Project Descriptions – PhD in Computer Science

Project A1: Scientific Machine Learning Using Physics-Informed Neural Networks: Algorithms and Applications
Supervisor: Prof. Bruno Carpentieri
Project Description: Goal of this activity is to make significant contributions to cutting edge research at the intersection of mathematics and artificial intelligence (AI), addressing complex real-world applications and catalyzing innovation in these rapidly expanding fields. Physics-Informed Machine Learning (PINN) is a novel approach for incorporating domain specific knowledge from the traditional physical laws of science into machine learning models. It can be seen as a methodology that serves both as a modelling tool for capturing the physics of a system and as a computational tool for efficiently solving mathematical problems. This synergy between physics and machine learning not only improves model accuracy but also provides valuable insights into the underlying physical processes, making PINN an effective modelling tool for addressing complex problems in computational science and engineering fields.
In this project, we analyze large datasets to extract meaningful patterns using advanced mathematical and computer science techniques, such as statistical analysis, linear algebra, calculus, high-performance parallel computing on CPU and GPU systems. We then use PINNs to solve models of partial differential equations, fractional equations, and integral differential equations that arise in real-world scientific applications. The aim is to drive AI model development and optimization, particularly in the domains of energy and medical problems, contributing significantly to the implementation and optimization of mathematical algorithms and AI models.
Required mandatory skills: Basic knowledge of linear algebra methods. Computer programming skills. Analysis and problem solving. Critical thinking. Collaboration.
Desirable (optional) skills: Knowledge of one high-level programming language. Knowledge of machine learning techniques. Experience with parallel computing.

Project A2: Characterization and Optimization of Structural Properties in Multi-task Deep Learning
Supervisor: Prof. Giuseppe Di Fatta
Project Description: This project will investigate structural properties of deep networks for multi-task learning. To this aim the project intends to study how to design network architectures and training procedures (subset of tasks and their data subsets) to effectively learn from multiple tasks simultaneously. Some important aspects to be addressed include architectural design, loss function design and alternative aggregations of task-specific loss functions, training, and test strategies, and, most importantly, the analysis of transfer learning, i.e. the regularization effect versus the negative task interference by means of specific metrics and techniques.
By characterizing and optimizing these structural properties in multi-task deep learning, researchers and practitioners can design more effective models that learn from multiple tasks simultaneously, leading to improved performance, better sample efficiency, and enhanced generalization capabilities.
Required mandatory skills: A degree in computer science, computer engineering, mathematics or any other degree involving mathematics, computing, and computer programming; General knowledge of mathematics and machine learning; Mastering at least one programming language, preferably Python; Good communication skills, substantiated by a final-year thesis or reports preferably written in English.
Desirable (optional) skills: A final-year thesis relating to advanced computing; Understanding of concepts and methods of Machine Learning; Programming expertise for Deep Learning; Ability to work in teams, substantiated by one or more collaborative projects.

Project A3: Computational solutions for association graphs on large scale genetic data
Supervisor: Prof. Johann Gamper
Project Description: Association graphs are graph structures in which the edges indicate interesting associations among its vertices. In genetic studies, association graphs are used to find statistically significant associations between genetic variants and specific traits or diseases, such as diabetes or blood pressure. These graphs tend to be very large and time-consuming to compute, e.g., the number of genetic variants measured in the Cooperative Health Research in South Tyrol (CHRIS) study is about 20 million. A graph for a specific study is generally created by using a filter to determine a subset of the entire cohort for which then the associations are computed, e.g., adult males.
The aim of this PhD project is to develop efficient and scalable algorithms to compute in real-time the associations between genetic variants and diseases when the filters on the base data change. Different techniques shall be explored,

including sampling, index structures, approximations, and machine learning. The obtained results can be tested and evaluated on the data of the CHRIS study, which is one of the largest population cohorts in Italy.
Required mandatory skills: Algorithmic thinking; Motivation in scientific work; Interest in bioinformatics; Good programming skills; Proficiency in English
Desirable (optional) skills: Knowledge in basic biology

Project A4: Computer Vision and Multimodal Learning
Supervisor: Prof. Oswald Lanz
Project Description: The Vision Computing and Learning (VCL) research group led by Prof. Oswald Lanz invites applications for a PhD position in Computer Vision and Multimodal Learning. Please visit the the website vision.projects.unibz.it for information about the research focus and setup of the group. There are currently 6 PhD students and two postdoc researchers at VCL, so you will join a dynamic team and vibrant environment. Topics are not sharply defined but might connect to relevant background and existing research of the group in

- Egocentric Perception (multimodal action/activity recognition and forecasting),
- Multimodal GenAI (retrieval-augmented generation, video search and retrieval),
- AutoML for Video Understanding (neural architecture search).

Furthermore, we also welcome expressions of interest in

- Foundational research on Neuro-Symbolic Integration in the context of multimodal procedural activity recognition and human-robot collaboration. Can be offered in co-supervision with other faculty, experts in process mining.

VCL is strongly connected to Covision Lab https://covisionlab.com/en and its spinoff company Covision Media https://covisionmedia.ai where specific topics of interest can be offered.
Required mandatory skills: PhD topics resides at the intersection of computer vision, computer graphics and machine learning. The candidate has undertaken computer vision and deep learning courses with proficiency. Ideally the MSc thesis is in the field of deep learning and computer vision. Solid programming skills and experience with deep learning frameworks such as pytorch are requested.
Desirable (optional) skills: MSc thesis as valuable background experience to start the PhD research. Ideally the MSc thesis has led or will lead to a publication.

Project A5: Artificial Intelligence methods for edge computing and smart sensing
Supervisor: Prof. Antonio Liotta
Project Description: Artificial Intelligence (AI) algorithms are especially geared toward data-driven decision-making, which is typically based on Cloud-computing and centralized big data. However, when it comes to intelligent Internet of Things (IIoT) and smart sensing, a new strand of AI is required, to cater for a completely different form of big data: these are the data that are continuously collected by myriad of tiny devices such as sensors, wearables, and all sorts of internet-connected machines.
This project is focussed on novel methods for edge-intelligence, a new approach to artificial intelligence which starts in small devices and collaborates with conventional Cloud-based AI. Starting from developing new fundamental concepts in edge-AI, the project will consider methods for training machine learning models which are suited to tiny devices, thus having a small footprint in terms of memory and energy consumption. Furthermore, the co-operation between such sparse Artificial Neural Networks and the massive-ANN present in Cloud systems will be an important consideration.
Ultimately, you will implement a new AI-engine for edge-intelligence, validating it in relevant case studies. You will be involved in the development of sustainable smart systems and massive-scale monitoring. Particular attention is drawn to environmental monitoring in climate, agriculture, urban and rural domains, where AI is used to grab and make sense of massive amounts of information from vast area.
Required mandatory skills: A degree in computer science, computer engineering, or any other degree involving substantial computing modules and computer programming; General knowledge of data science and machine learning; Mastering at least one programming language for machine learning (e.g., Python or R); Good communication skills, substantiated by a final-year thesis or reports written in English.
Desirable (optional) skills: A final-year thesis relating to advanced computing, ideally machine learning or data science; Understanding of smart sensing based on the Internet of Things; Ability to work in teams, substantiated by a portfolio of one or more collaborative projects.

Project A6: Automated Decision Making, Recommendation Systems and Decision Support
Supervisor: Prof. Markus Zanker
Project Description: The project will be carried out in the context of the research group on Decision Support and Recommender Systems. Recommender systems are software applications that support users in finding items and making decisions in situations of information overload. However, the traditional Machine Learning focus on accuracy measurements does not necessarily always lead to optimal results from a human-centric perspective. Therefore, the PhD project will assess the impact of recommendations on users' decision-making behaviour by observing also physiological signals and users' gazes. Application scenarios in domains such as etourism, social media, health or agriculture may serve as testbeds. The research will be facilitated by the instrumentation available in the faculties' newly established User Experience Lab.
Required mandatory skills: Adequate oral and written communication skills; Strong programming, algorithmic thinking, and data analysis skills.
Desirable (optional) skills: /

Project A7: Knowledge in Time
Supervisor: Prof. Alessandro Artale
Project Description: Research in 'Knowledge in Time' covers research topics where the temporal dimension of knowledge representation or reasoning with knowledge is central.
Typical research questions are:

- **Temporal and Action Languages:** The interest in temporal ontologies has increased in parallel to the development of temporal databases able to accommodate time-varying information. We aim to reason over temporally extended data by using various forms of temporal logics and developing efficient algorithms that could scale w.r.t. both the size of the models and the size of temporal data. Moreover, verification of complex infinite-state systems benefits from the development of temporal logics over structured data such as first-order temporal logics.
- **Neurosymbolic AI and process science:** Neurosymbolic AI aims at combining connectionist AI with symbolic AI. In the vast neurosymbolic spectrum, we are interested in neurosymbolic AI dealing with dynamic systems where agents engage in actions, interactions, and processes evolving over time. Process science provides a natural domain where these techniques can be developed to their full potential.
- **Multi-perspective temporal pattern mining:** Temporal (or sequential) Pattern Mining is an essential part of knowledge discovery and data analytics. However, it usually tackles only one single perspective, such as the names of activities in a process, disregarding relevant other perspectives. Filling this gap requires developing foundations, algorithms, and frameworks for multi-perspective temporal pattern mining that account for such different dimensions.

The specific direction of the project will be determined in discussion with the successful applicant.
Required mandatory skills: Applicants are expected to have some good acquaintance with classical logic and its syntax and semantics. The candidate will already have some background in KR languages and their semantics and usage (e.g. Semantic Web, Description Logics, Modal and Temporal Logics, Rules, Logic Programming, or similar), and a strong interest in modelling and reasoning over temporal databases, efficient temporal reasoning algorithms, or similar topics in temporal KR&R.
Desirable (optional) skills: Programming skills: experience with programming would be valuable, particularly for the purpose of carrying out evaluation studies and improving research prototypes; More advanced knowledge of proof methods, formal semantics and logical meta-theory, or non-classical logics will be a plus.

Project A8: Knowledge and Data
Supervisor: Prof Diego Calvanese
Project Description: Research in 'Knowledge and Data' covers research topics where data-intensive applications encounter complex domain modelling and knowledge engineering.
Typical research areas include:

- **Ontology-based Data Access:** Investigate foundational, methodological, experimental, and application-oriented aspects of access to structured and semi-structured data and information by leveraging its semantics.
- **Knowledge-based Data Management:** Study how to store, access and manipulate large amounts of information. Applications will present foundational challenges, both of conceptual and technological nature, and principled solutions are required to validate them.

- **Graph Data Management with Linear Algebra:** Model graphs and operations on graphs with concepts from linear algebra; leverage techniques from Algebra High-Performance Computing to efficiently store graph data and extract information.
- **Business Process Meta-Modeling:** Despite many modelling languages, meta-models, and definitions, clear and agreed definitions of the different elements composing Business Processes are not yet available. Often, meta-models even provide conflicting characterizations of the "same" elements composing a business process. We thus aim to exploit ontological analysis as the fundamental tool to shed light on this issue and build clear and unambiguous Business Process Meta-Models.

The specific direction of the project will be determined in discussion with the successful applicant.
Required mandatory skills: Applicants are expected to have some good acquaintance with classical logic and its syntax and semantics. The candidate will already have some background in KR languages and their semantics and usage (e.g. Semantic Web, Description Logics, Rules, Logic Programming, or similar).
Desirable (optional) skills: Programming skills: experience with programming would be valuable, particularly for the purpose of carrying out evaluation studies and improving research prototypes; More advanced knowledge of proof methods, formal semantics and logical meta-theory, or non-classical logics will be a plus.

Project A9: Knowledge Representation
Supervisor: Prof. Enrico Franconi
Project Description: Research in 'Knowledge Representation' covers the whole range of knowledge representation topics, including both classic symbolic and logic-based approaches as well as neuro-symbolic and hybrid approaches to representing and reasoning with knowledge. Core topics include the theory and applications of Description Logics, Knowledge Graphs, non-classical logic in knowledge representation, and neuro-symbolic reasoning.
Typical research questions are:

- **Description Logics:** Develop novel extensions of description logics to allow representation and reasoning for new domains or application areas. Study logical properties and the computational complexity of the languages. Develop modelling approaches and software prototypes for new applications areas.
- **KR for Data:** Combine techniques developed in knowledge representation and reasoning with industrial technologies for the efficient management of large amounts of data.
- **Neuro-symbolic KR:** Combine classical symbolic knowledge representation and ontology-based techniques with data-driven AI, neural networks, and large language models. Typical application areas of such combined approaches include automated ontology learning, populating ontologies with data, and concept learning through neural networks.

The specific direction of the project will be determined in discussion with the successful applicant.
Required mandatory skills: Applicants are expected to have good acquaintance with classical logic and its syntax and semantics. Candidates will have some background in KR languages and their usage (e.g. Semantic Web, Description Logics, Rules, Logic Programming, or similar), and a strong interest in the interdisciplinary study and application of logic and KR.
Desirable (optional) skills: Programming skills: experience with programming would be valuable, particularly for the purpose of carrying out evaluation studies and improving research prototypes; More advanced knowledge of proof methods, formal semantics and logical meta-theory, or non-classical logics will be a plus.

Project A10: Knowledge and Cognition
Supervisor: Prof Oliver Kutz
Project Description: Research in 'Knowledge and Cognition' focuses on topics at the intersection of knowledge-driven symbolic methods and various approach to model human cognition and computation, including work on foundational ontologies, natural language processing, computational models of cognition and psychology, computational creativity, common sense modelling, and multi-modal interfaces.
Typical research questions are:

- **Knowledge in Networks / Strategies:** How can techniques from multiagent systems and non-classical logic be applied to problems of collaborative ontology engineering and to concept combination and concept drift? How can logic be used to model the distortion of information in networks.
- **Explainability and Cognition:** How can we best combine the ideas of weighted logic, where different pieces of information have different weight, and refinement, where we specialize or generalize our information? How can we explain and justify the weakening of information?

- **Common Sense and Creativity:** How can conceptualizations of reality be constructed in an ontologically and cognitively adequate way, using novel logical methods, and applied to areas such as computational creativity or cognitive robotics.

The specific direction of the project will be determined in discussion with the successful applicant.
Required mandatory skills: Applicants for this project are expected to have some good acquaintance with classical logic and its syntax and semantics. The candidate will already have some background in KR languages and their semantics and usage (e.g. Semantic Web, Description Logics, Non-classical logics, or similar), and a strong interest in the interdisciplinary application of logic and KR methods to areas such as human cognition, natural language processing, common sense modelling, or computational creativity.
Desirable (optional) skills: Programming skills: experience with programming would be valuable, particularly for the purpose of carrying out evaluation studies and improving research prototypes; More advanced knowledge of proof methods, formal semantics and logical meta-theory, or non-classical logics will be a plus.

Project A11: Knowledge and Processes
Supervisor: Prof. Fabrizio Maria Maggi
Project Description: Research in 'Knowledge and Processes' covers research where concepts involving time are the central object of study, such as (business) processes, or the temporal evolution of data.
Typical research questions are:

- **Relational technology for process mining:** Process mining techniques typically rely on event data that is extracted from information systems through complex data processing pipelines, and then processed further externally to discover processes, check conformance, etc. We aim to investigate performing transformations and computations within the information system itself, leveraging on well-established, solid relational technologies.
- **Object-centric process science:** Work processes are traditionally represented in a simplistic way, by assuming that each execution of the process works over a single object. Real-life processes, instead, pertain multiple objects that co-evolve and influence each other. This "object-centric" wave is now at the center of a revolution in managing work processes. However, the field still misses proper foundations in the representation, analysis, and mining of such processes and their execution data.
- **Predictive and prescriptive process science:** Investigate foundational, methodological, experimental, and application-oriented aspects of AI techniques based on Machine Learning to produce novel ways to predict the behavior of process executions, to recommend strategies to guide them to a desired outcome, and/or do all of this in an explainable manner.

The specific direction of the project will be determined in discussion with the successful applicant.
Required mandatory skills: Applicants are expected to have some good acquaintance with classical logic and its syntax and semantics. The candidate will already have some background in KR languages and their semantics and usage (e.g. Semantic Web, Description Logics, Modal and Temporal Logics, Rules, Logic Programming, or similar), and a strong interest in modelling and reasoning processes.
Desirable (optional) skills: Programming skills: experience with programming would be valuable, particularly for the purpose of carrying out evaluation studies and improving research prototypes; More advanced knowledge of proof methods, formal semantics and logical meta-theory, or non-classical logics will be a plus.

Project A12: Dyna**m**ical Systems **o**n C**o**mplex **N**etworks (MOON)
Supervisor: Prof. Maria Letizia Bertotti
Project Description: This PhD research program aims to investigate the dynamics of systems composed by a multiplicity of interacting elements, which can be thought as nodes of complex networks. Applications in the socio-economic context, ecology and engineering can be foreseen. Modelling aspects, analytical investigations and computational simulations are expected to make up the project. In particular, the goal relative to different systems is to explore the emergent behaviour at the macroscopic/collective level in correspondence to different scenarios postulated to occur at the microscopic/individual level. Issues to be considered concern for example questions related to possible stability properties of some solutions also in the presence of randomness/stochastic perturbations.
Required mandatory skills: good knowledge of mathematics, in particular proficiency in differential equations; Strong computational skills for modelling and simulation; Familiarity with relevant programming languages (for example, Mathematica, MATLAB, Python); Ability to conduct interdisciplinary research bridging mathematics and physics with social sciences and engineering domains.

Desirable (optional) skills: A degree in mathematics or in physics would be preferable; Some proficiency in stochastic differential equations; Experience in empirical data analysis; Knowledge of methods for network design; Communication skills for presenting findings to diverse audiences and collaborating across disciplines.

Project A13: Innovative Solutions for Computing Education
Supervisor: Prof. Ilenia Fronza
Project Description: Computing Education Research explores all aspects of teaching and learning computing at all levels, from early education to professional contexts. We are looking for a PhD candidate who can work on developing customized, interactive, and immersive solutions to support computing education. These solutions will be based, for example, on XR and serious games and will primarily aim at teaching software engineering concepts during online/hybrid, non-conventional learning experiences such as coding camps. The ideal candidate should be prepared to work in a multidisciplinary team to evaluate solutions empirically by directly interacting with audiences of different ages, backgrounds, and needs, such as students and teachers in schools. Therefore, good communication skills are needed, and the ideal candidate should be interested in participating in communication and dissemination activities and events.
Required mandatory skills: General knowledge of software engineering principles; Basic knowledge on empirical research methods (e.g., experiments, interviews, surveys); Programming skills to develop research prototypes and carry out evaluation studies; Good communication skills; Ability to work in teams.
Desirable (optional) skills: Knowledge of Italian language; Experience in Software Engineering/Computer Science training and education; Experience in organizing or facilitating software/IT events, such as coding camps or coding competitions.

Project A14: ECHO: Creating feedback loops and facilitating team learning based on the metrics-based analysis of microservice-based software architectures.
Supervisor: Prof. Andrea Janes
Project Description: This dissertation project aims to improve microservice architectures by identifying and analyzing anti-patterns, with a focus on performance and energy consumption analysis in addition to structural metrics. The aim is to define a set of specific metrics for these architectures that can evaluate them based on the defined quality criteria. Using these metrics, the project will develop methods to find anti-patterns that can lead to systems being less efficient, more difficult to maintain or consuming more energy. The project plans to use the data obtained for feedback and learning: first, a feedback loop will be set up to provide development teams with visualizations of the analysis results directly into the development environment. This will help teams to relate the impact of their work to the source code they are developing. The visualizations will be designed to fit into existing DevOps workflows and make it easier for teams to continuously improve their projects. Secondly, the project will work on the development of a model-based/generative AI software development framework. This framework will capture the learnings from the identification and elimination of anti-patterns. The aim is to make these insights a permanent part of the software development process and institutionalize team learning.
Required mandatory skills: Strong programming skills in at least one programming language; knowledge about software architecture patterns; knowledge in the development of microservice-based systems; passion about software architectures; good mathematical skills to apply machine learning in software engineering contexts; interest in solving a general problem well (opposed to solving a small problem perfectly)
Desirable (optional) skills: /

Project A15: Digital Persona for Startup Development
Supervisor: Prof. Xiaofeng Wang
Project Description: Building a startup company is a highly challenging endeavour, manifested by an extremely high failure rate (above 99%). One of the major failure reasons is creating a product that doesn't address real needs of the customers.
Persona is a technique that helps startup teams to identify potential customers and understand their needs. The current implementation of this technique is a canvas (either analogue or digital, or as more interactive web application) that gathers various static information about a type of customers. How to build a smarter persona and evolve it over the time with the information a startup team gather and the learning they obtained from their entrepreneurial experiences? This research project intends to answer this research question.

The overall research paradigm would be Design Science Research. The eventual goals will be constructing a framework that can be used by startup teams to build their own digital personas. A proof-of-concept prototype will be developed to demonstrate the framework, utilising the generative AI technologies, such as Large Language Models (LLMs) and text-to-image generation tools.
Required mandatory skills: Software engineering general knowledge; Good knowledge on web application development; Basic knowledge on empirical research methods (e.g., experiment, interviews, surveys); Good communication and scientific writing skills.
Desirable (optional) skills: Understanding of AI-assisted tools and techniques (experience in chatbots and natural language processing is preferred but not mandatory); Basic knowledge on business development in startups; Design and conduct scientific experiments.

Project B1 FBK: Evolving Fuzzy Systems with Interpretability and Trustworthiness for Regression Problems
Supervisor: Dr. Dragoni Mauro
Project Description: The field of machine learning and computational intelligence has seen significant advancements in the development of models for regression problems. However, there is a growing demand for models that not only provide accurate predictions but also offer interpretability and trustworthiness, especially in domains where decision-makers require a clear understanding of the underlying reasoning process. This research aims to explore and develop evolving fuzzy systems that address these challenges, focusing on regression problems.
Objectives:
1. To design evolving fuzzy systems capable of handling regression problems with an emphasis on interpretability and trustworthiness in the generated models.
2. To integrate mechanisms for the evolving aspect in fuzzy systems applied to regression problems, allowing them to adapt to changes in the data distribution and problem dynamics.
3. To investigate and incorporate techniques that enhance the interpretability of fuzzy systems, making the reasoning process transparent and understandable to non-experts.
4. To develop methodologies for assessing and quantifying the trustworthiness of fuzzy systems, ensuring robust and reliable predictions.
Research Questions:
RQ1. How can evolving fuzzy systems be designed to effectively handle regression problems?
RQ2. What mechanisms can be employed to enhance the interpretability of evolving fuzzy systems for regression?
RQ3. How can the trustworthiness of fuzzy systems in regression be assessed and quantified?
METHODOLOGY
Model Design: Develop evolving fuzzy systems based on adaptive mechanisms that allow continuous learning and adaptation to changes in the regression problem.
Interpretability Enhancement: Explore and implement techniques such as feature relevance analysis, rule simplification, and linguistic interpretation to improve the transparency of the evolving fuzzy systems.
Trustworthiness Assessment: Propose methodologies for evaluating the trustworthiness of fuzzy systems, considering factors such as uncertainty, model stability, and prediction reliability.
Empirical Evaluation: Conduct extensive experiments and comparisons with existing regression models using real-world datasets to validate the effectiveness, interpretability, and trustworthiness of the proposed evolving fuzzy systems.
Expected Contributions:
Novel evolving fuzzy systems tailored for regression problems.
Techniques for improving the interpretability of fuzzy systems in regression.
Methodologies for assessing the trustworthiness of evolving fuzzy systems.
Insights into the practical applications of evolving fuzzy systems in real-world regression scenarios.

Project B2 FBK: Causality in AI & Deep Learning
Supervisor: Ronzani Massimiliano
Project Description: We are looking for PhD students which are interested in exploring causality aspects of Deep learning and Artificial Intelligence.
This is a very trending topic in the Computer Science and Deep Learning community and impacts several research areas: explainable AI, recommender systems, formal logic, generative AI, automated learning, etc. Examples of aspects to be investigated are:
- Deep Learning and predictive methods applied to temporal data
- Causality aspects of learning policies and their evaluation
- Knowledge Representation and Linear Time Temporal Logic

This topic is particularly interesting because it can benefit from expertise coming from different disciplines: computer science, physics, mathematics, neurobiology. Therefore, students with a strong scientific background in one (or more) of these subjects are encouraged to apply.
Moreover, the research performed through this scholarship can range from abstract and foundational research to very applied one and therefore the topic can adapt to the candidate's natural inclination and preferences.

Project B3 EURAC: CHRIS2People: a framework to increase population health based on the analysis of large data collections
Supervisor: Prof. Johann Gamper
Project Description: Why do we get sick? And what role do genes, lifestyle, and a person's environment play in the onset, progression, and treatment of disease? To investigate these questions the Eurac Institute for Biomedicine uses data from the Cooperative Health Research In South Tyrol (CHRIS) study. CHRIS is the largest population-based resource in Italy to investigate the genetic and molecular basis of age-related common chronic conditions, such as diabetes and cardiovascular disease. Until now, >13,000 adults have participated, and more than one million biological samples and epidemiological, molecular and genetic data were collected. Thus far a strong focus has been on the collection of the data and the generation of novel scientific insights. To date, the main benefit for the participants have been a free blood and urine test, ECG, blood pressure and anthropometric measurement. However, these data are not shared directly with their general practitioner (GP), nor has their GP access to additional data available in CHRIS (such as genotype data which e.g. could help to predict adverse drug reactions).
The goal of this PhD-project is to design, model, and implement techniques and algorithms to dynamically identify the most relevant data for each CHRIS participant during his/her visit at the GPs office, to exchange this information between CHRIS and GPs in a GDPR compliant and privacy conserving manner, and to visualize the shared information to the GP and CHRIS participant taking into account the scientific nature (=uncertainty) of the collected results.
Required skills:

- motivation in scientific work
- basic knowledge in bioinformatics
- algorithmic thinking
- good programming skills
- proficiency in English