Università
della
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italiana

Faculty of Informatics
Master's Research Scholarships (MaRS) Projects
2016-2020

A tangible interface for controlling capture and sharing of personal data (RECALL.A)
Contact: Prof. Marc Langheinrich
The goal of this project is to design and prototyping a tangible device for controlling the capture and exchange of “lifelog” data – e.g., photos captured by a wearable camera, or audio recorded by a wrist-worn audio-capture device – with other, co-located peers. The overall vision of lifelogging is that captured experiences can help us remember better our past, and thus improve our cognitive skills and overall memory performance. By supporting the dynamic exchange of such captured data when co-located with other (e.g., in a meeting) we can also have access to our own experiences from someone else’s vantage point. The to-be-designed device would allow one to control both the capture and the subsequent sharing of experiences not only in a tangible way, but also act as a social marker that would allow all parties involved in a meeting to understand when their discussions would be captured and shared. For example, recording would only take place if the device is placed on a table; exchange with others would only proceed if other devices are placed next to it; shaking the device would delete the last minute of captured data, etc. The first stage of this project will study the different requirements for a privacy friendly data recording device. The second part will be about applying those requirements and constructing a first prototype of a physical recording gadget. Willingness to learn advanced prototyping skills (3D printing, embedded systems development) is required, prior actual experience with embedded systems programming (Arduino or Raspberry Pi) is a plus.

API metrics and pattern visualization
Contact: Prof. Cesare Pautasso
APIs are at the center of microservice architectures as they decouple clients from service providers by explicitly describing the interface contracts connecting them. In this project you will contribute to the development of a tool for statically measuring API specifications (of different languages, e.g., OpenAPI/Swagger/RAML) and visualizing API landscapes so that various microservice API patterns can be observed in the wild.

Approximating order-k Voronoi diagrams using clusters of sampled points
Contact: Prof. Evanthia Papadopoulou
The Voronoi diagram is a versatile space partitioning structure finding applications in various areas of science and engineering.
Given a family S of sites, a Voronoi diagram (VD) partitions the plane into regions, one for each site in S. In the nearest VD, all points belonging to a region have the same nearest neighbor. Analogously, in the farthest VD, all points in a region have the same farthest neighbor. A generalized definition is that of the order-k Voronoi diagram, where points belonging to a region have the same k nearest neighbors.

When the sites are not simple objects, and it is difficult to compute the exact nearest Voronoi diagram, a common approach is to sample the sites, compute the nearest VD of all points and keep the edges of the VD which are equidistant to different sites. The larger the sample of the sites the better the approximated diagram resembles the exact one. Unfortunately, this simple and efficient approach works only for the nearest VD and fails for any other order-k VD.
We propose a method of approximating order-k Voronoi diagrams by using Color Voronoi Diagrams (CVD), where each site is a cluster of points. More specifically, the concept is to sample a cluster of points from each site and to construct the order-k CVD, Such a diagram approximates the exact order-k diagram and can be accompanied by theoretical guarantees. The goal of this project is to implement such construction algorithms and to experiment with different datasets. Work can then be extended to theoretical guarantees for the quality of the approximation or to the design of more efficient algorithms for special input sets.

ASQ
Contact: Prof. Cesare Pautasso
ASQ is a Web platform for delivering interactive lectures in traditional brick and mortar classrooms. It allows presenters to pose questions inside HTML slides and reveive answers from the audience ASQ has grown to a platform that scales to hundrends of students, featuring its own plugin system for advanced question types and HTML5 presentation frameworks (reveal and impress) and a data-driven presenter control view with live statistics. ASQ has been succesfully used both at USI and other universities from which we have gathered a lot of valuable feedback. We are looking for motivated students that will help us make ASQ an indispensable tool for teachers and presenters in general that are interested to ask questions to everyone attending their talk. There are a lot of different areas to work on from data analysis and visualization to live programming and Web presentation development tools.
More information: http://asq.inf.usi.ch

Automated Program Analyses of Student Programs
Contact: Prof. Matthias Hauswirth
Are you interested in programming languages? Would you like to hack compilers or program analysis tools? Then this MARS internship may be for you.
The Luce research group is looking for Master students interested in joining our new research project on Conceptual Change in Learning to Program.
We are developing program analyses that syntactically and semantically analyze student source code. We then run these analyses on code snippets and programs the students submit, to identify flaws in their conceptual understanding of language features. The results of these analyses inform the design of educational materials and assessments and enable educational environments that automatically adapt to the students' current understanding. This project is related to two other projects offered by Luce ("Qualitative Analysis of Programming Interview Videos" and "Educational Technology for Learning to Program"). Unlike in these other projects, in this project the focus is on program analysis design and implementation development. Knowledge about compilers and programming languages as well as excellent programming skills are a must, and experience writing some kind of program analysis (such as one might get in a compilers course) is an advantage.

Collaborative Economy Practices and Communities in Switzerland – A Case Study
Contact: Prof. Marc Langheinrich
The general principle of "collaborative consumption" enables the effective and efficient coordination, acquisition, distribution, and sharing of many kind of different resources, e.g., vehicles, housing, or fertile land. Apart from the well-known for-profit sharing services such as Airbnb, Uber, and TaskRabbit, an increasing amount of community groups and organizations have established not-for-profit cooperatives that often prioritize environmental, social, and cultural values within their local communities.

The goals of the master project are (1) to conduct an empirical research study in the form of in-depth interviews and observations in both commercial and non-for-profit organizations (e.g. in the context of sharing personal artifacts and/or bike sharing); and (2) to compare and contrast sharing practices throughout these services and provide a comprehensive interpretation of the results. Particularly, we would be interested in utilizing practice-based approaches (e.g. Shove's theory of social practice) within the data analysis. This project requires strong analytical skills and a willingness to learn about a novel and emerging research field. Experience with empirical research is a plus (e.g., ethnography, seminar work in human-computer interaction) though supervising guidance is available. Proficiency in any of the Swiss official languages (mostly German, French, or Italian) is an asset.

Computational Display and Fabrication
Contact: Prof. Piotr Didyk
In recent years, there has been a tremendous increase in the quality and the number of new output devices. Standard 2D screens are being replaced with 3D stereoscopic and multiscopic high-resolution displays. New virtual and augmented reality headsets are being developed to provide new, interactive, and immersive ways to explore the real and the virtual worlds. 3D printers empower millions of users to create, customize, and manufacture digital models. Unfortunately, the abilities of these emerging technologies outperform the capabilities of current methods and tools for creating content.
The Perception, Display, and Fabrication Group at USI Lugano offers a wide range of projects in the field of computer graphics with a common goal of developing novel computational methods for driving novel display devices (e.g., AR/VR displays) or different digital fabrication devices (e.g., 3D printers). They involve (1) working with novel hardware, such as VR and AR displays or 3D printers, (2) investigating their essential aspects which influence the perceived quality, and (3) devising new content optimization and creation techniques which: maximize quality and human performance while overcoming computational and hardware challenges. Besides using traditional computational approaches, the projects also aim at employing new machine learning techniques, such as deep neural networks, to solve the above challenges. The examples of the projects include but are not limited to foveated rendering for VR and AR displays, content and hardware optimization for varifocal displays, appearance fabrication, and 3D printing surfaces with prescribed haptic properties. For more details on the research topics, please check our website, or contact us via email.

Converting complex polygons into simple polygons
Contact: Prof. Kai Hormann
Most algorithms in computational geometry for 2D polygons (e.g. polygon partition, Boolean operations, and offset curves) assume the input to be simple, that is, without self-intersections. Your task will be to develop and to implement an algorithm that takes as input an arbitrary complex polygon, with possible self-intersections and degeneracies, and generates as output a set of simple polygons that together enclose the same interior than the complex polygon. The ideal candidate for this project has good programming and mathematical skills and enjoys geometric thinking and reasoning.

Design and Evaluation of a Smartphone App to Support Sharing Physical Objects (SHA21.C)
Contact: Prof. Marc Langheinrich
Many persons are willing to contribute to the community by sharing objects they own, such as household items, tools and media items. The goal of the project is to develop an application that supports this by connecting lenders and borrowers in an easy way. Beyond the obvious features of a standard "classifieds" app (i.e., a potential lender provides information about objects that he is willing to lend; the application provides an easy way for the borrower to find the items he is interested in and, once found, contact the lender) the app

should focus on supporting the interaction inherent in such physical lending, i.e., the physical exchange of the item in question. For example, a simple "bump" could allow a borrower to acknowledge receipt of an item, or an embedded NFC tag in the item itself could be used. Optionally, the app should be evaluated within a short study with several participants. Willingness to learn qualitative research methods in Human-Computer Interaction, as well as basic iOS programming skills required; strong Web programming skills an asset. Hardware such as a mobile phone and a smartwatch will be provided.

Educational Technology for Learning to Program
Contact: Prof. Matthias Hauswirth
Are you interested in web applications? Would you like to contribute to sites with highly interactive components, rich visualisations, and powerful backends? Then this MARS internship may be for you.
The Luce research group is looking for Master students interested in joining our new research project on Conceptual Change in Learning to Program.
We are developing novel learning platforms, from clicker systems that allow students to produce open-ended answers to questions, to platforms that enable mastery learning, boost metacognitive development, and provide novel collaborative and social learning support. We want to extend these platforms to better capture and track the conceptual understanding of students who are learning to program. This work will enable the construction of more efficient and effective learning environments.
This project is related to two other projects offered by Luce (“Automated Program Analyses of Student Programs” and “Qualitative Analysis of Programming Interview Videos”). Unlike in these other projects, in this project the focus is on web development. Knowledge of JavaScript is a must, and experience developing with React is an advantage.

Evaluating a Human Memory Augmentation App (RECALL.C)
Contact: Prof. Marc Langheinrich
Technology always had a direct impact on what humans remember. In the era of smartphones and wearable devices, people easily capture information such as pictures and videos on a daily basis which can help them evoke memories for reminiscing or simply to help one remember a past event. The ubiquity and increasing use of such devices and technologies produce a sheer volume of pictures and videos that, in combination with additional contextual information, could significantly improve one’s ability to recall a past experience or future event. The successful MSc student candidate will design, develop, deploy and evaluate a mobile app that collects and displays such information on mobile devices (Android and/or iOS) for assisting memory recall. As part of the MSc project, the student may help fine-tune and improve an existing set of software (alternatively develop novel modules as needed), combine them with state-of-the-art hardware (E4 wristband, Narrative Clip 2, last-generation smartphone) into a fully functional prototype, and trial the entire system in a week-long study (which includes participant recruitment, participant briefing and de-briefing, data collection, and data analysis). The student will be part of an international research project and will gain invaluable experience in running scientific studies with real participants in real settings. Basic mobile programming skills (Android and/or iOS) and willingness to learn about human subject research required; knowledge of human-computer interaction methodologies and visual design skills are a plus.

Evaluating Secure Personal Memory Sharing with Co-Located People (RECALL.B)
Contact: Prof. Marc Langheinrich
Using smartphones and wearable devices people now can fully log their life in pictures, audio or even video recordings. Such data - "life-logs" - can help evoke past memories and potentially improve our overall cognitive abilities. One interesting opportunity in highly networked environments is the ability to share parts of one's life-logs with others, in order to benefit from recordings of each-other (e.g., by having access to a third person view of oneself in a meeting). In order to avoid any privacy violations, life-logs should only be shared

with co-located people – as soon as people leave or join the meeting, the exchange of lifelogs should be stopped or initiated, respectively. In prior work we have designed an initial prototype of this system, running on several Nexus 5X smartphones. The aim of this project is to evaluate the Android app - called 'MemShare', in order to understand usability requirements and use, and to further refine the overall system (including the backend server and web-based control and inspection tools) based on collected feedback and observed use. This project required a highly motivated student that will co-design, develop, and trial the MemShare system. Basic Android programming skills and willingness to learn about human subject research required; knowledge of human-computer interaction methodologies and visual design skills are a plus.

Formal Analysis of Smart Contracts
Contact: Prof. Natasha Sharygina
Transactions of smart contracts in a decentralized network (e.g. the Ethereum blockchain) are executed by miners that execute the contract functions requested by each transaction sender in exchange for a fee. The fee is proportional to the amount of computing resources necessary to complete the transaction and it is expressed in an abstract quantity called gas. The sender specifies the maximum amount of gas for each transaction and miners execute the transaction code until such limit is reached. Miners either complete the transaction returning the unused gas back to the sender, or abort the transaction when the execution exceeds the gas limit. In both cases miners keep the actual gas used for the execution as a compensation for mining the transaction. In general the cost of a transaction depends on the unknown state of the contract, exposing the sender to the risk of setting the gas limit not high enough to complete the transaction, and therefore leading to a sure money loss. Furthermore contracts cannot be changed once deployed, and predicting the gas needs considering all future possible scenarios the contract could get is a hard task. The goal of this project is to reduce the problem of finding the worst-case gas consumption of contracts to the optimization problem in the Satisfiability Modulo Theories (SMT) context. The SMT problem is the decision problem of determining whether a logical formula is satisfiable, given that some of the variables have an interpretation with respect to combinations of first-order background theories. The work, including implementation and experimentation, will be carried out as an extension of frameworks and tools such the novel parallel version of SMT solvers OpenSMT (http://verify.inf.usi.ch/opensmt) and the C model checker HiFrog (http://verify.inf.usi.ch/hifrog) currently being developed by the Verification Group at USI, and the induction-based model checker Z3-Spacer (https://github.com/Z3Prover/z3) by Microsoft research and others. We are looking for a motivated student who wants to improve his/her knowledge on software verification applied to smart contracts. This project will give the student an excellent overview of a quickly developing field while being sufficiently approachable. Prior knowledge of C++ and Solidity languages is desirable.

Geometric properties of indirect Pythagorean hodograph curves
Contact: Prof. Kai Hormann
An offset curve is a curve of fixed distance away from a given planar curve along its normal direction. They arise in a variety of applications, which include CNC machining, railway design and shape blending. However, for polynomial curves that are widely used in computer-aided design and manufacturing, their offset curves may not be polynomial or rational. Only a special set of polynomials curves has rational offsets, and they are called "Pythagorean hodograph curves". For these curves, there exists a polynomial such that this polynomial, together with the x- and the y-component of the derivative (or hodograph) of the given curve form a "Pythagorean triple", hence the name. An extension of this concept are those curves that do not have a polynomial Pythagorean hodograph, but can have a rational Pythagorean hodograph, after a properly chosen reparameterization, and hence they are called indirect Pythagorean hodograph curves. While the geometric properties of Pythagorean hodograph curves are well understood by now, little is known so far about indirect Pythagorean hodograph curves, and the aim of this project is to change that. We are

therefore looking for a highly motivated student with a thorough background in Mathematics (esp. Algebra, Analysis, Geometry, and Numerics) and basic programming skills.

Highly parallelizable public blockchains
Contact: Prof. Patrick Eugster
Distributed ledgers have recently emerged as a promising technology that can strengthen the trust relationships between its users. These ledgers are conceived as auditable systems that record the actions of the participants to enable accountable behaviors. Blockchains, in particular, are highly replicated distributed ledgers that rely on cryptographic primitives to prevent record tampering. Blockchains are often used in public environments designed specifically not to contain any authority that on one hand can tremendously help with the performance of the system, but on the other hand might compromise the security of the system due to its greater power.
The lack of authority in public blockchains forces its participants to rely on agreement protocols to establish the state of the blockchain. These agreement protocols have prohibitive costs when deployed on large-scale networks and must yet be instanced every time new records are added to the chain. One approach to increase the throughput of such large-scale systems is called sharding: the system is divided into several partially independent sub-systems to limit the scope of coordination happening on the entire system. The selected student will take part in designing a sharded public blockchain, and performing evaluations to assess its performance. Understanding the inner workings of distributed systems and that of public blockchains in particular (e.g., Bitcoin, Ethereum), including their incentive mechanisms, is a clear advantage.

Investigating the dichotomy of sharing practices in virtual and physical realms: from theoretical overview to design considerations (SHA21.A)
Contact: Prof. Marc Langheinrich
Online social networks have made sharing personal experiences with others - mostly in form of photos and comments - a common activity. Nowadays the scope of user-generated and shared content on the net varies vastly from personal media to individual preferences to physiological information (e.g. in form of daily workouts). Popular "sharing economy" services (e.g. AirBnB, Uber) and connected devices are expanding the set of "things" one can share. Given that a new generation of sharing services is about to emerge, it is of crucial importance to understand how traditional sharing practices inform and support designers of those services. This project will look into consolidating the existing body of work on both sharing personal digital content (e.g., on social networking sites, through photo sharing apps) and personal physical possessions (e.g., apartment sharing). The project aims to identify commonalities and differences between digital and non-digital context sharing, in particular summarizing existing research on motivations to share, audience management, privacy and trust issues, and user experience requirements. If possible, these findings should be connected to contemporary theories of social psychology and practice theory. The final results of this project would be: (1) a comprehensive account of the existing body of knowledge on content and resource sharing practices; (2) a set of design considerations that allows designers and developers to build future sharing services to enable sharing activities bridging virtual and physical realms. This projects requires strong analytical skills and a willingness to learn about a novel and emerging research field. Experience with interdisciplinary research literature a plus (e.g., seminar work in human-computer interaction) though supervising guidance is available.

Just Share It: A Decentralized Autonomous System to Support Sharing Physical Objects Using Blockchain and Smart Contracting
Contact: Prof. Marc Langheinrich
Many persons are willing to contribute to the community by sharing objects they own, such as household items, tools and media items. For example in Switzerland an online service

pumpipumpe.ch provides a set of stickers for a mailbox to let people see what household items one can borrow from their neighbours. However, the service does not support the actual act of sharing those items – how borrower and lender meet, agree, and exchange. "Just Share It" is meant as an application that provides such a service, by connecting lenders and borrowers through mobile technology.
A potential lender provides information about objects that he is willing to lend. The application provides an easy way for borrowers to find the items they are interested in. Once a borrower has found an item, the application provides a way for the lender and the borrower to communicate and come to an arrangement. An underlying layer of blockchain-driven smart contracting technology facilitates online contractual agreements (e.g., to record sharing transactions). In order to maintain a positive and friendly environment, “Just Share It” will also need to provide means by which users can build up trust. For example, the application should allow the borrower to leave a short feedback about the experience with the item in the form of a short notice and a picture.
This project is part of the Swiss National Science Foundation funded SHARING21 research project, where we are looking into new ways of supporting sharing both digital information and physical objects. The goal of this master project is to implement and eventually evaluate the "Just Share It" application on a mobile platform, incorporating blockchain and smart contracting technologies (e.g., using Etherium, an open-source distributed computing platform). Strong Web programming skills (Ajax frameworks) are required, basic Solidity and/or C++ programming skills are an asset, prior experience with iOS and/or multi-platform smartphone app development (e.g. Ionic framework) is desirable. Hardware such as a mobile phone and a smartwatch will be provided.

On the farthest-segment Voronoi diagram: predicates and robust computation
Contact: Prof. Evanthia Papadopoulou
The Voronoi diagram is a versatile space partitioning structure with numerous applications in diverse areas of science and engineering. The basic concept is simple: given n simple geometric objects in a space, called sites, their Voronoi diagram divides the space into regions such that the Voronoi region of a site s is the locus of points closer to s than to any other site.
In this project we will focus on the farthest Voronoi diagram of line segments and lines in the plane. It is well known that the farthest-segment Voronoi diagram has a tree structure of complexity linear in the number of the input segments. We want to study the algorithmic predicates involved in computing this diagram robustly. If successful this project may lead to a new package in CGAL - the Computational Geometry Algorithms Library, https://www.cgal.org. The project, however, will focus on the construction algorithm and its predicates.
The ideal candidate must have good programming skills, good algorithmic skills, and an interest in geometric computing. Some mathematical skills are also a plus.
More information about the algorithm and robust computation.

Online data-center modeling
Contact: Prof. Robert Soulé
The open position will focus on the design of a common data model and representation for the state of an operational data center. The model will be populated and driven by logs, traces, and configuration information; queried by operators to determine global properties of the system (such as traffic matrices), and drive online workload-driven simulations to explore the effects of configuration changes. The open position will involve research in data representation, language design, and distributed data processing.

Production optimization through water-front control using adjoint gradient-based techniques
Contact: Prof. Olaf Schenk
The optimization of oil production is a tedius and computational intensive process that requires the solution of time dependent nonlinear set of partial differential equations describing the flow of hydrocarbons in anisotropic porous media. Optimization of production is usually performed using either gradient free techniques like genetic, particle swarm algorithms, or gradient-based techniques where the gradients are computed through the solution of the adjoint problem. Optimization using gradients converges much faster than gradient-free techniques resulting in significant saving in computational time but it usually gets trapped to poor local optima. It is known that the optimal solution of the production optimization problem in homogeneous reservoirs requires equal arrival times of the water-front from the injector wells to the production wells. The aim of this project is to achieve production optimization by a redefinition of the objective function, which is usually defined to be the cumulative oil recovery, so that water-fronts can be controled directly to arrive simultaneously at the production wells. This project requires a highly motivated student that will co-design, develop, and implement the adjoint gradient-based method for the particular objective functions in a compositional reservoir flow simulator. Strong C++ programming skills are required as well as experience in reservoir simulation and compositional flow models.

Qualitative Analysis of Programming Interview Videos
Contact: Prof. Matthias Hauswirth
Are you interested in qualitative research, and specifically in trying to “debug” people’s conceptual understanding (or misunderstanding)? Are you a proficient programmer, and like to help others in learning to program? Then this MARS internship may be for you.
The Luce research group is looking for Master students interested in joining our new research project on Conceptual Change in Learning to Program.
We are conducting “mastery checks” of students in undergraduate programming courses. The students are asked to explain concepts, and to perform various programming tasks. We record these checks on video, over the course of an entire semester. We then use modern qualitative data analysis software to study the videos and to analyze how the students’ conceptual understanding of specific programming language features and of programming strategies changes over time. The goal is the identification of learning trajectories which will inform the design of educational materials and assessments.
This project is related to two other projects offered by Luce (“Automated Program Analyses of Student Programs” and “Educational Technology for Learning to Program”). Unlike in these other projects, in this project the focus is on qualitative research. Interest in gaining a profound understanding of how people learn difficult concepts is a must, and experience using qualitative data analysis methods (such as one might get in a qualitative research course) is an advantage.

Query optimization for graph databases
Contact: Prof. Robert Soulé
The position will focus on investigating language and system support to optimize graph database queries. The current focus is on interaction graphs, which are append-only, temporal graphs used for analytics in telecommunications, transportation, and social media.

RESTful conversation mining
Contact: Prof. Cesare Pautasso
Given a set of logs tracking the HTTP interactions of multiple clients with a REST API, the project will develop a tool to analyze the logs and build a representation of the conversation between each client as it uses the API. The representation should use the RESTalk visual

notation (an extension of BPMN for modeling RESTful conversations). Additionally, the mining could be extended to detect recurring conversation fragments and patterns.
More information: http://design.inf.usi.ch/publications/2015/ecsa

Scalable State Machine Replication
Contact: Prof. Fernando Pedone
State Machine Replication (SMR) is a well-established replication technique used by many production systems, including Apache Zookeeper, Google Chubby, Windows Azure storage, Google Spanner, and many others. Scalable State Machine Replication (S-SMR) is a recent extension of SMR developed at the distributed systems group at USI that promises unlimited performance in addition to configurable fault tolerance. Some initial efforts, for example, resulted in a prototype that outperforms Zookeeper by almost an order of magnitude. This project will look into various aspects of S-SMR and contribute to cutting-edge research with high prospects of applicable results within a team of highly motivated and talented students.

Smart Group Activity Journal – Creating an Automated Activity Feed for Outdoor Sports (SHA21.D)
Contact: Prof. Marc Langheinrich
Skiing and snowboarding are highly social activities. Winter enthusiasts capture and share vast amount of pictures and videos during outdoor vacations. To support information exchange among groups of skiers and snowboarders, this project seeks to create a semi-automated group activity journal. The journal would be automatically shared among group members with an option to grant access to external observers who want to follow a particular participant or the entire group in near real time. The student should implement an app that allows one to both post to and visualize a shared "event stream". Events posted should be supported with a simple plug-in system, e.g., one could imagine a "slope tracker" that posts to the stream whenever one has finished a ski run. Types of content added to the shared stream should include, but are not limited to (1) a pin on a map with geolocation information to setup a meeting point while on the slope; (2) captured media content (photos, videos, an optional live-stream) of the run; (3) reference information in a form of text necessary for descent (e.g., the time left until sunset, the operational hours of a ski lift at a particular location, conditions of the slope with detailed information about potential hazards during descent). Following the recent trend in instant messaging services such as Snapchat or iMessage, where a message can expire after some time, optionally one would be able to associate an expiration tag to any events added to the feed. An additional smartwatch interface should support quick entry of items, e.g., one could post a "hazard" on the slopes by selecting a hazard type and the system automatically adding time and location. The shared activity journal will be hosted on a central server and will be accessible by group participants or observers through the app. An optional integration with an optical head-mounted display for augmented reality (RideOn, Recon Snow 2) is encouraged. Intermediate to strong iOS/Android programming skills required, strong Web programming skills an asset. Hardware such as a smartphone, smartwatch, and augmented reality gear will be provided.

Understanding End-user Attitudes towards Location Sharing Services
Contact: Prof. Marc Langheinrich
So-called “geosocial” applications allow one to share one's current location with friends, families, or even the public. In order to better understand why people are (or are not) using such applications in their daily life, we drew up a technology acceptance model (TAM) – a model that helps predicts what factors influence a person’s use or non-use of such services. The initial model was based both on prior work in location sharing, as well as on actual service use by 36 participants of a 4-week study we conducted. In a subsequent step, we now plan to verify this model in a much broader survey study.
We are thus seeking a highly motivated student to join us in planning, conducting, and analyzing an international survey study. A good understanding of location sharing

technology, as well as basic statistics is required. You will learn how to design and administer survey research using crowdworking services such as Amazon Mechanical Turk or Prolific, as well as understanding the results with the help of analysis software such as SPSS and AtlasTI. Ultimately, the student will join our international research team to analyze and write up the results for submission to a high-profile journal.

Understanding Practices and Motivations for Sharing Physical Resources through Digital Services (SHA21.B)
Contact: Prof. Marc Langheinrich
Today, vast amounts of user-generated and user-mediated content populates social networks. Current research has focused extensively on needs, practices, and concerns surrounding the sharing of photos and videos, textual information (e.g., status updates), and documents. However, in recent years, the scope of what is "shareable" has greatly increased, comprising not only audio-visual content but also preferences and tastes (e.g., playlists, food), physiological data (e.g., workouts), trips, and even information about and access to real-world artifacts (e.g., "couchsurfing"). A recent market trend is to share personal physical possessions, initially rooms and apartments (e.g., Airbnb), but more recently rides (Uber), cars (Getaround) and household items (Snapgoods). The goal of this project is to design, conduct and subsequently analyze an online survey that attempts to elicit current practices of usage of selected sharing economy services, as well as identify motivations to participate in such services. Additionally, the student should conduct contextual interviews involving different stakeholders of such service (e.g. users, non-users, owners, suppliers) to further understand the economic role of using such sharing-economy services. This projects requires strong analytical skills and a willingness to learn about a novel and emerging research field. Experience with performing survey research and/or interviews a plus.