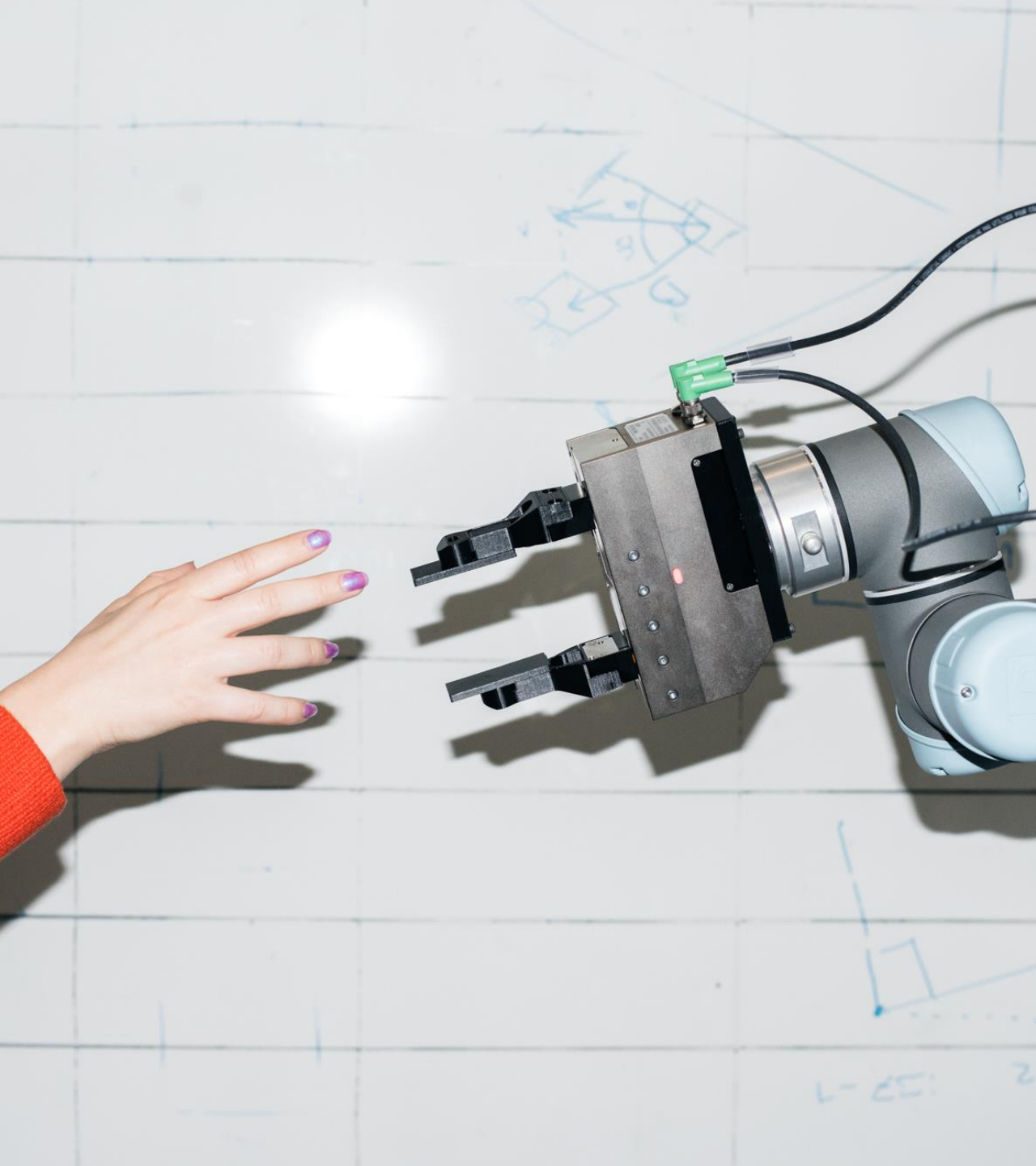


Welcome to IMADA

→ **Breaking new frontiers in:**

Algorithms – Optimisation – Analysis – Data Science – Statistics – Computational Science – Artificial Intelligence (AI) –
Cybersecurity and Programming Languages – Quantum Mathematics – STEM Education



We are ...

- Department of Mathematics and Computer Science (aka IMADA)
- Founded in 1972
- Programme in Computer Science established in 1988
- Master's programme in Data Science in 2019
- Computer Science and Data Science are two of the largest programmes at the Faculty of Science
- Around 100 employees and 750+ students
- Around 90 students graduate every year in a variety of full-time study programmes within Mathematics, Computer Science, Data Science and Didactics

Our education programmes

→ **Mathematics**

- Bachelor
- MSc
- Master's degree programme

→ **Applied Mathematics**

- Bachelor
- MSc

→ **Computer Science**

- Bachelor
- MSc
- Master's degree programme for working professionals

→ **Computational Biomedicine**

- MSc – together with Biochemistry and molecular biology

→ **Mathematics-Economics**

- Bachelor
- MSc – together with Department of Business and Economics

→ **Data Science**

- MSc

→ **Science Teaching**

- Master's degree programme

Home to and member of



**Laboratory for
STEM Education and Learning**



External Funding

→ In the last five years, IMADA has been heavily funded from external sources, totalling **DKK 150M+**

→ **Private Foundations**



THE VELUX FOUNDATIONS

VILLUM FONDEN ✕ VELUX FONDEN

CARLSBERG FOUNDATION



→ **European Union and International**



→ **Danish Public Research and Innovation Bodies**



→ **Ministries and other**



Project examples



EOSC-Nordic

EOSC-Nordic facilitates the coordination of European Open Science initiatives within the Nordic and Baltic countries to establish these as frontrunners in the take-up of the EOSC concept, principles and approach. EOSC-Nordic brings together a strong consortium of 24 partners relevant for implementing open science policy.



Choreographies for Connected IT Systems

This project will develop a new programming language and toolchain (Choral) that will bridge the gap between choreographies and mainstream development practices.



Drones4energy

Drones4energy aims to build a collaborative, autonomous, and continuously operating drone system that will be offered to powerline operators to inspect the power grid accurately, frequently, and autonomously.



EuroPLEx

EuroPLEx will train a new generation of researchers in Theoretical Particle Physics. The main core of EuroPLEx research aims at a deeper understanding of strongly interacting matter. This will be pursued by numerical simulations of the underlying fundamental theories.



FeatureCloud

FeatureCloud is a novel artificial intelligence (AI) platform, based on a ground-breaking new cloud infrastructure to integrate local AI globally without the need for any transfer of primary medical data – totally anonymous by default.



Mathematical Modelling for Microbial Community Induced Metabolic Diseases

This project will combine mathematical modelling and wet-lab experimentation to investigate how changing the composition of the microbiome can create a novel therapeutic tool for treating people with obesity.

A broad department with six research sections and six centres

Our research at IMADA is organised in six research groups:

- **Algorithms**
- **Artificial Intelligence, Cybersecurity and Programming Languages**
- **Computational Science**
- **Data Science and Statistics**
- **Laboratory for STEM Education and Learning**
- **Topology, Algebra, Analysis and Geometry**

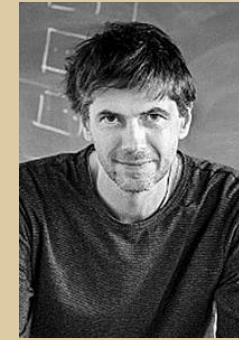
And in six centres:

- **Centre for AI Science and Applications (CASA)**
- **Centre for Distributed Systems**
- **Centre for Mathematical Modelling for Microbial Community Induced Metabolic Diseases (MATOMIC)**
- **Centre for Quantum Mathematics**
- **Centre for Research in Science Education and Communication**
- **SDU eScience Centre**

Algorithms

- Algorithms are at the core of computer science. In addition to offering expertise in concrete application areas, a solid background in algorithms makes it easy to enter other subareas of computer science.
- IMADA's algorithms group has a heavy impact in many areas, including algorithmic cheminformatics, cryptology, data structures, external memory, fixed parameter tractability, graph theory, online algorithms and optimisation, with publications in top journals and conference proceedings.
- **Keywords:** Algorithmic cheminformatics, online algorithms, graph algorithms.
- **Partners:** Top international universities, international and regional industry.
- **Supported by:** Independent Research Fund Denmark, the Villum Foundation, the Novo Nordisk Foundation and the Danish Centre for Cybersecurity.

Contact



Professor

Daniel Merkle

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[More information](#)

Artificial Intelligence, Cybersecurity and Programming Languages (ACP)

- In the ACP group at SDU, we are interested in the challenges brought about by modern digital systems, such as big data systems, the Internet of Things, and data clouds: Software, data and systems are getting increasingly larger and complex, pushing beyond the limits of developing and analysing them manually.
- In our group, we develop theory and tools that automate crucial steps of the development and analysis processes, enhancing their efficiency and reliability.
- **Keywords:** Choreographic programming, microservices, DevOps, cybersecurity, cloud/edge computing, AI, reasoning and theorem proving
- **Partners:** Imperial College London, Univ. of Oslo, Univ. Lisbon, Univ. of Bologna, INRIA, Univ. of Edinburgh, Imola Informatica, NTNU, Equinor and EU Braunschweig.
- **Supported by:** The Villum Foundation, the Danish Centre for Cybersecurity, Independent Research Fund Denmark and the European Union.

Contact



Professor and Head of
Digital Innovation Office

Fabrizio Montesi

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[More information](#)

Computational Science

- Modern science is computational science. We use computers to simulate models of reality, thus exchanging the classic laboratory with a digital one. In some fields, this is the most efficient way to test solutions, e.g. aerodynamics of aircraft, market models and electric circuit simulations. In other fields it is the only way: When trying to understand the basic 'rules' of our universe, numerical simulations provide the only window into many rich and unexplored phenomena in the world of elementary particle and nuclear physics.
- The Computational Science Section consists of the groups Computational Quantum Field Theory and Numerical Analysis.
- **Keywords:** Lattice field theory, computational mathematics, high-resolution shock simulations, high-performance computing (HPC)
- **Partners:** German Aerospace Center (DLR), Volkswagen Group Research, Newtec Engineering A/S, CERN, nVidia, Google, CRAY.
- **Supported by:** The Lundbeck Foundation, Independent Research Fund Denmark and EU Horizon 2020.

Contact



Professor and Head of
SDU eScience Centre

Claudio Pica

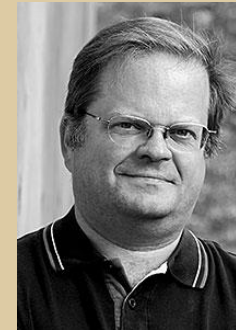
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[More information](#)

Data Science and Statistics

- Our group combines expertise in different aspects of computer science (data mining, machine learning, optimisation, artificial intelligence, visualisation), statistics (extreme value theory, Bayesian inference, multivariate analysis) and bioinformatics (analysis of biological networks and large-scale biomedical data).
- We develop data-driven techniques and apply them in practice to gain insights and to create knowledge and value in collaboration with other academic fields and with companies from both the private and public sector.
- **Keywords:** Machine learning, data mining, cluster analysis, anomaly detection, visualization, AI, bioinformatics and statistics
- **Partners:** Top international universities, regional industry and municipalities.
- **Supported by:** Villum Foundation, Industriens Fond, H2020, TrygFonden and others.

Contact



Professor

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[More information](#)

Laboratory for STEM Education and Learning

- Laboratory for STEM Education and Learning (LSUL) is a strategic research partnership between the Faculty of Science at the University of Southern Denmark and the university colleges UC SYD (University College South Denmark) and UCL University College.
- LSUL aims to initiate and innovative practice-based research collaborations that create the best educational and learning opportunities in mathematics, science and technology, from daycare to higher education.
- Since 2014, LSUL has collaborated with teacher educators and professionals on science and mathematics education.

Contact



Professor and Head of Centre

Connie Svabo

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[More information](#)

Topology, Algebra, Analysis and Geometry (TAAAG)

- Our group conducts research in mathematics related to quantum phenomena. We cover topological, analytic, algebraic as well as geometric aspects of pure mathematics, with particular emphasis on quantum topology, Fukaya categories, gauge theory, operator algebras, quantum groups, representation theory and non-commutative and symplectic geometry.
- **Keywords:** Quantum topology, Fukaya categories, gauge theory, moduli space theory, operator algebras, quantum groups, geometric quantization, algebraic geometry, cluster algebras, non-commutative geometry, differential geometry and symplectic geometry.
- **Supported by:** The European Research Council, the Villum Foundation, the Danish National Research Foundation, Independent Research Fund Denmark and the Novo Nordisk Foundation.

Contact



Associate Professor

David Kyed

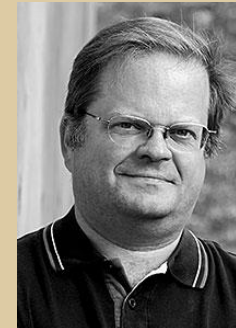
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[More information](#)

Centre for AI Science and Applications (CASA)

- CASA creates and supports smooth, transparent and systematic matchmaking between highly requested skills and interested collaborators within and outside the University.
- CASA includes world-leading researchers in areas like data mining, machine learning, deep learning, statistics, optimisation, personalised medicine, automated reasoning, time series, spatio-temporal data, formal methods, (semi-)automated programming, and decision systems.
- CASA benefits from a thriving research environment with easy access to the national SDU eScience Center, providing world-class facilities for high-performance computing significantly leveraging the research and innovation capacity located at CASA.

Contact



Professor and Head of Centre

Arthur Zimek

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[More information](#)

Centre for Distributed Systems

→ The areas of expertise of the Centre include:

- Cloud computing
- Edge computing (also called fog computing)
- Internet of Things
- Microservices, service-oriented architectures, and service-oriented computing
- Development and operations (DevOps and DevSecOps)
- Security for distributed systems, including security protocols, post-quantum cryptography, and big data, data-intensive systems, and high-performance computing (HPC)
- Decentralised computing and peer-to-peer systems
- Programming languages and frameworks for distributed software, including choreographies and data science workflows
- Web technology
- Formal methods for concurrency
- Artificial intelligence, including logic, knowledge representation, optimization, machine learning for cloud deployment, and federated machine learning

Contact



Professor and Head of Centre

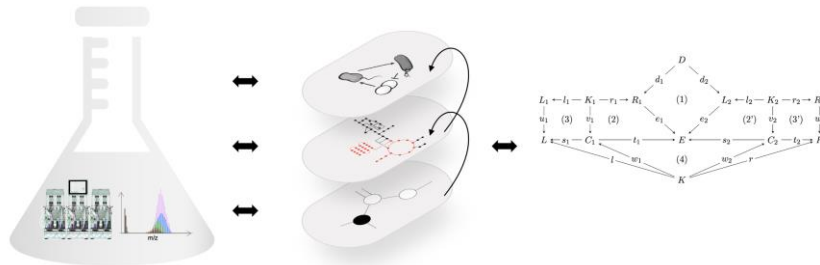
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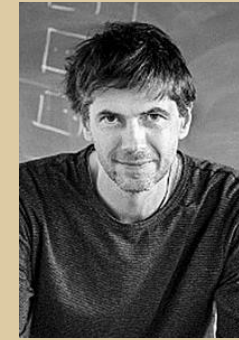
[More information](#)

Centre for Mathematical Modelling for Microbial Community Induced Metabolic Diseases (MATOMIC)

- In March 2022, the new MATOMIC Centre will be established, headed by the Algorithmic Cheminformatics group.
- The MATOMIC members will develop quantitative mathematical models and algorithmic cheminformatic approaches for the prediction of properties of microbiota cultures.
- MATOMIC is supported by DKK 46.2M by the Challenge Programme of the Novo Nordisk Foundation.



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UNIVERSITÄT
LEIPZIG



HELMHOLTZ
Centre for Environmental Research



universität
wien

Centre for Quantum Mathematics

- On 1 January 2021, the Centre for Quantum Mathematics became affiliated with the Department of Mathematics and Computer Science at the Faculty of Science.
- QM researchers perform research in mathematics with relations to quantum theory, covering both foundations as well as applications to quantum computing and engineering.
- QM is supported by the European Research Council, The Danish National Research Foundation, the Novo Nordisk Foundation and the Villum Foundation.

→ **International Advisory Board from (see [list of board members](#)):**



Contact



Professor, DIAS Chair and
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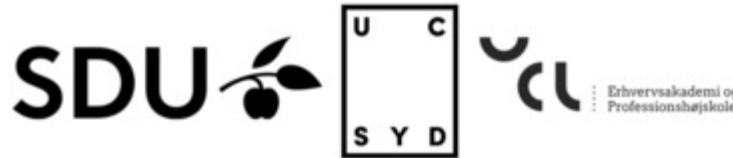
Centre for Research in Science Education and Communication

- Advancing STEM engagement, interest and learning, this transdisciplinary centre is a hotbed for research in science education, communication and outreach
- Human-centred, world-centred experiences of insight and knowledge are designed and developed with practice-based research approaches and methodologies for engaging and effective life-long STEM learning.

The Centre

- is cross-departmental and cross-institutional
- brings together students, researchers and practitioners
- works on real-life problems and phenomena
- addresses complex societal concerns

→ In collaboration with:  **Laboratory for STEM Education and Learning**



Contact



Professor and Head of Centre

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[More information](#)

SDU eScience Centre

- The SDU eScience Centre was created in 2013 at IMADA. The Centre provides access to and support for the DeiC National HPC facilities as well as international HPC facilities like the pan-European pre-exascale supercomputer LUMI. In 2020, the SDU eScience Centre was selected to host two of the four national HPC facilities: HPC Type 1 (Interactive HPC) based on UCloud and designed to give researchers easy access to HPC regardless of their level of experience, and HPC Type 3 (Large Memory HPC), designed for large memory systems.
- The SDU eScience Centre furthermore has a coordinating role in the new consortia for HPC Type 1 (AU, AAU and SDU), HPC Type3 (SDU) and the DeiC 'Project 5' National Integration Portal system (AU, DTU and SDU).

→ In collaboration with:



AARHUS
UNIVERSITY



AALBORG UNIVERSITY
DENMARK



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Thank you!

→ For more information, please visit our website:

www.imada.sdu.dk