGITAL TOOLS FOR LIFE AND HEALTH

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Digital health

Description

In this cross-disciplinary area, we design various digital tools (machine learning, optimisation, formal methods, simulations, modelling of biological systems and flexible and robotic devices, geometric and bio-mechanical modelling of anatomical structures, bioinformatics methods) for the analysis, modelling and simulation of data from living organisms, including heterogeneous data, omics, imaging and video. This research has applications in ecology (evolution of species, role of interactions between molecules/individuals/species, etc.) and health (patient monitoring, prediction and diagnosis of pathologies, modelling of biological processes, simulation of surgical operations, etc.).

'Emblematic' projects

- European projects: FLUTE, ITN ALPACA, SimCardio Test, TRUMPET
- PEPR digital health: SSF-ML-DH
- Projet PIA4 Skills and professions of the future CAPSUL
- Projet Interreg: ALCOVE, COBRA, PATHACOV
- Industrial chair E-LoDi
- Projets ANR: AGATE, BIP-UP, Find-RNA, FullRNA, INSSANE, MIGAD, OÏLH, PMR, REBON, Robocop, Specular
- Norine, labelled platform by ELIXIR for non-ribosomal peptides
- consortium InriaSoft, VidjiNet

Teams concerned

♠ ***GT DatInG (Data Intelligence Group):*** MAGNET, SCOOL

♠ ***GT MSV (Modélisation pour les Sciences du vivant):***

BioComputing, Bonsai

♠ ***GT OPTIMA (OPTImisation Modèles et Applications):***

ORKAD, OSL

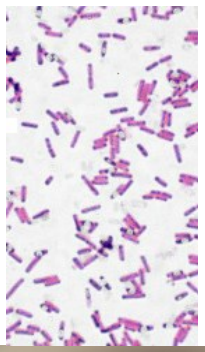
♠ ***GT I2C (Interaction et Intelligence Collective):***

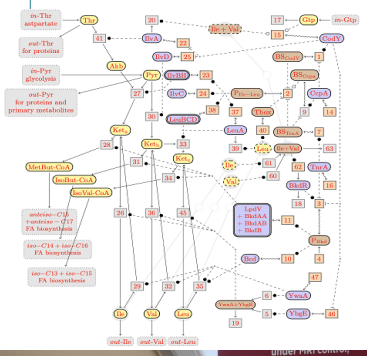
BCI, Loki, MINT

♠ ***GT Image:*** FOX

♠ ***GT CO2 (Commande et Calcul Scientifique):*** DEFROST

♠ ***GT ToPSyS (Tolérance Pronostic Système de Systèmes):*** SoftE





Digital tools for life and health

This cross-disciplinary area focuses on the design of digital tools for life and health. Several themes are represented: modelling, simulation, analysis and processing of multiple types of data (omics, heterogeneous, imaging and video), new brain-computer interfaces and confidentiality management.

Modelling and simulation are based on formal methods and differential equations. Applications include diabetes, metabolic regulation pathways and interaction networks in marine ecosystems. Methods for geometric and bio-mechanical modelling of anatomical structures are also developed and applied to digital simulation of the patient for surgical operations, and to the simulation of new flexible and robotic devices.

The data studied in this area is vast: omics, proteomics and palaeoproteomics, heterogeneous health data, imaging. Various methods are used: machine learning, optimisation, bioinformatics algorithms and methods, image and video analysis. The issue of confidentiality in the processing of health data is also studied. Applications range from predictive analysis to diagnosis (diabetes, lung cancer, cancer, etc.), monitoring patients after surgery, designing clinical trials, optimising the therapeutic management of hospitalised patients, and studying the fine motor skills of patients suffering from Parkinson's disease, to name but a few.

From the point of view of brain-computer interfaces, these have applications in the development of palliative communication tools for severely disabled people and in the treatment of psychiatric pathologies.