Application BASTRI

Fiches Equipes

MIMESIS (SR0711RR)

Simulation médicale guidée par les données
SHACRA (SR0672ER) MIMESIS

Statut: Décision signée

Responsable : Stephane Cotin

Mots-clés de "A - Thèmes de recherche en Sciences du numérique - 2023" : A2.5. Génie logiciel , A3.1.1. Modélisation, représentation , A3.1.4. Données incertaines , A3.2.2. Extraction de connaissances, nettoyage , A5.1. Interaction Homme-Machine , A5.3.4. Recalage , A5.4.4. Reconstructions 3D et spatio-temporelles , A5.4.5. Suivi d'objets et analyse de mouvements , A5.6. Réalité virtuelle, réalité augmentée , A6.1.1. Modélisation continue (EDP, EDO) , A6.1.2. Modélisation stochastique , A6.1.5. Modélisation multiphysique , A6.2.3. Méthodes probabilistes , A6.2.4. Méthodes statistiques , A6.2.5. Algèbre linéaire numérique , A6.2.8. Géométrie numérique et maillages , A6.3.1. Problèmes inverses , A6.3.2. Assimilation de données , A6.3.3. Traitement de données , A6.3.4. Réduction de modèles , A9.2. Apprentissage , A9.10. Approches hybrides de l'IA

Mots-clés de "B - Autres sciences et domaines d'application - 2023" : B1.2. Neurosciences et sciences cognitives , B2.2.6. Maladies neuro-dégénératives , B2.4. Thérapies , B2.4.3. Chirurgie , B2.6. Imagerie biologique et médicale , B2.7. Instruments médicaux , B2.7.1. Chirurgie

Domaine : Santé, biologie et planète numériques
Thème : Neurosciences et médecine numériques

Période : 01/07/2015 -> 31/12/2027
Dates d'évaluation : 15/05/2022

Etablissement(s) de rattachement : CNRS, U. STRASBOURG
Laboratoire(s) partenaire(s) : ICUBE (UMR7357)

CRI : Centre Inria de l'Université de Lorraine
Localisation : Bâtiment eXplora Strasbourg
Code structure Inria : 051100-0

Numéro RNSR : 201521769B
N° de structure Inria: SR0711RR

Présentation

The main focus of the MIMESIS team is to develop new solutions at the crossroad between imaging, robotics, medicine and computer science. Through this work, we seek at creating a synergy between clinicians and scientists as a mean to develop new technologies that can redefine healthcare. The scientific objective of our team is to develop new approaches supporting advanced simulations in the context of simulation for training, surgical planning and computer-aided interventions. In the field of computer-based training, some pf our work on cataract surgery training has led to the creation of our start-up InSimo. We are now taking our expertise on real-time soft tissue modeling and multi-physics interactions to new applications and developments. We are investigating novel numerical methods for real-time computation such as the Smoothed FEM, Immersed Boundary Method, adaptive meshing, and using bayesian methods and computer vision techniques to provide inputs and parameter estimation to our model. The medical applications we seek include augmented reality for hepatic surgery, elastic registration for liver and brain surgery, and robotized percutaneous procedures.

Axes de recherche

- Biomechanics
- Modeling
- Real-time simulation
- Numerical methods
- Meshing and topological changes
- Image-guided therapy
- Augmented reality
- Medical robotics
- Open source software
- Neuroscience

Contact

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En savoir plus

- Site sur inria.fr
- Derniers Rapports d'Activité : 2015 , 2016 , 2017 , 2018 , 2019 , 2020 , 2021 , 2022 , 2023

Documents sur la structure

- Intranet
- Privés

Décisions

- 11092 (21/07/2015) : création
- 11680 (10/06/2016) : prolongation
- 11958 (12/12/2016) : prolongation
- 12586 (21/12/2017) : prolongation
- 13281 (20/12/2018) : prolongation
- 14039 (16/12/2019) : prolongation
- 14231 (25/03/2020) : prolongation
- 14326 (16/06/2020) : prolongation
- 14446 (29/09/2020) : prolongation
- 14549 (07/12/2020) : prolongation
- 14790 (03/05/2021) : prolongation
- 14805 (07/05/2021) : création
- 15197 (14/09/2022) : prolongation
- 16555 (31/10/2023) : prolongation

Localisation

- **Adresse postale :** Bâtiment ORL eXplora 2 rue Marie Hamm (accès rue de la Porte de l'Hôpital) 67000 Strasbourg
- **Coordonnées GPS :** *Non renseignées*

Relations industrielles et internationales

Academic collaborations

- ICube laboratory, Strasbourg, France: research on dynamic topologies for real-time FEM computation, and robotized needle insertion and needle tracking in soft tissues.
- MAGRIT team, Inria, Nancy: interventional radiology simulation and augmented reality in surgery.
- ASCLEPIOS team, Inria, Sophia Antipolis: joint development of the SOFA framework and cardiac electrophysiology using personalized FEM simulations for cardiac arrhythmia.
- CAMUS, Inria, Strasbourg, France: we have just started a two-year collaboration with CAMUS on the topic of automatic parallelism of real-time simulation. We will use and adapt methods developed by CAMUS to improve computation times of typical applications without significantly re-engineering the code.
- TIMC, Grenoble, France: we are collaborating with Yohan Payan (DR CNRS) on the modeling and simulation of the brain shift. A PhD thesis is actually taking place on that topic. Other areas of interest are in the field of advanced soft tissue modeling and computer aided surgery.
- CIMIC, University College London, UK: our collaboration with UCL aims at making advances in image-guided surgery, by developing new methods for robust tissue registration and tracking.
- Team Legato, University of Luxembourg: real-time soft tissue cutting simulation and error-driven adaptive refinment of FEM meshes.
- CIMIT, Boston, USA: we are working on a joint project on interventional radiology simulation, involving the design and development of a hardware interface for tracking catheters and guidewires.
- SINTEF, Norway: we started our collaborating with SINTEF in the context of the FP7 European project RASimAs, and we are continuing this collaboraton on computer-assistance for liver surgery through a H2020 project (HiPerNav).
- Harvard Biorobotics lab, Cambridge, USA: this group focuses on the role of sensing and mechanical design in motor control, in both robots and humans. This work draws upon diverse disciplines, including biomechanics, systems analysis, and physiology. We started a collaboration on inverse problems for identifying optimal areas of cardiac ablation using our work on electro-mechanical modeling of the heart.
- Masaryk University, Czech Republic: we had an extensive collaboration with Igor Peterlik, leading to 7 publications over that past 18 months. This collaboration covers the fields of non-rigid registration, augmented reality and haptics. Dr. Peterlik has now joined our team, but the collaboration will continue, in particular with the Centre of Biomedical Image Analyses in the area of biological image processing. This work is funded as part of the project entitled “Development of Reliable Methods for Automated Quantitative Characterization of Cell Motility in Fluorescence Microscopy”.
- University of Twente, Netherlands: collaboration with the Robotics and Mechatronics group at Twente University on flexible endoscopy simulation to develop a low-cost training system for medical students.
- Koc University, Turkey: we are collaborating with Prof. Catagay Basdogan and 2 PhD students on a hyper-viscoelastic model which was fitted to real data obtained in rheological experiments on bovine liver. We are investigating the possibility to integrate this model the MJED method available in SOFA to significantly improve computation times.

Industrial collaborations

- Siemens: we are collaborating in the area of 2D-3D registration, augmented reality and interventional radiology.
- InSimo: beyond our initial work on the HelpMeSee project, we have started a collaboration on an ANR project focusing on retina surgery. We also obviously collaborate on the SOFA project, and the consortium, when created, will include representatives of the company.
- Altran: we collaborate with a special focus group within Altran (Medic@) on non-rigid registration. They sponsored a PhD thesis defended in June 2016 on elastic registration for hepatic surgery. We are continuing this collaboration on similar topics.