Centre Universitaire d'Informatique

2025

Activity Report

CUI UNIGE

Journée des Bachelors, Uni Mail (Geneva), March 5th 2025

UNIVERSITÉ DE GENÈVE

Foreword

Advances in Artificial Intelligence, Digital Security and other major digital technologies such as Robotics let us glimpse at a world where everyone will have to define his/her space and actions. The role of Universities in this landscape for Education but also Research is increasingly crucial. Education because the understanding of the complex mechanics subtending easy-to-access processes such as GenAI is key for preserving the ethics of their usage and restricting their integration to preserve human deep well-being. Research because is it the role of public Institutions to maintain research in non-directly-profitable aspects of these technologies and also ensure that the knowledge related to these technologies is shared and openly accessible. In turn the acceleration of the development of all digital technologies and the increasing challenges that they carry is forcing Universities to review and evolve their positioning with respect to the Digital Era.

Therefore, in 2025, the CUI has undergone an evaluation process leading the University to propose in September an evolution of its very concept with the reintegration of its curriculum in Information Systems and Service Science back into Faculties, while emphasizing the preservation of its assets such as the FacLab or the "Adopt a Skill" forum and proposing new collaborative structures for research and education in the context of the University's Digital Strategy.

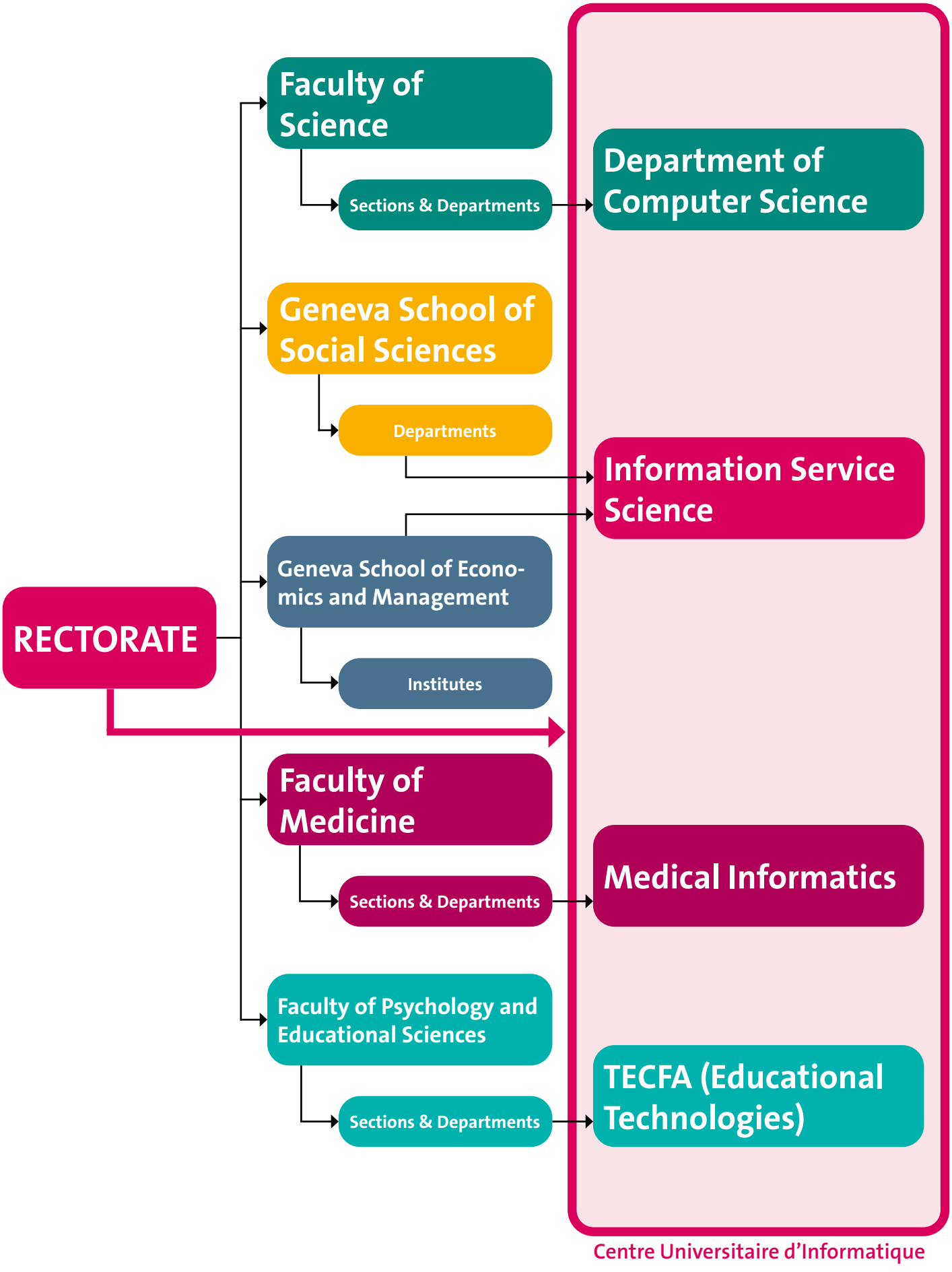
The transdisciplinary and collaborative structure of research that has been encouraged, organized and supported by CUI for almost 50 years will therefore be reshaped. Nevertheless, current collaborative projects will continue to run. In particular, the research reported in this report for 2025 demonstrates the vitality of the researchers and collaborators for proposing, developing and maintaining initiatives and actions at the forefront of the Digital world.

Almost 50 years ago, the CUI was missioned to organize and support the development and integration of Digital Sciences and Services across the University. This integration has clearly been successfully conducted and the CUI will continue living in the University via all the assets it has initiated, developed and supported.

I therefore wish to thank all CUI members of staff, students and researchers (past and present) for their hard work, commitment, innovation, reach out and research activities, for building together the national and international visibility and excellence in all aspects of the Digital Development that the University can enjoy now and build upon.

Prof. Stéphane Marchand-Maillet
Director of the CUI
University of Geneva

Organisation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Information Service Science
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TECFA (Educational Technologies)
Centre Universitaire d'Informatique

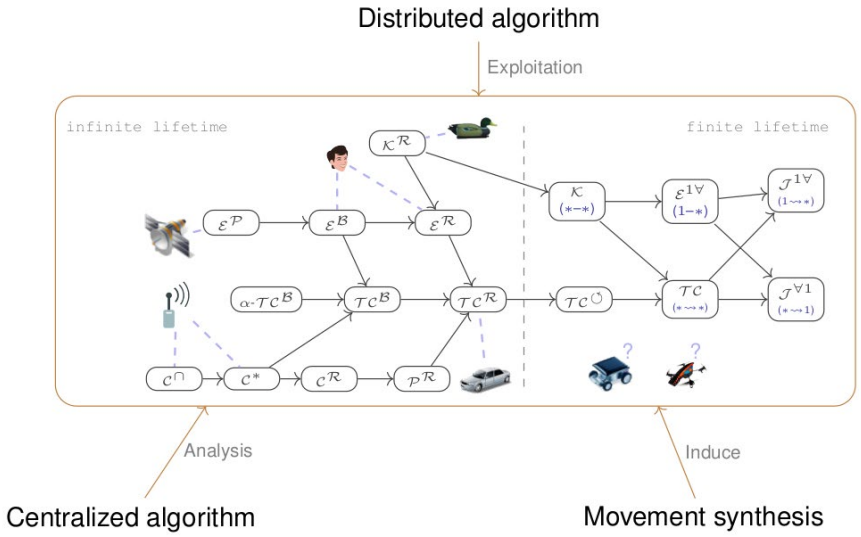
www.unige.ch/algo

ALGO

Algorithms, Graph theory, and Complexity

Domain activities

Our group is interested in the many facets of theoretical computer science and network science, ranging from distributed algorithms to graph theory, computational complexity, and quantum algorithms. Many real-world networks (e.g. networks of robots/drones, wireless sensors, and vehicular networks) are dynamic, which makes their modeling and study challenging. For this reason, the group has a strong focus on temporal graphs, i.e. graphs that change over the time and whose temporal properties are essential. For example, we study the shape of communication patterns in these new graphs and the computational complexity of related algorithmic questions like connectivity, spanners, and distributed computing in time-varying networks. We also revisit motion planning problems for mobile entities, using a discrete (algorithmic) approach. Finally, we recently started to investigate the connection between graph algorithms and quantum computing, in particular the role played by graph optimization problems such as maximum independent sets in the quantum annealing paradigm.



Director
Arnaud Casteigts
Full professor

Pierre Leone
Senior Lecturer and Researcher

ACG

Applied Complexity Group

Domain activities

The applied Complexity group (ACG), directed by Prof. Roland Bouffanais (Computer Science & Global Studies Institute, University of Geneva), conducts interdisciplinary research at the intersection of Complexity Science, Multi-Agent Systems, Network Science, Computational Social Science, Data Science, including Artificial Intelligence.

Director
Roland Bouffanais
Associate professor
H-index: 30

Our research involves a synergistic combination of computational and theoretical developments, with real-life experimental validations.

We foster cross-disciplinary exploration to gain insights into a range of complex systems including social networks, swarm intelligence, complex urban systems, human dynamics, etc. We maintain a constructive and open dialogue between science, society and industry.

Our team members hail from various fields and have expertise in a vast range of disciplines – including computational science, social sciences, machine learning, network science, robotics, and control theory.

A significant part of our funding comes from industry collaborations, with local industry or government agencies, as well as multi-national companies.

CCL

Citizen Cyberlab

Domain activities

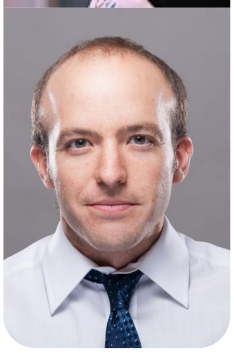
In the domain of Citizen Science, Citizen CyberLab (CCL) aims to design and develop new ways of enabling public participation in research. In 2024, CCL completed a citizen science initiative for gathering data about water resources in Nigeria, as a result of its collaboration with UNICEF and the Botnar Foundation. This initiative, called DonateWater, was co-created with a team of four young Nigerians through an online innovation methodology developed as part of the EU project Crowd4SDG.

Since March 2024, Citizen Cyberlab is participating in an EU Horizon Europe project called ALBATROSS, coordinated by the University of Bologna with 18 partners. The project aims to develop strategies which simultaneously support sustainable development and climate resilience in diverse African contexts, using citizen science to and nature-based solutions to tackle the impact of climate-induced migration on local ecosystems.

The task within the project led by Citizen Cyberlab concerns the implementation of a challenge-based innovation cycle called the SDG Olympiad. This task is carried out together with several African University partners and in collaboration with the social network for youth Goodwall (a Swiss SME). The SDG Olympiad will use a Citizen Science Solution Kit developed in a previous EU Project led by Citizen Cyberlab, Crowd4SDG.

Directors
François Grey
Associate professor
H-index: 38

Jose Luis Fernandez-Marquez
Senior Lecturer and Researcher
H-index: 16



clcl.unige.ch

CLCL

Computational Learning and Computational Linguistics

Domain activities

The Computational Linguistics and Computational Learning (CLCL) Research Group (http://clcl.unige.ch/) is concerned with interdisciplinary research combining linguistic modelling with machine learning techniques. We participate in two major projects.

In our SNF Advanced Grant project Disentangling linguistic intelligence: automatic generalisation of structure and meaning across languages, we set the challenging goals of investigating higher-level linguistic abilities in machines, in more realistic settings. We identify these abilities as the intelligent ability to infer patterns of regularities in unstructured data, generalising from few examples, using abstractions that are valid across possibly very different languages. We study if current neural network architectures have these properties with a new set of tasks inspired by IQ intelligence tests, called Blackbird Language Matrices. This year we have expanded the languages of investigation to Hebrew, Turkish, German and Chinese and developed techniques using large language models. For more information, visit our Github site: https://github.com/CLCL-Geneva/BLM-SNFDisentangling and our SNF Site https://data.snf.ch/grants/grant/209426.

Director
Paola Merlo
Associate professor
H-index: 25

We continue our participation in the NCCR Evolving Language. In this project, we are collaborating with our colleagues in neuroscience, (https://noce-lab.github.io/) to test how humans perform on the Blackbird Language Matrices tests in French and English, and how they compare to machine intelligence.

For more information see https://evolvinglanguage.ch/

CryptoSec

Cryptography and Cybersecurity Group

Domain activities

Our research group focuses on the security challenges of next-generation digital infrastructures, with particular emphasis on the migration toward Post-Quantum Cryptography (PQC) and the development of crypto-agile systems capable of adapting to evolving cryptographic standards and emerging threats. Our activities include the design of secure transition strategies, hybrid cryptographic architectures, and resilient key management mechanisms for large-scale and critical environments.

We also conduct research on the security of IoT and edge computing ecosystems, addressing the specific constraints of embedded and resource-limited devices. In parallel, we investigate advanced privacy-enhancing technologies such as Confidential Computing, Trusted Execution Environments (TEE), secure hardware architectures, and Homomorphic Encryption for privacy-preserving data processing. More broadly, our work covers applied cryptography, secure systems engineering, vulnerability analysis, and the long-term protection of digital infrastructures facing increasingly sophisticated cyber and AI-driven threats.

Director
Eduardo Solana
Senior Lecturer and Researcher

CVML

Computer Vision and Multimedia Laboratory

Domain activities

The **Computer Vision and Multimedia Laboratory** (CVML, http://cvml.unige.ch), divided into three groups, carries out research in multimedia data processing, multimedia data management and security, as well as in multimodal human-machine interaction. Research applies to media such as text, audio tracks, sounds, images and videos, and to physiological signals.

Information Retrieval and Machine Learning group (Viper, Prof. S. Marchand-Maillet, Prof. A. Kalousis, http://viper.unige.ch): develops strategies for the efficient modeling, indexing, retrieval and exploration of large-scale datasets. The group studies fundamental machine learning strategies to provide efficient and accurate understanding and access to large-scale collections of complex data. Research themes include information retrieval, recommendation systems, data analytics and exploration, learning over sequential and temporal data, structured and kernel learning, regularization techniques for neural networks. Applications are considered in the fields of data visualization, forecasting, IoT, chemoinformatics, biomedicine.

Stochastic Information Processing group (SIP, Prof. S. Voloshynovskiy, http://sip.unige.ch): studies various aspects of information-theoretic machine learning. The applications mostly cover several domains : physical object security, generative models and anomaly detection in high energy physics, astrophysics and next generation imaging techniques for the radio-astronomy.

Social Intelligence and Multi-Sensing group (SIMS, Dr. G. Chanel, http://sims.unige.ch): Social Intelligence and Multi-Sensing group (SIMS, Dr. G. Chanel, http://sims.unige. ch): conducts research in artificial intelligence, socio-affective computing, multi-sensing, human machine interaction, entertainment and games. Our objective is to better understand human behaviors in their daily environment particularly when interacting with machines and multimedia. Our approach is based on multi-modal sensing and artificial intelligence to make meaning out of several measures including audio, videos, eye-movements, physiological signals such as EEGs (electroencephalograms), EMG (electromyograms), blood pressure, galvanic skin resistance (GSR), skin temperature, and breathing rate. The SIMS group is also part of the Institute for IT Engineering and Telecommunications from HEPIA and tightly collaborate with the Swiss Center for Affective Sciences (faculties of psychology, literature and medicine).

Co-Directors

Sviatoslav Voloshynovskiy
Full professor
H-index: 39

Stéphane Marchand-Maillet
Associate professor
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Alexandros Kalousis
Full professor
University of Applied Studies, Geneva School of Business Administration
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Guillaume Chanel
Associate professor / Senior Lecturer (also affiliated with CISA and HEPIA)
H-index: 33

fmap.unige.ch

FMAP

Formal Modeling, Analysis and Proofs

Domain activities

The FMAP group focuses on formal methods. The primary goal of these methods is to develop tools that can verify (at least semi-automatically) that a system meets its specification (i.e., that it fulfills the purpose for which it was developed).

Formal methods are particularly suited to critical systems where a malfunction could cause significant damage: application areas such as avionics, aerospace, and rail transportation (automated trains) are of particular interest. Other areas of interest include the development of embedded systems and, to a lesser extent, the validation of mathematical results.

Our activities focus on models and frameworks for representing such systems using techniques such as refinement, partial ordering... They also focus on validation methods such as model checking, abstract interpretation, and the use of proof assistants such as Rocq or Lean.

A large part of our research activity is devoted to the validation of fault-tolerant distributed algorithms. In this context, we are developing tools and use cases to formally analyze, verify, and prove such algorithms.

Director
Karine Altisen
Full professor

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Institute of Information Service Science

Collective Adaptive Systems

Director
Giovanna Di Marzo Serugendo
Full professor
H-index: 34

Domain activities

Collective Adaptive Systems are complex systems made up of diverse, autonomous entities that interact without centralised control. These entities adapt to their environment to pursue individual or shared goals, with intelligent behaviour emerging through swarm or collective intelligence. This field intersects with multi-agent systems and distributed AI.

We lead cutting-edge research in:

- **Modeling natural systems** (biological, social, human) using agent-based simulations to uncover core mechanisms and interaction patterns.
- **Designing artificial collective systems** such as swarm robotics, smart city ecosystems, and higher-order emergent behaviours.
- **Ensuring system reliability and trustworthiness** before real-world deployment.
- **Developing digital twins and AI services** to support evidence-based policy-making.
- **Exploring semantic-based multi-agent systems** and digital twin architectures.
- **Transforming business processes** through semantic AI, multi-agent systems, and generative AI.
- **Providing AI based design patterns**

Application domain include:

- Smart grids
- Natural disasters and crisis management
- Urban development and underground data management
- Galleries, libraries, archives, museums (GLAMs)
- Data cooperatives

We also drive innovation in academia. Through student-led projects, we launched the Science & Services Accelerator and an R&D unit to turn prototypes into scalable services. We are pioneers in this field within the Swiss academic sector, regularly mentoring BSc/MSc students, hosting internships, and delivering expert mandates.

Our expertise is recognized beyond academia—we serve as advisors to various institutions, including our appointment to the **Strategic Council for Geoinformation of the Canton of Geneva**.

http://unige.ch/cui/cas/
http://scholar.google.com/citations?user=CAGi2oMAAAAJ
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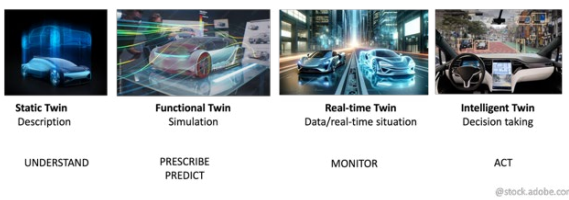

Four levels of Digital Twins and their link with Policies lifecycle

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Digital Trust, from Decentralized Finance to Augmented Human & Metaverse

Domain activities

For ages, humans have used the human notion of trust as a means to cope with uncertainty, to engage in an action in spite of the risk of a harmful outcome. More recently, computational models of this human notion of trust have been researched in order to be able to use trust in the digital world as well, between computers and/or digital accounts controlled by remote humans, from direct observations to recommendations and online reputation. Technical decentralized trust solutions such as blockchains are revolutionizing many business domains from finance to supply chain certification. In the near future, it is even envisioned that humans and computers merge together, possibly creating a metaverse. We have contributed to this trend with the organization since 2010 of the augmented human international conferences focusing on scientific contributions towards augmenting or retrieving human capabilities through technology. We are researching how these augmented human technologies can improve computational trust assessment not only of machines but also of humans.

https://www.linkedin.com/in/jmseigneur/

Director
Jean-Marc Seigneur
Senior Lecturer and Researcher
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Institute of Information Service Science

Digital Rights & Policy

Domain activities

Director
Jean-Henry Morin
Associate professor

The Digital Rights & Policy Research Group conducts research on the design and governance of digital systems and services, with a particular focus on the implications of data-driven infrastructures for rights, regulation, and institutional design. As digital technologies increasingly underpin economic and societal processes, our work examines the conditions under which such systems can remain accountable, transparent, and aligned with legal and societal norms.

The group's research is grounded in the study of Information Protection and Control (IPC), data governance, and digital rights, addressing both technical and regulatory dimensions. Particular attention is given to the challenges raised by distributed and decentralized architectures, including the management of data and trust across organizational and jurisdictional boundaries.

A significant strand of the group's work focuses on distributed ledger technologies (e.g., blockchain) as mechanisms for supporting coordination, traceability, and policy enforcement in complex service ecosystems. This includes the analysis of their potential and limitations in contexts requiring compliance, auditability, and trust.

Current research activities are structured around the following themes:

- Governance of data ecosystems and data marketplace architectures
- Digital rights and policy specification, implementation, and enforcement
- Mechanisms for dispute resolution and arbitration in digital environments
- Data protection, privacy, and regulatory compliance in distributed systems

The group adopts an interdisciplinary approach at the intersection of information systems, law, and public policy, contributing to both theoretical and technical developments in the domain of digital governance.

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Digital Transformation

Domain activities

Director
Jolita Ralyté
Senior Lecturer and Researcher
H-index: 23

Digital transformation is not just the adoption of new information technologies and the computerization of human activities. It embraces much broader strategic ambitions and involves fundamental changes in the activities, structure and even culture of the organization, with the primary goal of innovating and creating value. Service Science plays a driving role in digital transformation by providing key concepts, such as information service and service system, that facilitate business innovation through the integration of digital technologies. The approach for information service and system engineering must be necessarily exploratory, agile, and contributory, as the implementation of new services transforms the daily life of many people, and affects the organisation's activity and even its position in the ecosystem. Such transformation has to be understood, assessed and accepted by all parties. To be successful, it must be value-driven and ensure the involvement of all stakeholders by making them responsible co-creators. The transdisciplinary is another dimension to be considered in service co-creation as it allows to cross the borders of the conventional information system engineering and create new capabilities and new values. To make the approach holistic, we need to consider many other service-related aspects, such as ethics, accountability, compliance to the regulatory framework, and risks. The robustness and sustainability of services will depend not only on the quality but also on the situational-fitness of the approach. Indeed, the context and requirements of each organisation facing the digital transformation challenge is different, and therefore requires a situation-specific approach. We apply situational Method Engineering principles and techniques for developing our approach and defining contextual criteria for its configuration and application.

https://cui.unige.ch/~ralyte/
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https://www.researchgate.net/profile/Jolita-Ralyte

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Institute of Information Service Science

Information Security Lab (I-SEC)

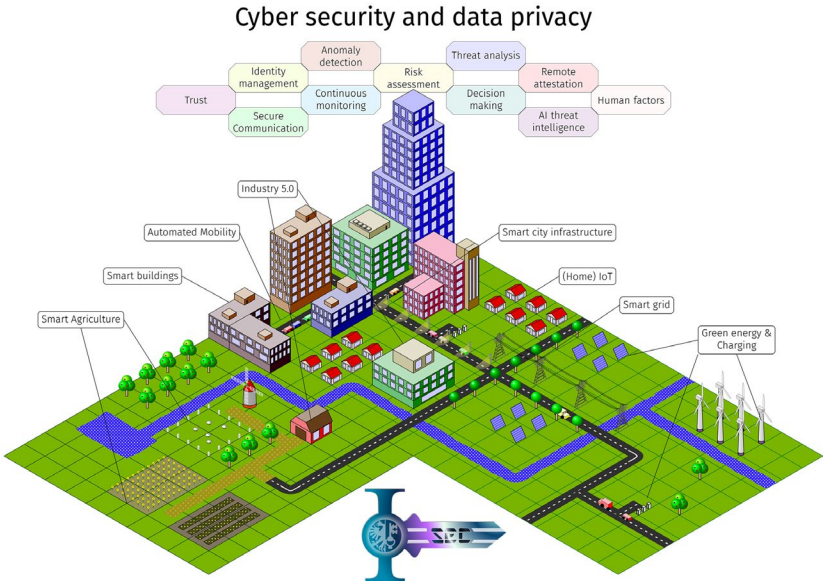
Domain activities

In the domain of cybersecurity, the institute's Information Security Lab (I-Sec) aims to translate the complex nature of cybersecurity into an easily comprehensible way to understand, monitor, and control the risks of employing current and future technologies. With a strong commitment to co-designed solutions with end-users, we research new ways on how to expose and present the raised implications on privacy, risk, security, and safety. In 2024, I-Sec has been working on several EU projects, namely ULTIMO, ENFLATE, OPEVA and AutoTRUST, in the domains of the Internet of Things (IoT), Connected (autonomous) vehicles, Smart Cities, and (critical) infrastructure. I-Sec's research works vary from risk assessment, threat identification, anomaly detection, privacy preservation, usability in security and privacy to mitigation advisory.

isec.unige.ch

Director
Niels Alexander Nijdam
Senior Lecturer and Researcher

Anastasija Collen
Senior Researcher
H-index: 12



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Mobile Services

Domain activities

The CCAMLab's research continued to play a pivotal role in shaping policy and regulatory frameworks for Connected, Cooperative, and Automated Mobility (CCAM) across Switzerland and Europe. Its expertise contributed directly to the development of new legislation and mobility service regulations in Switzerland, Germany, Luxembourg, and Denmark. Through its participation in European Commission high-level strategy groups, the lab influenced Horizon Europe's priorities for CCAM research and deployment.

The CCAMLab iniated and leads the ULTIMO project, the largest Horizon Europe project in automated mobility, with €40 million in funding and 24 international partners. ULTIMO is pioneering the deployment of fully automated, on-demand public transport services at scale, with a focus on societal integration, service orchestration, and energy sustainability.

The lab also contributes to the SINOGENES project, advancing hydrogen-powered vehicles for sustainable public transportation deployment in collaboration with the TPG.

Directors
Dimitri Konstantas
Full professor
H-index: 35

Maher Ben Moussa
Senior Researcher
H-index: 15

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Institute of Information Service Science

Quality of Life Technologies (QoL)

Domain activities

Director
Katarzyna Wac
Full professor
H-index: 34

The Quality of Life Technologies (QoL) Lab explores how mobile and emerging sensor-based technologies can be used to measure and improve human behavior, well-being, and quality of life. Using a large-scale Living Lab established in 2012—with thousands of smartphone users testing various services—we carry out both fundamental and applied research. Our work has real-world impact, influencing health policy and decision-makers.

We focus on accurate, personalized, real-world assessment of life quality as it unfolds naturally over time and context. This includes leveraging longitudinal "quantified-self" and N-of-1 data approaches, treating everyday life as something that can be examined, diagnosed, and improved—similar to how a physician would examine a physical organ. We have been supported by more than 45 grants so far and published around 200 peer-reviewed papers across computer science, human-computer interaction, and health informatics.

In a past Geneva-wide initiative, our lab contributed policy recommendations based on resident well-being data, helping guide sustainable improvements in the region. Recent projects address chronic and acute conditions like migraine, type 2 diabetes, obesity, hip replacement recovery, and breast cancer self-management. These studies validate digital endpoints that reflect life quality, moving beyond traditional medical metrics toward patient-centered outcomes.

Our contributions are shifting the focus in healthcare: from tracking only clinical or bio-physiological signals to integrating data-driven insights into life quality. This shift supports better disease risk assessment, diagnosis, and evaluation of therapeutic interventions. As a result, the lab's work plays a pivotal role in the future of personalized, digital healthcare.

qol.unige.ch

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Institute of Information Service Science

Travelling and Mobility (TaM)

Domain activities

The TaM group of the University of Geneva has proved, for many years, that they are able to contribute to the scientific state of the art by publishing in peer review journals or conferences. Machine learning techniques are mastered up to the state of the art. The success of the Innosuisse projects Alina (2023), HorseTrack (2021), QueueForMe (2020) and Recover@home (2018) are the perfect examples of why our team is the most relevant when dealing with machine learning in applied research in various fields. During the last two projects we published in the AI4I conference. One of this work led to a best paper award that was attributed to a member of our team. Beyond machine learning techniques, our group is experienced in working with different kinds of sensors and the special data post treatment they require. Finally our research group is used to working with private companies and their constraints. TaM's infrastructure is perfect for deep learning computing thanks to batch job access to run heavy computation on the cloud.

Keywords: artificial intelligence, machine learning, data processing, sensor data analysis, fusion algorithms, indoor positioning, indoor localisation, indoor navigation, GPS, maps, Geographic Information Systems, health tracking, health monitoring, eHealth

tam.unige.ch

Director
Michel Deriaz
Senior Lecturer and Researcher
H-index: 16

mlg.unige.ch

MLG

Machine Learning Group

Domain activities

The Machine Learning Group of the computer science department investigates the development of novel machine learning methods with a particular interest for their algorithmic cost and sample efficiency.

Learning from data is a key element in modern techniques of artificial intelligence and has demonstrated remarkable performance for real-world tasks that require to deal with complex large dimension signals such as images.

The first downside of these methods is the requirement for very large training sets, recorded sensor data accompanied with a human-generated «ground truth» that specifies the ideal response an AI system should generate. Such ground truth is difficult to generate and often suffers from undesirable and problematic biases. The second downside of high-performance leaning-based AI methods is their computational requirements, that often translate to tens of thousands of computer hours, with the associated financial cost and environmental impact.

We aim at mitigating both to allow a wider use and lesser impact of AI.

Director
François Fleuret
Full professor
H-index: 53

smv.unige.ch

SMV

Software Modeling and Verification

Director
Didier Buchs
Honorary professor
H-index: 23

Domain activities

Symbolic Model Checking was developed with the idea of verifying complex high level models with a reasonable amount of work for the user. In particular we propose to separate the model to the informations for performing eficiently model checking (clustering, anonymization, partial unfolding). The introduction of new kind of decision diagrams (∑ -DD) based on a generalization of the Shannon decomposition principles allow us to perform model checking for models with huge combinatorial explosion of states (around 10E4500 symbolic states). We are currently exploring the systematic use of rewriting of set of terms principles based on decision diagrams and operational control based on strategies as a metalevel in model checkers.

We currently develop several tools such as StrataGEM for the set rewriting principles, Stew as an abstraction over StrataGEM and Ardoises a meta-environment for managing formalisms and their veri cation tools. We also continue to organize a model checking contest in the conference Petri Nets in order to be able to compare existing model checkers on significant benchmarks. We also study programming language construction that check that the use of memory is alias safe. This language SafeScript is extending JavaScript in an elegant way. We also develop methods to adapt our formalisms (CREST) to the domain of modeling and verification of cyber-physical systems.

Several application domain have been covered by the team such as the development of a domain specific language for computing on sets (Trexmo Tool for the SECO). This language is applied successfully for expressing various models of toxicology analysis in the context of health in the workplace.

SPC

Scientific and Parallel Computing

Domain activities

The Scientific and Parallel Computing laboratory (SPC, https://spc.unige.ch/en/), divided into two groups, dedicates its research to the fields of computational science and high performance computing, with a special focus on the study of complex systems and modelling approaches based on cellular automata, lattice Boltzmann, and multi-agent techniques. Massively parallel programs and algorithms are developed, capable to explain or reproduce natural phenomena with the help of computer simulations executed on CPU and GPU-based supercomputers. The SPC lab develops and maintains the open-source software Palabos (www.palabos.org), which is widely used and acknowledged by the simulation community and has been used as a tool for more than 300 publications by universities world-wide. Palabos is used as a tool to spread the research of the UNIGE internationally, establish collaborations, and assess the expert position of the UNIGE in the field of lattice Boltzmann modeling.

https://spc.unige.ch/en/
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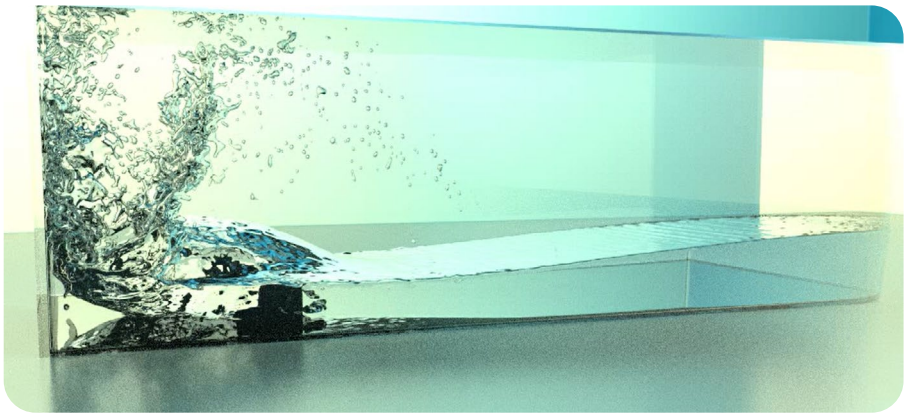


Co-Directors

Bastien Chopard
Honorary professor
H-index: 46

Jonas Lätt
Associate professor
H-index: 26

Jean-Luc Falcone
Senior Lecturer
H-index: 18

Franck Raynaud
Senior Lecturer and
Research Associate
H-index: 17

TCS

Theoretical Computer Science

Director
José Rolim
Honorary professor
H-index: 26

Domain activities

Experimental driven research on Topology Control Protocols for Wireless Sensor Networks (WSN) using transmission power and throughput rate feedback schemes. The goals include link qualification in terms of symmetry and coherence and link quantification. Transmission power constitutes the link «generator» and throughput rate the link «regulator» to meet the qualitative and quantitative criteria for links between WSN nodes .

Research on designing a geographic routing algorithm for large scale networks, which is an extension to the Virtual Raw Anchor Coordinate localization based geographic routing. The goal is to perform routing in wireless ad-hoc network in a hierarchical manner, where in the top level routing is done between two geographic regions and in the bottom level performing routing to the exact node. A randomized protocol is designed and evaluated with simulations.

Design of a distributed publish/subscribe algorithm for an ubiquitous sensing scenario. We consider unstructured and free-geocoordinates sensing networks in which no network protocol is provided. Our solution, which avoids implying all the nodes of the network in the dissemination process, uses a distributed notification service defined by Directional Random Walks (DRW). A DRW is a probabilistic technique able to go forward into the network following a loop-free path. The principle assumed in our research is that two lines in a plane cross.

Also research on Future Networks, Internet of Things and Crowdsensing. Our efforts focus on problem modeling aspects and incentive formulation regarding the crowd participation in tasks that aim at optimizing spatial and temporal coverage issues.

Also, research on radiation aware wireless networking; studying the cumulative impact on ERM caused by multiple wireless sources in terms of numbers, topology, protocol, etc.

Thesis completed

Alexandre-Quentin Berger

Doctor ès Sciences, mention Computer Science

17th November, 2025

Directors: Prof. Arnaud Casteigts, Prof. Jose Rolim

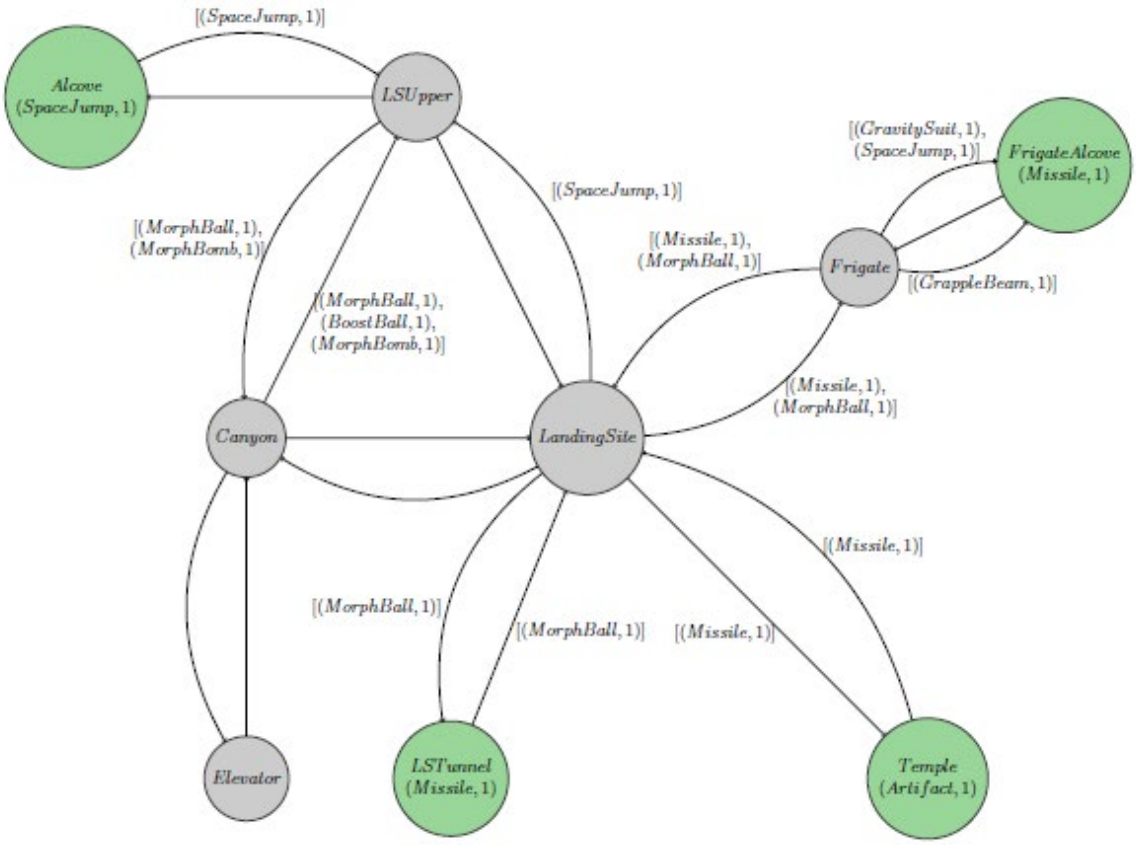
Video Games Randomizers: Models, Complexity Analysis and Probabilistic Algorithms to Properly Randomize Games

Many video games include randomizers natively or can be augmented with external randomizers. The goal of these randomizers is to change some parts of the game randomly, while keeping it playable and ensuring that the game can still be finished.

In this thesis, we investigate the problem of randomizing a game for various types of games. We start by formalizing this problem as a labeling problem in directed graphs. Unfortunately, we show that a general randomizer (i.e., one that can possibly generate any finishable game) involves solving NP-hard problems as a subroutine for the vast majority of games.

Motivated by this limitation, we define a restricted family of randomizers that produce finishable games by construction. We classify games in two categories, lossless and lossy games, and present multiple polynomial time randomizers for both categories. For lossless games, we present first a simple algorithm, which we then improve with multiple parameters and other options to extend as much as possible the diversity of generated games. Similarly, we follow with algorithms for lossy games, using the lossless algorithms as a base and adding another graph structure tracking resources importance in the game.

Finally, we also perform practical experiments with these algorithms on a real video game, which demonstrate that these randomizers have the potential to generate meaningful games for the community of players, and so, for a broad range of video games.



Doctorat thesis: Univ. Genève, 2026 - Sc. 5976 - 2026/01/28
https://archive-ouverte.unige.ch/unige:191242

Ashley Caselli

Doctor ès Social Sciences, mention Information Systems

16th June, 2025

Directors: Prof. Giovanna Di Marzo Serugendo, Prof. Gilles Falquet

A Domain-Agnostic Semantic Framework for Automating RegulatoryCompliance

Organizations face significant challenges in ensuring compliance with complex and ever-growing legal and regulatory requirements, typically written in natural language. Thismakes automation difficult and resource-intensive. Existing compliance solutions are often domain-specific and lack scalability and reusability. This research proposesa domain-agnostic framework leveraging Semantic Web technologies to automateregulatory compliance processes. These technologies enable semantic data enrichment,interoperability, and the creation of FAIR-compliant knowledge bases.

The framework introduces a unified model for regulatory knowledge formalization,implemented as an ontology-based language. It separates domain-specific business logic-from regulatory representations, promoting maintainability and reusability. Additionally,it outlines an abstract workflow for both compliance checking and compliance-by-design approaches, adaptable to various regulatory contexts.

A proof-of-concept (PoC) demonstrates the framework's flexibility and effectivenessacross multiple domains, including (i) architecture, engineering, and construction (AEC),(ii) finance, and (iii) academia, using knowledge graphs and SHACL. Results show theframework's potential to streamline compliance efforts and support organizations andpractitioners in managing regulatory knowledge more efficiently. Future work will refinethe framework and expand its application scope, with the goal of further promotingautomation, scalability, and traceability of regulatory compliance processes acrossindustries.

Doctorat thesis: Univ. Genève, 202x - SdS xxx - 202x/xx/xx
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Flann Chambers

Doctor ès Social Sciences, mention Information Systems

19th December, 2024

Director: Prof. Giovanna Di Marzo Serugendo,
Prof. Christophe Cruz (Uni Bourgogne)

Autonomous Generation of a Public Transportation Network by an Agent-Based Model: Mutual Enrichment with Knowledge Graphs for Sustainable Urban Mobility

This thesis develops agent-based models of land cover change and mobility inside the canton of Geneva, and demonstrates that, given the establishment of dedicated infrastructure, agent-based models become self-adaptive digital twins of urban systems, which foster communication around its inner workings, state and future trajectories among a wide variety of audiences, and provide valuable guidance for policy-making.

Working towards the sustainability of our cities is one of the greatest challenges of this century, and its assessment requires the development of tools dedicated to holistically capturing the complexity of such urban systems. It is not sufficient to analyse separately each of their components (such as urban mobility, land cover change, etc.), because the interactions between these components are of capital importance to the evolution of the system as a whole.

Agent-based models are highly capable at integrating key characteristics of these complex systems, such as individual behaviours and population heterogeneity, and hold great value in the eyes of policy-makers in their ability to provide insights for decision-making processes. However, research in the agent-based modelling field has encountered a wide array of hurdles, ranging from its data hungriness, and the lack of standardised infrastructure for real time incorporation of real-world data, to drowning out the user in a wealth of parameters to calibrate and output data to visualise efficiently.

In this thesis, we develop three models of urban mobility, commuting patterns and land cover change due to urban expansion, for the canton of Geneva and the Greater Geneva region. We identify four major shortcomings of the current state of the art in the agent-based modelling field and show that our studies adequately address them.

The first model, of commuting patterns along the Cornavin-Meyrin-CERN axis, showcases the capability of agent-based models to capture population heterogeneity, by customising the commuter agents' timetables based on their age class. The results show that decreasing public transportation offer will drastically deteriorate the commuting experience, with overcrowded trams preventing the boarding of many passengers along this axis. Conversely, increasing the public transportation offer will dampen the influx of commuters caused by the emergence of a new residential district.

The second study harnesses a DPSIR analysis of residential choices based on public transportation offer in the canton of Geneva. Results show that people would rather relocate in homes that are closer to the city centre, and that when this preference is denied by high rent prices and low housing availability, priority shifts to residences located near modes of public transportation with high passenger capacity and travelling speed.

In the third study, we coupled an agent-based model with an ontology and knowledge graphs for representing the history and future of public transportation network development in the Greater Geneva region. The model is able to replay the development of the tram line network, predict future tram line extensions and generate an artificial network from scratch, by building tram lines based on the existing road network and the spatial distribution of the population and aiming to maximise the amount of people reached by the tram lines. Results show that the artificially generated networks closely resemble their real-world counterpart, and both the knowledge graphs and the agent-based model are enriched by the outputs of their consort.

This thesis highlights the strengths of agent-based models in capturing the complexity and emergent phenomena of urban systems. These models integrate the heterogeneity of populations, individual behaviours, and enable the exploration of various hypothetical scenarios, providing valuable insights for policy-making. The works conducted during this thesis make use of additional techniques, such as the DPSIR framework for supporting the establishment of evidence-based model evolution rules, and knowledge graphs, for enhancing communication about the research paradigm among project members and other audiences (such as the general public), as well as for streamlining the design of hypothetical scenarios to explore in the model.

This thesis also addresses four major hurdles that hamper the widespread use of agent-based models in the researcher community as well as for guiding policy-making. The data hungriness of such models is solved by advocating for the establishment of large geomatic databases in open access for the studied system. Decoupling the visualisation of agent-based models' results, a computationally intensive yet crucial process for unlocking the full powers of such models, from the simulation course, leads to the creation of standalone data exploration platforms. Their deployment to web applications further fosters an efficient communication of these results. Coupling agent-based models with knowledge graphs greatly simplifies the model's parametrisation process and the design of scenarios, and unifies project members around a common vocabulary and grammar ruleset. Real-time integration of real-world data allows agent-based models to function as self-adaptive digital twins, monitoring the state of the system and its key indicators, predicting its future evolution and allowing for the exploration of hypothetical scenarios. With these barriers lifted, this new generation of «agent-based digital twins» provides a goldmine of insights for guiding political decision-making processes, and helps shape the sustainable cities of tomorrow.

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https://archive-ouverte.unige.ch/unige:183012

Hafiz Firmansyah

Doctor ès Social Sciences, mention Information Systems

14th January, 2025

Directors: Prof. Giovanna Di Marzo Serugendo,
Dr. Jose Luis Fernandez-Marquez

Improving Disaster Response With Advanced Machine Learning ToAnalyse Social Media Content

Over the last decade, disasters have impacted more than 1.5 billion people worldwide, causing more than half a million deaths and resulting in major economic losses for the affected areas. The most impacted are those residing in the least developed countries and small island developing states. Accessing relevant information in a timely manner is key for providing an accurate and efficient response to these situations. Traditionally, satellite imagery has been a common approach, yet analyzing these images is both costly and time-consuming. In contrast, recent advancements indicate that social media plays a pivotal role in delivering timely information. On these platforms, users share critical updates about disasters, including the extent of damage to infrastructure, severity of the damage, and the condition of victims. Despite its potential, the utility of social media data in operational contexts is limited by challenges such as filtering irrelevant information and the lack of location in the content.

This thesis addresses the problem to get relevant information and retrieve location from social media content. It investigates the role of advanced machine learning in two directions. Firstly, it seeks to enhance information classification by applying sophisticated machine learning techniques to improve the accuracy of categorizing social media data into vital response categories, such as information relevance, damage severity, and urgent needs. Secondly, it involves predicting the geolocation of social media content to aid disaster response. This thesis employs advanced machine learning algorithms to infer the geographical origins of social media posts lacking explicit location data, aiming to accurately identify areas in need during disaster situations, thereby optimizing response efforts. This problem-driven research leverages and analyzes real-world datasets from social media platforms. Motivated by real-world problems, the thesis is conducted in collaboration with various practitioners and institutions, including the Joint Research Center of the European Commission, Digital Humanitarian Organization VOST Portugal, Artificial Intelligence Research Center CSIC Spain, and Politecnico di Milano, Italy. As a contribution to the field, this thesis offers an approach, design, and implementation of advanced machine learning to analyse social media data. The results are expected to assist policymakers in understanding the technical approach to applying social media analysis to enhance disaster response.

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https://archive-ouverte.unige.ch/unige:183585

Philippe Glass

Doctor ès Social Sciences, mention Information Systems

20th June, 2025

Director: Prof. Giovanna Di Marzo Serugendo

Coordination model and Digital Twins for managing energy consumption and production in a smart grid

Smart grids play a key role for energy management directly supporting the socioecological transition of neighbourhoods. This research provides the design of a coordination model to enable the management and exchange of electrical energy between producers and consumers at a microgrid level. The coordination model proposed, which derives from the SAPERE coordination model, allows intelligent digital twins to interact and generate data on the fly to meet different needs in real time. We have designed prosumer digital twins, which autonomously generate supply contracts in the form of a transaction, and supervisor digital twins, which regulate energy overflow in real time and proactively using predictions generated by a learning model. The interactions of digital twins through the coordination model not only generate energy exchanges between prosumers but also enable peak shaving - to avoid energy overflows. We have also adapted and used the coordination model to integrate two decentralised approaches to distributed learning applied to a micro-network: the Gossip Federated Learning approach, which consists of exchanging homogeneous learning models between neighbouring nodes, and the Gossip Ensemble Learning approach, which consists of exchanging prediction results between neighbouring nodes, possibly obtained from heterogeneous learning models. The experimentations, based on real data, show that the combination of a coordination model and intelligent digital twins makes it possible to implement and operate these two purely decentralised learning approaches. The results obtained on the predictions confirm that these two implemented approaches can improve the efficiency of learning on the scale of a microgrid, while reducing the congestion caused by data exchanges. Because a microgrid project involves major changes and efforts on the part of users, it has no chance of succeeding unless the aspirations and fears of potential users are thoroughly taken into account: these can be collected and then used to define social acceptance criteria to be taken into account when implementing the project. A group from the same research project carried out a study to construct these criteria 'by design' and we then incorporated some of them into the digital twin's algorithms. The main features implemented consists in avoiding the tragedy of the commons, reducing free-riding behaviour through reward credits, integrating energy storage at the microgrid level and integrating certain salient attributes that can be handled by the digital layers of a microgrid. We have implemented and tested the coordination model with different microgrid network topologies and with different types of data: simulation datasets, which are purely generated, and realistic datasets, based on household statistics, and real datasets, collected in the 'Les Vergers' living-lab near Geneva. The results show that the combination of a coordination model and intelligent digital twins supports self-adaptive energy management, collaborative and decentralised learning framework, while taking account of issues linked to social acceptance. Such approaches are fundamental to developing smart grids that are resilient, reliable and respectful of environmental and social criteria.

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Laetitia Gosetto

Doctor ès Economy and Management, mention Information Systems

19th September, 2025

Directors: Prof. Gilles Falquet,
Dr. Frédéric Ehrler

Personalization in Mobile Health Applications for Behavior Change: ALiterature-Based Preference Matrix, Empirical Validation, and OntologyDevelopment

Unhealthy behaviors, including physical inactivity, poor diet, tobacco use, and alcohol misuse, continue to be signiSicant contributors to global mortality, highlighting the pressing need for effective, scalable interventions to promote sustained health behavior change. In recent years, mobile health (mHealth) applications have emerged as promising tools for promoting such
change, offering cost-effective, accessible, and personalized solutions. However, despite their potential, many mHealth applications still adopt a «one-size-Sits-all» approach, which fails to account for the considerable variability in user characteristics that inSluence engagement and behavioral outcomes.

This thesis addresses the challenge of personalization in mHealth by proposing a structured, empirically validated framework that links user proSiles to mechanisms. The work is grounded in established behavior change theories and gamiSication principles. It identiSies key dimensions relevant to personalization, including personality traits (e.g., Big Five), player types (e.g., Hexad, BrainHex), and demographic variables (e.g., age, gender). A multi-stage research process was conducted. An initial scoping review established a comprehensive preference matrix linking user types to mechanisms. This matrix was subsequently validated through an empirical study involving self-reported proSiling and mechanism selection tasks.

In order to operationalize these Sindings, the thesis introduces two major contributions. First, it proposes a preference matrix that systematically maps user characteristics to mechanisms, providing practical guidance for developers and researchers aiming to design adaptive mHealth interventions. Secondly, it presents a formal ontology that encodes these relationships in a semantic framework, thereby enabling advanced querying, reuse, and future integration with broader behavior change ontologies.

The findings suggest a substantial degree of convergence between literature-derived predictions and empirical user preferences, thereby substantiating the external validity of the proposed framework. Furthermore, the work delves into the methodological and ethical considerations associated with user proSiling, advocating for the utilization of validated instruments over opaque, automated inference systems. The limitations of the study are acknowledged, including the exclusion of some dimensions, such as message framing and social norms, which are proposed as avenues for future research.

In summary, this thesis presents a principled, extensible approach to user-centered personalization in mHealth for behavior change. The integration of theoretical models, empirical data, and semantic tools is a signiSicant contribution to the development of more engaging, effective, and individualized mhealth interventions.

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https://archive-ouverte.unige.ch/unige:187978

Julien David Marc Knafou

Doctor ès Sciences, mention Bioinformatics

10th April, 2025

Directors: Prof. Bastien Chopard, Prof. Patrick Ruch (HEG Geneva)

TransBERT: Leveraging Automatic Translation for Domain-Specific Knowledge Transfer

Natural Language Processing (NLP) and machine learning technologies have transformed many facets of life science research and healthcare in recent years. However, the development of advanced Language Models (LMs) and NLP tools for life sciences has largely been limited to English because of the scarcity of scientific publications in other languages. This language barrier presents significant difficulties for international researchers and healthcare professionals, limiting their ability to use the most recent NLP features in their native languages. The aim of this thesis is to explore innovative methods for developing competitive life science LMs for non-English languages, focusing on French, by exploiting recent progress in Machine Translation (MT). The study was structured around two primary hypotheses:

1. The current state of MT enables the development of a LM trained entirely on an automatically translated corpus, maintaining competitiveness with State-of-the-Art (SOTA) models in the field.
2. Domain-Specific (DS) tokenization enhances the performance of Pre-trained Language Models (PLMs) on specialized downstream tasks.

To support the first hypothesis, TransBERT, a French life science model, was trained exclusively on an extensive collection of automatic translated MEDLINE abstracts. Specifically, the advanced M2M-100 translation model was deployed to translate more than 22M MEDLINE abstracts from English to French, creating TransCorpus, the most extensive French life science corpus to date, encompassing roughly 36GB of raw text. Subsequently, following the training of a BERT architecture on a Masked Language Model (MLM) task utilizing this synthetic corpus, TransBERT was evaluated against two SOTA PLMs through comprehensive experiments. The first model, CamemBERT, is a French LM trained on a general corpus, whereas the latter, DrBERT, is a life science focused LM developed using a native French corpus. The performance of these models was assessed on various life science NLP tasks employing an adaptation of DrBenchmark, the first French biomedical benchmark for Natural Language Understanding (NLU). Even though TransBERT was pre-trained solely on translated data, our results showed that it achieved competitive or better performance compared to these leading models. Statistical analyses validated the strong performance of TransBERT in two key tasks of the field, classification and Named Entity Recognition (NER).

To evaluate the second hypothesis, the e!ect of DS tokenization on model performance was analyzed by comparing TransBERT, which employs a DS tokenizer trained on TransCorpus, with cTransBERT, an equivalent model architecture pretrained on the same corpus but using CamemBERT's general domain tokenizer. Using the same benchmark, our analysis shows that the model using the DS tokenizer repeatedly enhanced performance while getting statistical significance for NER. These results highlight the necessity of tailoring the tokenizer to the specific domain when developing specialized LMs.

Beyond just validating our core hypotheses, this research makes several key contributions to the field of multilingual life science NLP. Firstly, we illustrate a scalable method for swiftly developing competitive DS LMs for low-resource languages by leveraging high-quality MT. This approach can potentially be applied to other domains and language pairs. Secondly, we provide TransCorpus as a valuable new resource for life science NLP research. Finally, our comprehensive evaluation framework and statistical analysis methodology o!er a rigorous way to compare LMs performance that goes beyond simple metric comparisons.

This thesis introduces innovative strategies for bridging the linguistic gaps in life science NLP by leveraging MT and DS pre-training. The success of TransBERT demonstrates that it is feasible to develop highly e!ective DS LMs for non-English languages, even in the absence of extensive native corpora. These insights have significant implications for democratizing access to advanced NLP capabilities across various languages and domains. Future research can build on this foundation to further improve cross-lingual transfer learning and domain adaptation techniques, ultimately aiming for truly multilingual biomedical Artificial Intelligence (AI) systems that can benefit researchers and clinicians worldwide.

Doctorat thesis: Univ. Genève, 2025 - Sc. 5898 - 2025/04/10
https://archive-ouverte.unige.ch/unige:185244

Bátin Máté

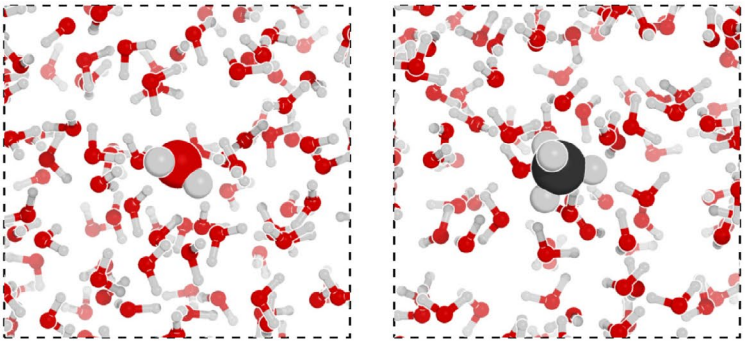
Doctor ès Sciences, mention Computer Science

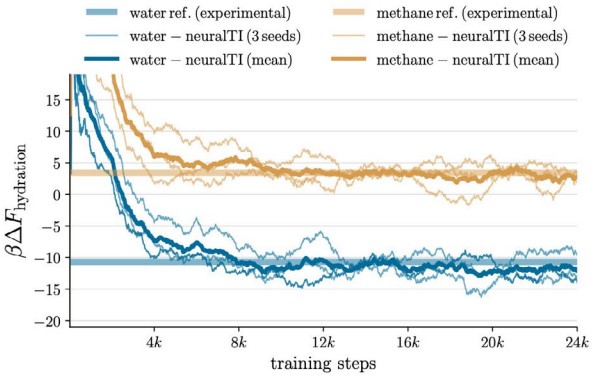
9th December, 2025

Directors: Prof. François Fleuret,
Prof. Tobias Golling

Sampling and Free-Energy Computation via Interpolating NeuralNetwork Potentials

Les simulations moléculaires classiques, utilisant des méthodes telles que la DynamiqueMoléculaire (MD) et la Chaîne de Markov Monte Carlo (MCMC), rencontrent souventd'importants obstacles dans l'échantillonnage efficace d'espaces de configurationscomplexes et l'estimation précise des énergies libres, limitant ainsi leur applicabilité auxsystèmes présentant une dynamique complexe ou lente. L'émergence récente desmodèles génératifs profonds, capables d'apprendre et d'échantillonner à partir dedistributions de données de haute dimension, offre une piste prometteuse pour releverces défis. Dans cette thèse, nous explorons de nouvelles méthodologies exploitant cesmodèles génératifs profonds avancés afin de surmonter les limitations inhérentes àl'échantillonnage et à l'estimation des énergies libres en physique statistiquecomputationnelle.





Doctorat thesis: Univ. Genève, 2025 - Sc. xxxx - xxxx/xx/xx
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Vincent Micheli

Doctor ès Sciences, mention Computer Science

28th November, 2025

Director: Prof. François Fleuret

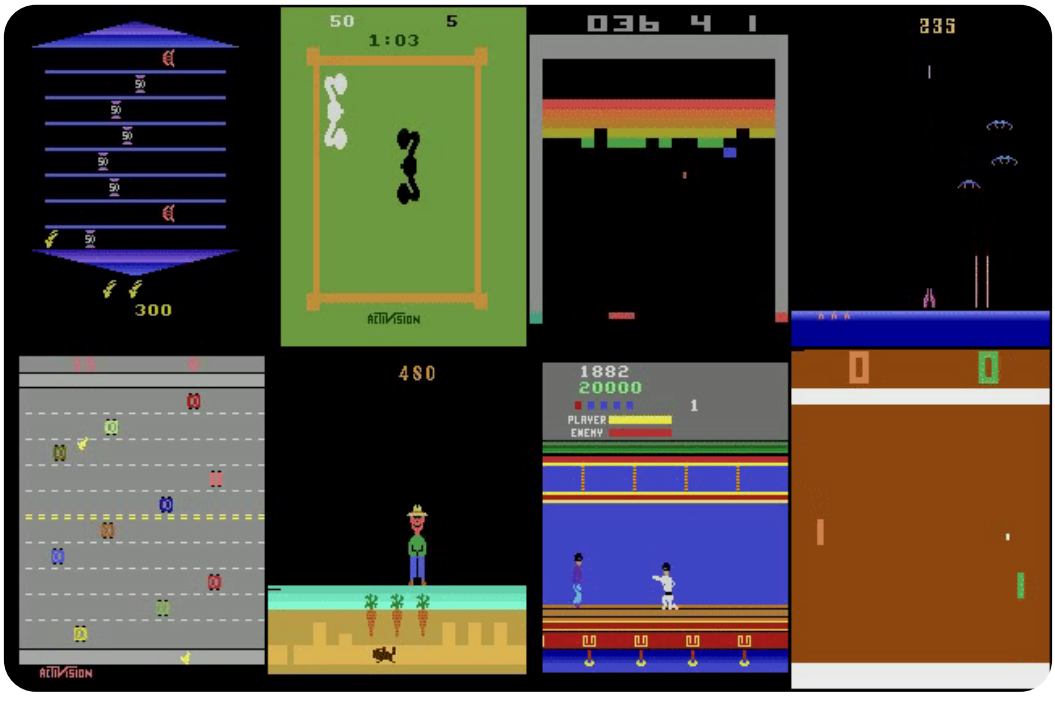
World Models for Decision Making

Deep learning has become the dominant paradigm for solving a myriad of tasks ranging from natural language processing to computer vision. However, the adoption of deep neural networks as agents in the digital and physical worlds has been hampered by their lack of data efficiency. In this thesis, we propose methods to build and leverage world models for sample-efficient decision making.

Firstly, we propose to initialize agents for text-based environments with pretrained language models. We introduce a fine-tuning procedure that blends imitation learning and reinforcement learning into a common objective. The resulting models drastically outperform previous approaches while being significantly more sample efficient.

Secondly, we develop a novel world model architecture composed of a discrete autoencoder that builds a vocabulary of image tokens and an autoregressive transformer that composes the vocabulary over time. We train agents to solve environments by learning from synthetic trajectories imagined in the world model. Our agents achieve superhuman performance with only a few hours of real data.

Finally, we improve the world model architecture to render it scalable to more complex domains. We encode differentials between frames instead of the frames themselves, thus reducing the sequence length of the model, and inject absolute state representations in its conditioning to simplify the world modeling task. We demonstrate that our approach surpasses existing methods when scaling the number of interactions in a challenging environment.



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Mohamad Moussa

Doctor ès Social Sciences, mention Information Systems

28th November, 2025

Directors: Prof. Giovanna Di Marzo Serugendo,
Prof. Nabil Abdennadher (HEPIA Geneva)

Towards Decentralised Machine Learning Predictions for Local Energy Communities

The liberalization of the electricity market and the proliferation of new forms of electricity production and consumption are paving the way for new smart digital services. These services will involve a new generation of intelligent devices, called Grid Edge Devices (GEDs), designed to support electric systems and microgrids. Microgrids are localised energy systems capable of operating either connected to the main grid or independently in islanded mode.
Accurate prediction of energy consumption and production is essential for maintaining microgrid stability, and leveraging machine learning, whether through centralized models or privacy-preserving federated learning, enables adaptive, data-driven forecasting that supports efficient grid management.
In this thesis, we investigate and propose several federated learning (FL) approaches that leverage intelligence at the edge, ensuring data privacy. Unlike traditional machine learning models that require centralizing raw data for training, our methods enable edge devices to collaboratively train forecasting models locally, without transmitting raw data to a central server. This paradigm is particularly valuable in energy systems, where privacy, security, and communication constraints present significant operational challenges.
Through extensive experiments using real-world energy consumption data provided by a Swiss energy company, we investigated different machine learning models for load forecasting. Although XGBoost, DeepAR, and Transformer-based models were also in consideration, Long Short-Term Memory (LSTM)-based models were selected as the primary solution due to their favourable balance between predictive performance, and simplicity of adaptation to FL paradigms.
We explore and compare different FL architectures, including centralized - where learning models are collected and centralized into a global model, decentralized variants - where individuals models are aggregated only with a selected set of neighbouring node models, as well as continual learning extensions for adaptability in dynamic environments. Unsurprisingly, centralized FL achieves the highest predictive accuracy due to global model aggregation. However, from a decentralization perspective —where avoiding central dependence and excessive communication is desirable — our decentralized FL approaches demonstrate performance that closely approaches centralized FL, especially when communication is limited to a small number of similar neighbors. Furthermore, integrating continual learning through periodic model retraining, enables decentralized models to achieve performance that is comparable to, and in some cases even surpasses, multi-device or centralised configurations.

Overall, the results from this thesis show conclusively that decentralized federated learning mechanisms, especially using LSTM architecture and neighbor-aware collaboration, can serve as a viable and efficient alternative to centralised federated learning (FL) for energy forecasting in local energy communities.
Decentralized federated learning offers transformative potential for smart grids by enabling secure, privacy-preserving collaboration across distributed energy resources. By allowing edge devices to train models locally and share only model updates, decentralized FL eliminates the need to centralize sensitive energy data. This approach not only enhances data privacy and security but also reduces communication overhead and latency, making real-time forecasting and decision-making more efficient. In complex energy systems where data heterogeneity and operational constraints are prevalent, decentralized FL fosters scalable, adaptive intelligence that strengthens grid resilience, optimizes energy distribution, accelerates the adoption of renewable energy, and supports the transition toward more autonomous and sustainable energy infrastructures.

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Gilbert Mushi

Doctor ès Social Sciences, mention Information Systems

14th August, 2025

Directors: Prof. Giovanna Di Marzo Serugendo,
Dr. Pierre-Yves Burgi

Design and Implementation of a Farmer's Digital Information System for Sustainable Agriculture Among Smallholder Farmers in Tanzania

Sustainable agriculture among smallholder farmers has the potential to ensure food security and alleviate extreme poverty in a rapidly growing population and the face of global climate change. Additionally, smallholder farmers contribute 70% of the world's food and employ more than one billion people, the majority of whom live in rural and semi-urban areas. However, this group of farmers faces various challenges in adopting sustainable agriculture. We conducted a literature review and a survey of key agricultural stakeholders in Tanzania to identify common challenges of smallholder farmers. It was revealed that smallholder farmers lack access to essential services, including subsidies, credit, insurance, government services, markets, and farming information.

In this thesis, we aim to design and implement a digital framework for smallholder farmers to access all essential services (subsidies, credit, insurance, government services, market, warehouse services, logistics services, quality farm inputs, and farming information) under one roof. Indeed, digital technology can play a significant role in digitizing the agricultural value chains (AVCs) of small-scale farmers in countries of the Global South. The use of advanced digital technologies in agriculture, including artificial intelligence (AI), the Internet of Things (IoT), blockchain, robotics, and big data, has enabled sustainable farming through increased production and income, as well as enhanced environmental conservation. However, these technologies are not accessible to smallholder farmers (the majority of whom reside in countries in the global South) as they require high investment capital, expertise, and well-established infrastructure. Although various digital services are available for smallholder farmers, the existing services often lack sustainability in the agricultural context and fail to meet their needs.

We employed the Design Science Research (DSR) method to design and provide a proof of concept of a digital platform that brings together all key agricultural stakeholders, enabling farmers to access all essential services throughout the complete farming cycle. Moreover, we conducted a literature review using the PRISMA guidelines to establish the state-of-the-art technology in agriculture and the use of ICT-based services by smallholder farmers in Tanzania. A survey method was employed as part of the DSR to collect stakeholders' opinions on the proposed digital artifact solution. The study follows the theories of Information and Communication Technology for Development (ICT4D), which posits that technological advancements should have a positive impact on people's lives by developing solutions that work well within the local context, rather than simply copying and pasting technology from other contexts, such as from developed to developing countries.

As a research contribution, we identified common challenges of smallholder farmers, designed and provided a proof of concept of a Farmers' Digital Information System (FDIS) that integrates services from different stakeholders, including farmers, agro-dealers, warehouses, logistics companies, subsidies, advisory services, market, credit, insurance, and government(permit) services. We expect our findings will help governments, the private sector, and policymakers to adopt and implement FDIS. This will make the agriculture sector more dynamic and help smallholder farmers participate in sustainable agriculture.

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Karthik Thyagarajan

Doctor ès Sciences, mention Computer Science

10th April, 2025

Director: Prof. Jonas Lätt

Compressible supersonic flow modelling with Lattice Boltzmann Method for GPU's

The lattice Boltzmann method (LBM) has become a powerful tool in computational fluid dynamics, yet its application to high-speed compressible flows remains a significant challenge. Considering all the developments towards achieving this goal, the numerical equilibrium approach stands out. This thesis presents a comprehensive framework for simulating compressible flows across subsonic, transonic, and supersonic regimes, addressing long-standing limitations in Numerical Equilibrium. Through an introduction of novel techniques, this work bridges gaps between mathematical theory and practical applications, offering robust solutions for high-speed compressible and multiphase flow dynamics.

The first contribution redefines the collision operator by framing it as a linear algebra problem, creating a unified framework that encompasses both linear and nonlinear methods. In this context, the linear approach refers to polynomial expansions, while the nonlinear approach pertains to the non-linear moment-matching technique introduced in numerical equilibrium [66]. The second contribution introduces a novel collision operator that extends the nonlinear moment-matching methodology aptly named, numerical collision. This innovation replaces heuristic assumptions with a mathematically consistent Multiple Relaxation Time (MRT) method, which is validated through both analytical and computational benchmarks. Furthermore, the research advances multiphase flow modeling by proposing a new model that integrates the Volume of Fluid (VOF) method with the Partially Saturated Cell (PSC) approach. This integration enables accurate simulations of early-stage shock-droplet interactions, demonstrating both theoretical rigor and practical applicability, as validated by comparisons with published results.

The algorithms developed were implemented in parallel using the C++17 standard parallel algorithms, providing a hardware-agnostic solution that runs seamlessly on both CPUs and GPUs [65]. The resulting LBM framework delivers a scalable and efficient tool compatible with modern CPU and GPU architectures, significantly extending its applicability to a wider range of high-speed flow simulations. Beyond these immediate contributions, this research lays a solid foundation for future advancements in LBM, including the development of collision models and the investigation of complex physical phenomena. These advancements represent a notable step forward in harnessing LBM for state-of-the-art computational fluid dynamics applications.

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https://archive-ouverte.unige.ch/unige:188251

Joakim Tutt

Doctor ès Sciences, mention Computer Science

15th December, 2025

Director: Prof. Sviatoslav Voloshynovskyy

Un modèle mathématique d'impression et d'imagerie pour l'authentification des codes de détection de copie

This thesis takes place in the field of Physical Object Security in view of the development of secure and reliable authentication schemes and is a part of the broader project of Informationtheoretic analysis of deep identification systems. The problem of object counterfeiting represents a major threat for the development of our modern societies. These attacks constitute a menace for the industrie's development and reputation and constitute a risk for the consumer especially when counterfeiters target vital industries such as drugs or security devices. The problem of object counterfeiting is further exacerbated today as we live in a decentralized world where goods and products are being shipped all across the globe, multiplying the possibilities of attack against production chains and complicating the task of object tracking and identification.

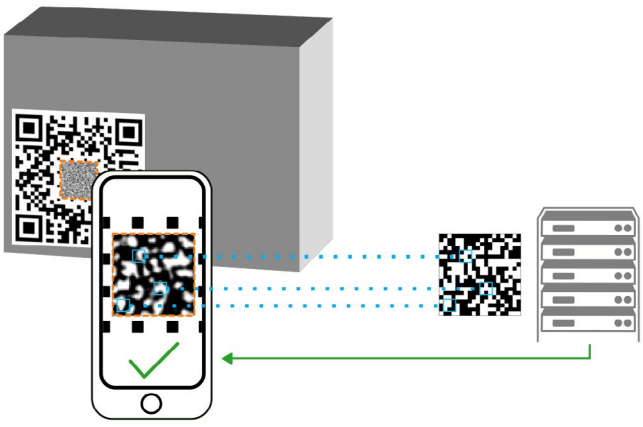
Among the great variety of technologies available for the fight against object counterfeiting, a recent anticopy technology emerged in 2004 which showed great promise as an interesting trade-off offering high level of security against product counterfeiting while still maintaining a relative simplicity in implementation for mass-manufacturing industries. This technology is called the Copy Detection Pattern (CDP). However, due to its relative youth when compared to other well-known technology, the approach based on CDP still lacks a deeper study of its strengths and weaknesses and its stability has only been tested empirically on small proprietary datasets, kept in the secrecy of private industrial research laboratories. Moreover, the recent breakthrough in synthetic image generation based on deep learning architectures were shown to be a major threat to the classical methods used for the authentication of CDP. As such, there is a pressing need in developing open researches on the security guarantees provided by the CDP authentication scheme that would allow for reproducible experiments and fair comparison of its capabilities by independent researchers.

The work we present in this thesis is a contribution to this general effort. Its main objective is to provide an in-depth study of the printing-imaging channel associated to the CDP authentication framework both theoretically and experimentally so as to develop a better understanding of this technology's main challenges and ultimately help fighting against the new threats posed by modern attacks. In this regard, this thesis proposes novel directions for the description and analysis of the printing-imaging channel of CDP, providing new tools and measures of the channel's features and statistics. These new approaches are studied both from a theoretical point of view, developing sound foundations to discuss the problem of CDP-based framework security guarantees, and experimentally, by testing them on publicly available datasets of CDP. The thesis also adresses the question of applying these new tools to enhance the classical authentication scheme and demonstrates that the proposed novel approaches are actually able to detect even the strongest attacks on CDP known as of today.

In a first part, the thesis concentrates on modelling the printing-imaging channel of CDP using a deep-learning encoder-decoder architecture. This approach is motivated by the multiple breakthrough in image generation and provides a fully digital clone of the printing-imaging procedure typically encountered in CDP authentication. We then provide a comparison study of the digital clone approach with the real setup of CDP and explore multiple directions for the use of this architecture to propose enhanced authentication schemes for CDP.

In a second part, the thesis introduces the BPC model, a probabilistic model that describes the printing-imaging channel of CDP, inspired by lattice models and information theory. This model allows us to predict the behaviour of a given CDP scheme and gives new insight on why classical authentication schemes fail against high quality fakes and points at possible directions of enhancement. New authentication schemes are then proposed and experiments demonstrate the superiority of these new approaches.

Finally, we tackle the question of theoretical performance guarantees for the authentication of CDP. Relying on statistical binary hypothesis testing for the BPC model, we derive optimal bounds and explore questions regarding the stability and reliability of CDP frameworks. This study provides criteria for the optimisation of CDP-based framework performances.



Doctorat thesis: Univ. Genève, 2026 - Sc. 5965 - 2026/01/08
https://archive-ouverte.unige.ch/unige:192628

pin.unige.ch

CUI UNI GE

Digital Innovation Hub

DIGITAL INNOVATION HUB
University of Geneva

As part of the University's digital strategy, the **Digital Innovation Hub** (https://pin.unige.ch) active since March 2019, hosts creativity and innovation activities in the field of digital services. The purpose of the hub is to be transverse to the University and to reach the City, i.e. Geneva State as well as companies and organisations of the Geneva area. It is part of the network of innovation hubs of the University (https://www.unige.ch/collaborateurs/innovation/).

The Digital Innovation Hub has the following missions:

- Support students and researchers with digital projects that lead to commercial exploitation or social impact;
- Provide a meeting place and collaboration with the public and private sector in the region;
- Develop innovative services for the university community.

To carry out its missions, the Digital Innovation Hub has developed a series of tools.

Accelerator of digital sciences and services

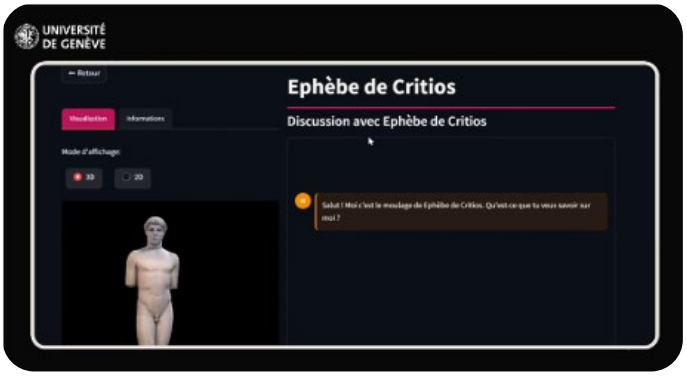
The Accelerator of digital sciences and services (https://cui.unige.ch/fr/pin/accelerateur/) is born from the joint effort between two university entities: the Information Systems Division (DISTIC), which makes its expertise available to the entire university for the development of professional digital services. and the Computer Science Center (CUI), which offer innovative technologies derived from research. Thanks to the Accelerator and joint coaching (provided by DISTIC and CUI), students and institutional projects follow an innovation process that spans from the conception of ideas (ideation) to the creation of a fully operational service prototype. The end user or stakeholder interested in the service is responsible for the final stages of deployment and maintenance. The Accelerator works closely with the R&D Unit, and together they contribute to the third mission of the Digital Innovation Hub.

Managed by a dedicated team, the Accelerator regularly offers new initiatives and innovative projects for the university community. In practice, these projects take the form of bachelor's work, internships, or research project conducted in coordination with the DISTIC, the CUI, and end users or stakeholders.

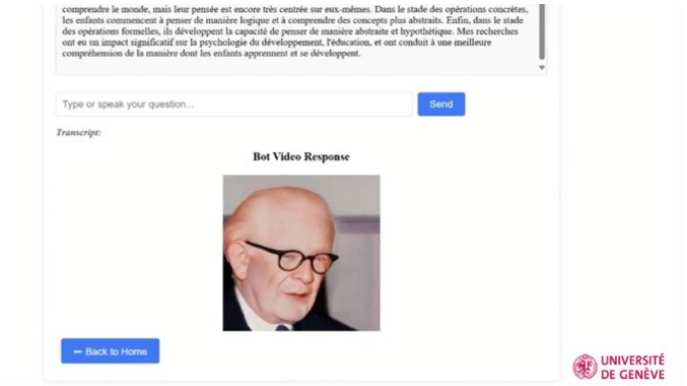
To date, the Accelerator of digital sciences and services has supported more than 150 projects. including 120 operational PoC, 50 pilot projects, and 15 deployed services made available to the academic community.

The novelties of 2025 focus on the development of specialised LLM-agents (AI Agents) as well as multi-agent LLM systems (Agentic AI). We have offered innovative services based on various workflows, such as RAG, GraphRAG, and semantic AI, utilizing knowledge representation and open-linked data. Among the Accelerator's notable projects in 2025 are:

- A multi-agent LLM system favouring the interaction with specific artefacts, such as castings of Ancient Greek and Roman statues. This work was also presented at AI4Good 2025.
- A RAG-based system for interacting with the UNIGE Memento pages (gathering directives and regulations on various subjects), thus facilitating the search of information;
- "Reviving" or create a realistic interactive representation of a deceased scientist using archival material such as audio recordings, videos, or photographs, and exploit other archives and research data to fuel interactive scientific debate;
- Together with the FacLab, we developed the concept of a digital twin for underwater archaeological sites and participated in the Immersum exhibition in December 2024.



https://youtu.be/vwp3QZZXNcM
@Aichatou Orou Bade



@Elham Abbassi, CUI

- Since 2020, the Accelerator has awarded the Digital Innovation Award annually to outstanding projects carried out by students in the BSc in Information Systems and Service Science or in the MSc in Digital Systems and Services. In 2025, the Accelerator awarded the prize to Kerfalla Cissé for his MSc's thesis, conducted in collaboration with OBSAN, on linked data governance; to Aïchatou Orou Bade for her MSc's thesis, conducted in collaboration with the Ancient Archaeology Unit, on interaction with casts of statues from ancient Greece and Rome; and to Wassila Ramli for her MSc's thesis, conducted in collaboration with OPE and OCSIN, on a GenAI service designed to extract information from the HR knowledge base of the Canton of Geneva. https://www.unige.ch/stic/innovation/actu/prix-de-laccelerateur-2025

https://www.unige.ch/stic/innovation

AI clinic

The Digital Innovation Hub's new "AI Clinic", established in 2023, serves as a communication platform for exploring Artificial Intelligence (AI). It offers a set of tools and frameworks enabling researchers and other university members to experiment with and harness the power of open-source LLMs (such as chatGPT) using their own data, processed on the University's servers. It addresses various topics, including the explanation of Large Language Models (LLMs), the societal and ethical implications of AI, and the practical application of AI tools.

The needs expressed regarding AI can be categorised into three main areas: "Scientific AI", "AI as a Service"' and "Everyday AI". The AI Clinic addresses these needs by setting the following objectives:

- Responding to Inquiries: The AI Clinic responds to requests for AI integration from UNIGE and external organizations by providing practical advice from experts, students, and researchers on the effective use of current AI tools.
- Advisory activities: The Digital Innovation Hub and R&D Unit advise national and international bodies on AI. Internationally, they contribute to the EU AI Act "Code of Practice" as experts appointed by the European Commission (https://www.cio.com/article/3543237/eu-taps-ai-experts-to-develop-compliance-framework-for-ai-regulations.html). Nationally, they advise the Swiss Academy of Engineering Sciences (SATW) and its SAI-ROP platform. This work led to the publication of an AI guide for Swiss SMEs, as well as an entry in the KMU magazine on no-code, low-code and high-code perspectives for SMEs. At the cantonal level, we serve on the Geneva's Strategic Council for Geoinformation and the Geneva's Advisory Commission for Data Protection and Transparency. We also participate to the AI commission of the EPA (Etablissements publiques autonomes) of the Canton of Geneva.
- Educational programs: The AI Clinic provides a range of short, certified and non-certified continuous education sessions. Aimed at a wide audience, including participants without prior technical expertise, the portfolio includes offerings such as Python, applied data science, advanced data visualisation, managing and evaluating generative AI systems, AI for non-specialists, and AI and ethics and education. Since 2023, the AI Clinic has delivered 27 sessions to 281 participants and awarded 88 micro certifications.
- Hands-on training sessions: In addition to its official programs, the AI Clinic offers hands-on, short training sessions on Copilot Chat. We have delivered various sessions to more than 250 Unige staff members: the University Library Office, the administrative teams of the FTI, the CIGEV research team, the Research and Grants office, and we are receiving an increasing number of requests from the Canton and Geneva city.
- On-premise open-source LLM infrastructure: The AI Clinic has deployed its own infrastructure, called Hactar, a node equipped with two GPUs that supports projects from the Accelerator and Digital Forge programs. In 2024, more than 20 projects were run on Hactar. The goal is to build expertise that will then be transferred to the future DiSTIC GPU infrastructure, enabling scalable AI deployment. This initiative exemplifies effective collaboration and knowledge transfer between academia and the professional sector.
- Debates: We have participated in various panels, seminars, broadcasts (radio, TV, podcasts), and have organised two symposiums (2024, 2026).

https://cui.unige.ch/fr/pin/clinique-de-l-ia/

Coding Dojo

In September 2021, the PIN launched a programming club called "Coding Dojo", the results of a collaboration between UNIGE and HEG. Based at FacLab, Coding Dojo has a dual mission: to provide coaching, tutoring, and mutual support for students (by enabling them to learn new programming languages, tools, or paradigms, and by helping them solve specific programming problems), and to raise programming awareness among secondary school and those in vocational training centre students.
Since its inception, Coding Dojo has developed specialized programs tailored to the following audiences: High school Students, University Students, and Researchers. During this time, we have mentoed more than 150 participants. We have awarded 23 certificates worth 3 ECTS for advanced University studies to high school students. Girls are well represented, accounting for 33% of the high-school students.

https://cui.unige.ch/fr/pin/club-de-programmation/

Digital Forge

The Digital Forge is a laboratory of scientific and technical expertise that transforms ideas into products. It is dedicated to the technical realisation of proof-of-concepts (POC) and rapid prototyping of digital project ideas. Firmly rooted between digital scientific research and the Swiss economic landscape, the Forge partners with companies and organizations to support and assist them during the ideation, validation, and prototype production phases.

The Digital Forge brings its scientific expertise in the fields of IoT, Blockchain, big data, and various forms of AI, and serves sectors such as smart city, digital health, fintech, cybersecurity, administration, and pharmacy. The Digital Forge works closely with the R&D unit and contributes to the second mission of the Digital Innovation Hub.

In 2025, the Digital Forge participated in various events: presentations as guest speakers at the Swiss Informatics Society Webinars on AI and Education, guest speaker at the IFSB on AI for HR in the banking sector, and participation in a panel at the Rencontres Economiques Auvergne-Rhône-Alpes et Genève. The Digital Forge and the R&D unit also contributed to the development of innovative services for our external partners, notably by supporting projects led by BSc/MSc students, as well as through internships at various organisations:

- We have developed a state-of-art tool for OBSAN (the Swiss Health Observatory project under the Swiss Federal Office of Statistics) that converts datasets into RDF format, in full compliance with LINDAS principles and standards. This solution also includes features for anonymizing data and protecting sensitive information.
- For the Canton of Geneva State's Personnel Service, we developed a GenAI service based on Retrieval-Augmented Generation (RAG) technology, which provides comprehensive and effective responses by extracting information from the Canton pf Geneva's extensive HR knowledge base. This tool faciltates access to critical HR information and serves as a valuable resource for the entire cantonal administration.
- We have developed an interactive visualisation service for the energetic/CO2 consumption at the Unige's building, using GenAI to automate the service (funded by OPI).
- Based on a proposal from the Canton of Geneva, we identified indicators of pedestrian accessibility ("walkability"), defined a pedestrian accessibility index for Geneva's streets, and developed a visualization service exploiting publicly available geographic data. (https://experience.arcgis.com/experience/bf335d11e82a4ce6934ac95e1218f56e#data_s=id%3AdataSource_1-1943cf57288-layer-2%3A313)

https://cui.unige.ch/fr/pin/forge-numerique/

Digital Innovators

Digital Innovators is a series of monthly seminar launched in February 2021 that showcases cutting-edge digital innovations and their real-world applications. Since its inception, the series has hosted 41 sessions, each highlighting a unique use case and fostering dialogue around emerging technologies and their impact.

https://cui.unige.ch/fr/pin/digital-innovators/

FacLab

The FacLab is an academic fabrication laboratory (FabLab) that supports the various stakeholders of the Digital Innovation Hub (Pôle d'Innovation Numérique / PIN) from ideation through to prototyping. It draws on the full range of techniques and methods traditionally used in such environments to foster learning and research through making: making to understand, making to learn.

Fabrication is understood in the broadest sense and is not limited to physical artefacts. It also encompasses the creation of intangibles, including business models, public policies, legislation, user experiences, innovation methodologies, and more.

Embedded at the heart of the university and forming part of the University of Geneva's digital strategy, the FacLab operates as both an internal and external network available to the entire academic community. It thus serves the university's three core missions: teaching, research, and public service.

Positioned as an instrument for addressing, among other things, the reform of pedagogical methods and the adoption of methodologies such as living labs and design thinking, it is intended to serve all university constituencies. The FacLab is networked with all of the University of Geneva's innovation initiatives (HUG, SDG Solution Space, Science Innovation Hub, etc.).

Externally, it also draws on a network of civil society partners and stakeholders with whom it develops projects, ephemeral residencies, and collaborations — notably with OpenGeneva, Pulse, IdeaSquare, and others — as well as «Sister FacLabs» in Italy and South Korea, through a partnership between the FacLab and Chonnam National University.

In 2025, the FacLab continued to offer the following services to University members and the general public:

Welcome & Reception: The FacLab welcomes and directs visitors, answers questions, and supports people discovering the space. The goal is to create an open, accessible, and welcoming environment. This service is free and given with a smile. In 2025, the FacLab welcomed hundreds of people — University members and members of the public alike — including for training sessions and workshops, tailored training, group discovery visits, course sessions for faculty colleagues, meetings, and more.

Training: Users are trained by FacLab staff to use the space's capabilities safely and autonomously. Training is free, with a small consumables charge of up to CHF 5 where applicable. In 2025, the FacLab trained 295 participants across 52 events.

Use of Capabilities: Once trained, users can freely access the FacLab's various capabilities, whether in tangible or intangible fabrication. They can develop their projects at their own pace using the available resources. Users pay at cost price for the materials they use as well as the machine time for certain capabilities like laser cutting and vinyl cutting. In 2025, the FacLab's tangible fabrication capabilities were used by hundreds of people, both University of Geneva members and members of the public. Precise figures are unavailable as the FacLab does not currently have the means to count users automatically. On the intangible fabrication front, capabilities were regularly used for FacLab training sessions, regular courses favouring non-frontal teaching approaches and flexible environments conducive to creativity, innovation, and group work, hackathons, student groups, and more. Intangible fabrication capabilities are available at no cost.

Tailored Training: On request, the FacLab organises personalised training sessions for groups or to address specific needs. Sessions are adapted to participants' level and chosen themes. The cost varies with session duration and trainer numbers (approx. 1 per 6–10 participants), with consumables charged at cost price. In 2025, the FacLab delivered the following tailored training sessions:

- 30 students from Dr Laurent Moccozet's STM course, who took part in 4 dedicated training sessions on the use of FacLab capabilities
- 20 young people for 3D training during the cross-disciplinary week at CO Montbrillant
- 6 young people for the 3D Summer at the FacLab
- 10 young people as part of a professional reintegration initiative, in collaboration with Lesa.teliers in residence at the FacLab
- 12 young people from the Famille IEF association (home schooling) for a 2-day introduction to digital fabrication

Custom Fabrication: On request, the FacLab offers a bespoke fabrication service to support institutional projects. This may include the production of objects, prototypes, scale models, or devices requiring the team's expertise and the FacLab's technical resources. Costs are calculated based on staff hours, with materials and consumables billed at cost price. In 2025, the FacLab produced custom solutions for:

- Multi-scale replicas of a nocturnal anti-pollution ring, made for the Institute of Ethics, History and Humanities (Faculty of Medicine, University of Geneva) and exhibited at the CMCSS as part of the exhibition Virility in Question: Remedies and Devices Against Nocturnal Seminal Losses (18th–21st Centuries)
- A 3D scale model with interactive projection of the underwater relief off the island of Antikythera, for the exhibition News from Antikythera at the University of Geneva's Cast Collection
- An interactive 3D brain model with illumination of resting and active zones during screen reading, used at the Cité des Métiers on behalf of the University of Geneva's communications department
- Camera mounts for observing Etna and Stromboli, for the Physical Volcanology and Geological Hazards group in the Earth Sciences department at UNIGE
- 3D-printed pipette sorter for the CMU, designed to reduce plastic waste and promote eco-responsible laboratory practices

Ephemeral Residencies: The FacLab has hosted ephemeral residencies since its inception. These are collaborative projects that necessarily involve both an internal (academic) and an external (association, startup, etc.) partner. Residents

are provided with minimal hosting — furniture (chairs and tables) and access to FacLab capabilities. In 2025, the FacLab hosted the following ephemeral residencies:

- Exploring the potential of the Beekee Box and Beekee Hub in educational contexts (with startup Beekee)
- Community intelligence for the implementation of socially sustainable technologies (with association Katametron)
- Acquiring digital (or computational) skills through project-based learning (with startup Lesa.teliers)
- Working on the theme of data reappropriation by collectives and informational self-determination (with association PersonalData.io)

https://faclab.unige.ch/

Innovation clinic

The Innovation Clinic was launched in 2019. The Innovation Clinic supports innovative student projects across all fields, from ideation to implementation. These projects benefit from personalised guidance, increased visibility, and the opportunity to connect with other interested students. The process is based on proven methods for carrying out innovation and transformation projects. Team members learn by participating in the innovation process, in a spirit of empowerment. The Innovation Clinic enables students to learn how to innovate by doing it. The Innovation Clinic participates in the first and third missions of the Digital Innovation Hub.

In 2024 the PIN's Innovation Clinic continued its support for a student startup aiming at promoting student internships through specific mandates. The Innovation Clinic has supported 3 startups since 2020, including 2 in 2025/2026.

https://cui.unige.ch/fr/pin/clinique-de-linnovation/

R&D Unit

Founded in 2021, the R&D unit is a key player within the Digital Innovation Hub (PIN) . As part of the DiSTIC (Information Systems Division of the University of Geneva), it develops pioneering digital solutions and accelerates the adoption of high-potential innovations within the university community. The R&D unit makes a major contribution to lifelong learning, data valorisation and AI literacy, while strengthening its collaboration with the Digital Innovation Hub, particularly through its Accelerator, the Digital Forge and the AI Clinic programs. This synergy enables the coaching, development, and deployment of the most promising digital services created by CUI students, thereby transforming ideas into real-world solutions for both the University and external organisations.

The R&D unit also leads the RDF (Resource Description Framework) and Linked Data Interest Group, an interdisciplinary initiative active at UNIGE since 2018. This group brings together experts and enthusiasts from across the university to explore and promote the use of Linked Data and the Web of Data.

The R&D unit has set up the AI Cafés, informal gatherings aimed at sharing experiences and tools related to the use of AI within the university community.

Coordinated by members of the R&D unit, the group hosts monthly meetings that dive into a wide range of topics, from semantic data modeling and ontology design to real-world applications of RDF technologies. It serves as a collaborative platform for sharing knowledge, fostering innovation, and promoting best practices in data interoperability and open standards.

https://www.unige.ch/stic/cellule-rd/index

SciCoS (Scientific Computing Support)

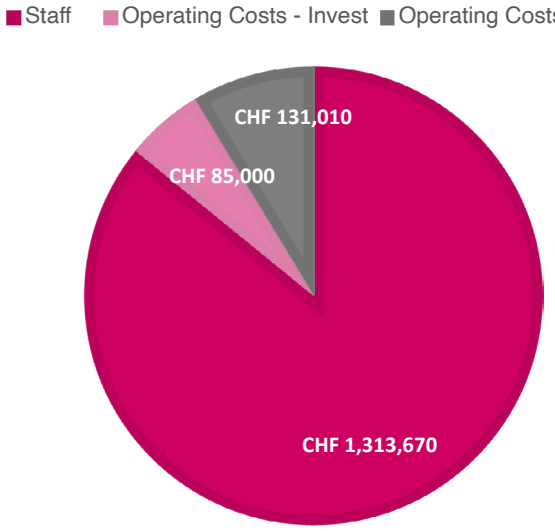
SciCoS is a team of experts in scientific computing dedicated to supporting researchers at the University of Geneva and the Applied Universities of Geneva (HES-GE). The services offered include: operational support for high performance computing (HPC) and data processing, the development of scientific applications, as well as consulting and training services for researchers. SciCoS contributes to the third mission of the Digital Innovation Hub. SciCoS is a new initiative of the Digital Innovation Center, which began offering its services on March 1, 2021. The project was initially funded by the State of Geneva (PL12146).

https://www.unige.ch/scicos/

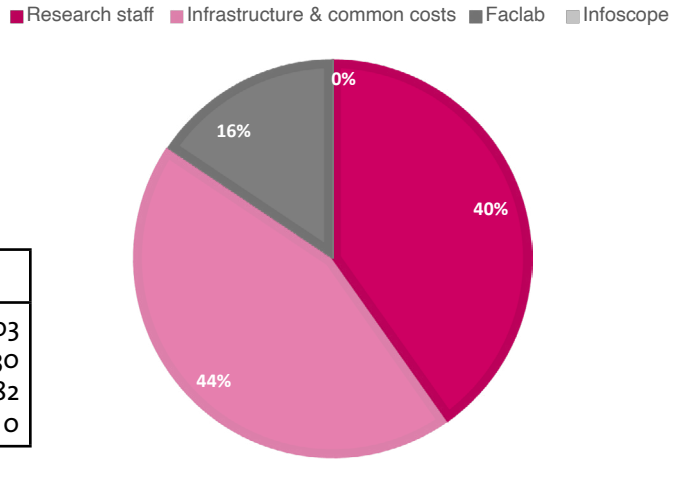
Financial Report 2025

Financial Resources State of Geneva (DIP)

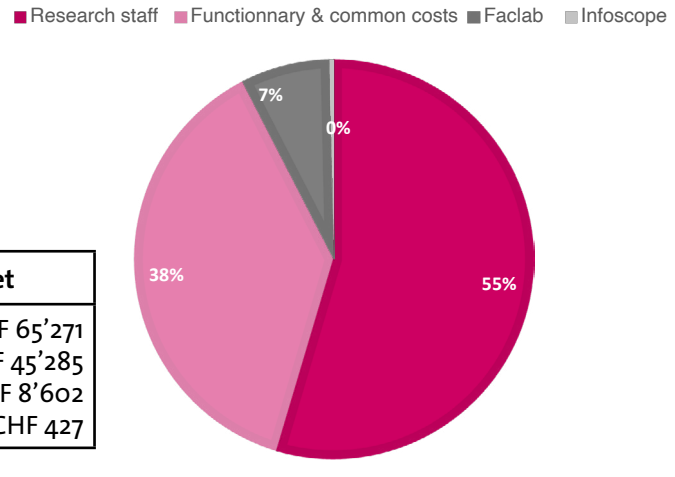
	Budget
Staff • Academic • Administrative and Technical • Employer's social contributions • Others	CHF 1'313'670 CHF 353'190 CHF 704'030 CHF 243'980 CHF 12'470
Operating costs - Investment	CHF 85'000
Operating costs - General expenses	CHF 131'010
Total Budget 2025	**CHF 1'529'680**



Main operating costs - Investment	Budget
• Research staff	CHF 32'903
• Infrastructure & common costs	CHF 36'130
• Faclab	CHF 12'782
• Infoscope	CHF 0



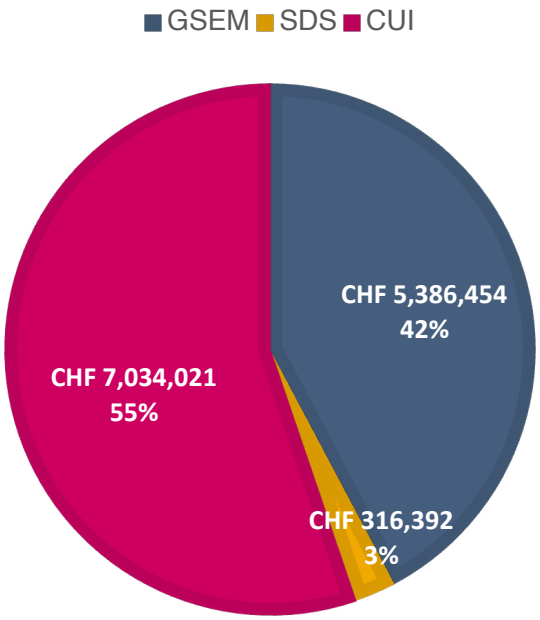
Main operating costs - General expenses	Budget
• Research staff	CHF 65'271
• Functionnary & common costs	CHF 45'285
• Faclab	CHF 8'602
• Infoscope	CHF 427



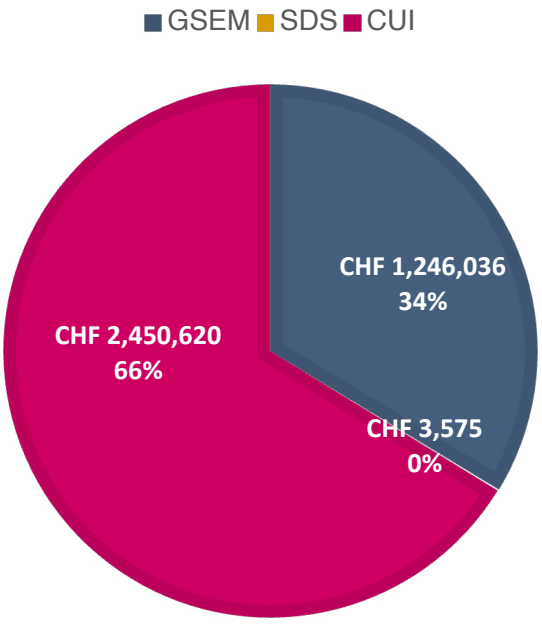
Funds with administrative workload on CUI (Contrats, Finances, Accounting)

	Total allocation for the projects	2025 allocation
GSEM registered projects	CHF 5'386'454	CHF 1'246'036
SDS registered projects	CHF 316'392	CHF 3'575
CUI registered projects	CHF 7'034'021	CHF 2'450'620
Total Credit	**CHF 12'736'867**	**CHF 3'700'232**

Total allocation for the projects



2025 allocation



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