PhD Open Call 2022

The IT University of Copenhagen encourages diversity of applicants regardless of age, gender, religious affiliation, or ethnic background to apply for the positions.

It is important that your application reflects the mission and vision of ITU which is to deliver internationally leading teaching and research that enable Denmark to become exceptionally good at creating value with IT. Furthermore, the vision of ITU is to create and share knowledge that is profound and leads to ground-breaking information technology and services for the benefit of humanity. It is expected that you aim to comply with ITU's 3 core values; Direction-finding, Forthcoming, and Accountable.

Please note that any application must always include the documents listed in the general call text. Applications without the mentioned documents will not be assessed.

Below you find project proposals for the Departments of Computer Science, Business IT, and Digital Design.

Computer Science

The ITU Computer Science Department has one or more vacant PhD positions for outstanding PhD students. The PhD positions are within computer science and data science, including algorithms, databases,logic, image analysis, machine learning, natural language processing, network science, operating systems, optimization, programming languages, proof assistants, robotics, security, semantics, software development tools, software engineering, type theory, verification and more, as well as a range of applications

Applicants must submit a PhD project description (statement of purpose) of maximum 5 pages and must specify member(s) of the department faculty as project supervisor. Applicants are encouraged to contact prospective supervisors beforehand. Applications must satisfy the general ITU requirements for PhDs.

Contact: Head of department **Peter Sestoft**

E-mail: sestoft@itu.dk

Read more about the Computer Science Department: https://en.itu.dk/research/departments/computer-science-department

In addition to open PhD project proposals the following projects are proposed by Computer Science faculty:

Programming Languages, their Learnability and their Target Audiences

The role of programming and technology is influencing educational programmes across the globe. Consequently, research aims to increase the teachability of programming by exploring teaching methodologies and the design of languages. To support this, it becomes important to investigate what makes it difficult to learn to program, what the practical problems novices in programming encounter, why certain languages are taught as opposed to others, and clarify contextual issues of access to, and inclusion in, using these programming languages. Exploring such questions, from the perspective of an individual who is about to learn to program, may aid in guiding future teaching.

The goal of this PhD project is to explore these topics and unveil programming language obstacles from the perspective of novices, to then produce contextually aware tools and/or guidelines that support future teachers. The successful applicant will perform quantitative and qualitative studies investigating programming languages we teach — in particular, the individual constructs and concepts of these languages — and conduct experiments with programming exercises to systematically explore (i) difficulties with programming, (ii) learnability differences of languages and their individual constructs, and (iii) design choices for introduction to programming courses and initiatives, doing all of this with a particular focus on how current approaches face problems of access and inclusion. Consequently, the applicant will have a strong background in teaching, programming languages, designing programming exercises, and mixed (quantitative/qualitative) methods, with, preferably, an MSc in Computer Science or Digital Innovation and Management.

Startdate: To be decided

Proposed supervisor: Claus Brabrand, Christoph Seidl, Marisa Cohn

Contact: Claus Brabrand: brabrand@itu.dk

Research Group: CCER, SQUARE, and TIP

If successful, the position is fully financed by ITU

Automatic Assessment and Visualization of Programming Skill for Learners and Educators

IT literacy is an essential skill in our times and, given the dynamism of the IT domain, programming-related learning is likely to become a life-long activity for many. Since there are disproportionately more students of programming than teachers, a great challenge in education will be the ability to assess and meet each student at their skill level and to provide suitable exercises, content, and feedback.

This Ph.D. project aims to develop novel technologies that will help people understand their own, their peers, and their students' programming skills and weaknesses. The project will develop tools for the continuous assessment of skill level. This will be achieved by monitoring and analyzing the source code committed by learners to version control systems, a technique from the field of mining software repositories. Visualization tools strived at helping users understand and monitor skills will be designed based on the scholarship of teaching and learning as well as the techniques that have emerged from information visualization (InfoVis) and the related field of software visualization.

The resulting tools and techniques will foster scaffolded self-evaluation and problem-solving skills for all students of programming, with the aim of increasing the effectiveness of IT education for students and educators worldwide.

Startdate: Upon agreement

Proposed supervisor: Mircea Lungu, Nanna Inie, Søren Knudsen

Contact: Mircea Lungu: mlu@itu.dk

Research Group: Software Engineering

If successful, the position is fully financed by ITU

More Efficient and Inclusive Natural Language Processing by Selecting What to Read

Language models have recently become the de facto standard for a wide variety of natural language processing tasks, reaching superior performance for example for hate speech detection, machine translation and question answering. These models can learn patterns in language from raw (unannotated) texts. By increasing the amount of text and parameters, the computational cost to train these models is skyrocketing and can only be done by huge supercomputers – which in the long run, is clearly unsustainable. At the same time, these language models have shown limitations on language varieties which were not included during the training of the language model, and since they are mostly trained on edited English texts, this leads to suboptimal performance for other varieties of language (e.g., social media data or Danish data).

Most research on making these language models more sustainable focuses on retraining or compressing previously trained language models. However, for many other machine learning problems it has been shown that data selection can lead to much faster training and higher performance. We propose to exploit data selection to decrease the training time (and cost) for language models, so that we can more easily train language models for more language varieties and make natural language processing systems more inclusive.

Startdate: 1 September 2022

Proposed supervisor: Rob van der Goot, Barbara Plank

Contact: Rob van der Goot: robv@itu.dk

Research Group: NLP North

If successful, the position is fully financed by ITU

Business IT

The ITU Business IT Department has one or more vacant PhD positions for outstanding PhD students. The PhD positions are within information systems and science and technology studies, including social media analytics, IT governance, management information systems, digital innovation and new process models, digital democracy, digital change management, innovation and society, and cybersecurity, as well as business and management foundations.

Applicants must submit a PhD project description (statement of purpose) of maximum 5 pages and must specify member(s) of the department faculty as project supervisor. Applicants are encouraged to contact prospective supervisors beforehand. Applications must satisfy the general ITU requirements for PhDs.

Contact: Head of department **Lene Pries-Heje**, or Deputy Head of department **Steffen Dalsgaard**

E-mail: lpries@itu.dk, sdal@itu.dk

Read more about the Business IT Department: https://en.itu.dk/research/departments/business-it-department

In addition to open PhD project proposals the following projects are proposed by Business IT faculty:

Public Sector Digitalization Exchanges between Denmark and Japan

In Autumn 2021, the Danish and Japanese governments signed a memorandum of cooperation on digitalization, focusing on data flow, policies, law and regulation. While Denmark consistently ranks highly on international e-government league tables, the reasoning for this often boils down to existing public sector infrastructure and processes that are specific to the Nordic welfare state (such as CPR numbers and Nem/Mit ID). The digital infrastructure that makes Denmark so successful in these league tables do not often translate to other national contexts which have different ideas around how the state structures and uses data on its citizens.

This PhD would examine how the Danish government seeks to translate and export its public digitalization strategies outside of the Nordic region through diplomatic efforts. The project would focus on whether these kinds of international partnerships are politically and socially sustainable or whether cultural divides provide challenges in bridging digitalization strategies. It would also seek to understand how Denmark can learn from other states and apply that knowledge to their own digitalization efforts.

The PhD would take a primarily ethnographic approach, and would be theoretically situated within sociology, anthropology, science and technology studies, policy studies, service design or international relations.

An ideal candidate for the PhD call would have a background in the MSc DIM public sector digitalization specialization (or similar program or industry experience); the ability to work in Japanese would be an advantage.

Startdate: 1 September 2022

Proposed supervisor: Signe Yndigegn, Jessamy Perriam

Contact: Jessamy Perriam: jper@itu.dk

Research Group: Center for Digital Welfare/TIP

If successful, the position is fully financed by ITU

Social Credit and the Digital Green Transition in China

As part of China's state digitalization initiatives, the next few years will see the establishment of a social credit system for corporate environmental governance. Through an ethnographic study, this project will follow Enterprise Environmental Credits as they are developed, trialed, discussed, and operationalized in organizational environments.

Drawing on research in environmental and legal anthropology, STS, and critical management studies, the project will examine the design and implementation of environmental governance through social credit. Focus areas may include (i) the everyday efforts of companies and individuals to manage the production of new credit ratings (ii) logics of incentive structures within the system (iii) characteristics of regimes of behaviouralism embedded in credit ratings (iv) mechanisms of accountability environmental credits rely on, or (v) the relationship between different types of data in the implementation of environmental credits. We are particularly interested in unfolding the sociotechnical and socioecological complexities at the intersection between corporate, data, and environmental governance.

Successful proposals will identify concrete sites for ethnographic research, key concepts and questions to ask of the field. The project requires fieldwork, with methods including participant observation, employee shadowing, interviews, and organizational ethnography. It will also require the capacity to critically analyse reports, documentation, memoranda and opinion documents in Chinese and English.

Applicants will have a strong background in anthropology, science and technology studies or similar fieldwork-based disciplines, and the capacity to conduct original ethnographic research in Chinese speaking environments. The appointed researcher will be invited to develop their research project in close collaboration with the Moving Data-Moving People project (2020-2025) which explores the question of when social credit becomes relevant to people on the move in China.

Startdate: 1 September 2022

Proposed supervisor: Rachel Douglas-Jones, Cancan Wang

Contact: Rachel Douglas-Jones: rdoj@itu.dk

Research Group: Technologies in Practice

If successful, the position is fully financed by ITU

Digitalisation of Labour Formalisation - An Ethnographic Investigation into the Impacts of Formalisation Technologies on the Social Exclusion, Governance, Poverty and Employment of Informal Workers in Emerging Economies

Although always having been there, the informal economy has recently attracted growing policy attention, in large part due to the exacerbation of global inequalities caused by the COVID-19 pandemic. Meanwhile, a growing list of governments are introducing new technologies, so-called formalisation technologies, to simplify and facilitate the transition from the informal to the formal economy in emerging economies. This has led the International Labour Organisation to advice governments to integrate strategies of so-called "e-formalisation" in their development policies.

The informal economy refers to any economic activity not regulated by the state. Informality, or undeclared work, often characterises the majority population in emerging economies and is as heterogenic in its nature as the people themselves. It is often considered a prime impediment to public revenue, productivity, and that which is in focus in this project, exercising labour rights and providing social security. Formalisation technologies are any technology or digitalisation initiative which supports traditional formalisation policies, including, but not limited to, initiatives for simplifying business, employment, and transaction registration, encouraging tax compliance, or detecting fraud. Examples of formalisation technologies in an emerging economy setting include, but are not limited to: electronic solutions for the registration of businesses and workers, e.g. on tablets; electronic tools for replacing cash payments with electronic transactions, e.g. digital payment wallets and virtual cash registers; digital identification of employers/employees; data collection with the aim of designing policy

supporting informal workers; or government-supported gig economy platforms, e.g. for selling products or services or enhancing the visibility of the informal sector.

This project will explore the effects of one such formalisation technology in practice in a development context. The focus will be on the effects of the technology on labour rights and social security, including access to work and any unintended effects for workers who straddle formal and informal spheres. The project takes a special interest in the grounded realities of workers. The PhD candidate will be expected to conduct an ethnographic study, including participant observation and semi-structured interviews, with workers at one or several sites of labour that have been subject to publicly supported digitisation initiatives aimed at absorbing informal activity in the formal sector.

The fieldwork will be used to explore the intersection of formalisation and public digitalisation policy initiatives and the prospects of the proclaimed emergence of 'e-formalization' as a new strategy to be pursued in development policy. This, in turn, will address a gap in the political economy of development literature, contributing with a study of labour formalisation through digital means.

Startdate: 1 October 2022

Proposed supervisor: Irina Papazu, Baki Cakici

Contact: Irina Papazu: irpa@itu.dk

Research Group: Technologies in Practice

If successful, the position is fully financed by ITU

An Ethnography of Digital Citizenship at Moments of Birth and Death

Knowing a population by counting the inhabitants of a territory is fundamental for the exercise of state power. Such knowledge necessarily entails counting the births and the deaths in addition to the currently living, but what kind of labour, expertise, and technologies are involved in moments where bodies are linked to state registers for the first time, and when those links are undone at the end of life?

In Denmark, every child is assigned a CPR number shortly after birth. The number remains unchanged throughout life and continues to exist in state registers even after death. The CPR number plays a key role in how the birth and the death of citizens are connected to the to the digital infrastructure of the Danish state, whether it is through the identification bracelets assigned to all newborn that allow for further medical interventions, or through the death certificate that links the event to bank accounts and digital post that must be handled following the death of a citizen.

The project will seek to understand the exercise of state power by attending to routine, administrative, and digitised work facilitated by the CPR number at moments of birth and death. Hence, the project will describe two sets of practices: the work of linking newborn bodies to new CPR numbers, and the work of undoing the link after the death of the state subject. As such, the project will involve ethnographic fieldwork at two institutions: a hospital labour ward and a care home. In these sites, caring in the moment for the newborn or the dying patient, and caring for the future of the patient or of those who survive them often demand conflicting responses from those in charge of the patients, all of which involves digital state infrastructures. For example, a midwife attending a birth might have to make a choice between being physically next to the bed versus finding a computer to register the birth so that an emergency during the birth event can receive a rapid response by another part of the hospital. The specific sites for fieldwork will be decided in discussion with the supervisors.

This project will attend to the frictions between the political subjectivities enacted by the CPR number and the expectations of intimacy in interpersonal care in institutions that deal with the administration of births and deaths. In so doing, it will attempt to answer questions about the role of experts in delivering personal care in a digitised state while balancing the requirements of a large, impersonal infrastructure with the needs of their patients, and potentially guide the design and development of population registration systems that do not lose sight of individual humans and their subjective experiences of emotionally charged moments.

Startdate: 1 August 2022

Proposed supervisor: Baki Cakici, Signe Louise Yndigegn

Contact: Baki Cakici: Bakc@itu.dk

Research Group: Technologies in Practice/Responsible Infrastructuring

If successful, the position is fully financed by ITU

Digital Design

The ITU Digital Design department has one or more vacant PhD positions for outstanding PhD students. The PhD positions are within artificial intelligence and machine learning, co-design of digital services, inclusive digitization of the public sector, computer games, digital health and wellbeing, big data and critical methods to understand social media phenomena and design of good user experiences in digital products and museums.

Applicants must submit a PhD project description (statement of purpose) of maximum 5 pages and must specify member(s) of the department faculty as project supervisor. Applicants are encouraged to contact prospective supervisors beforehand. Applications must satisfy the general ITU requirements for PhDs.

Contact: Head of department **Lone Malmborg**

E-mail: malmborg@itu.dk

Read more about the Digital Design Department: https://en.itu.dk/research/departments/digital-design-department-new

In addition to open PhD project proposals the following projects are proposed by Digital Design faculty:

Digital Game Controllers and their Relevance for the Play Experience in a Museal Context – Identification, Preservation, Outreach

Games form an integral part of culture. Attempts to preserve the cultural heritage of digital games are undertaken around the globe. Professional museal initiatives often focus on the games' software. However, many games function as intended by their designers and as experienced by players, for instance, in the 1980s, only when played with the original controllers. There is an untapped potential in giving the public as well as museum professionals and researchers access to this crucial part of their popular culture and recent past. Thus, this project sets out to recreate authentic game play experiences by taking the issue of materiality into thorough consideration. The project includes the identification of suitable conceptual frameworks and their application to the task at hand, the investigation of the intricate relationships between games and their controllers, the creation of a controller typology, and the examplatory construction (or reconstruction) of several controllers which afford authentic interaction modalities for today's players in museal contexts. Methodologically, the project is based in a close collaboration with gaming communities.

The project is a collaboration between Danmarks Tekniske Museum and the ITU.

Start date: August 2022

Proposed supervisor: Daniel Cermak-Sassenrath, Peter Bjerregaard (Danish Museum of Science and Technology)

Contact: Daniel Cermak-Sassenrath: dace@itu.dk

Research Group: Center for Computer Games Research

If successful, the position is fully financed by ITU

Designing Sustainable Food Futures

In Copenhagen, different volunteer groups are working to help address food system sustainability. Food production, transit, and waste are large impacts to the climate—33% of food is wasted, leading to 6-8% of human-caused carbon impact alone. Imagining alternate food systems locally, KBHFF is a cooperative that connects urban residents with local organic farms, and distributes it to members in various neighborhoods, and Foodsharing Copenhagen is a collects unsellable or food goods that otherwise would go to waste from a system of partners in and distributes it in the city.

Volunteers are essential for these groups' operation, relying on their enthusiasm in the mission to sustain their goals. This project asks: "what motivates volunteers, and how can technology design be used to coordinate, sustain, and activate volunteers in food communities such as these?"

By using particpatory and co-design methods as part of a research through design process, we seek to explore members' motivations, values, goals, and practices, articulating why people choose to participate in these groups and what visions of the future motivate them. In doing so, this proposal will develop 1) design solutions for the problems of maintaining and coordinating food communities, and 2) design proposals to spur participation in local food issues.

Start date: August 2022

Proposed supervisor: Tom Jenkins, Laurens Boer

Contact: Tom Jenkins: tomje@itu.dk

Research Group: Design Research Section, IxD Lab

If successful, the position is fully financed by ITU

Infrastructuring Open Data Commons: Exploring the Temporalities of Sustainable IT Design and Management

Idea, research design and research question
What sustainability thinking entails for digitalization and IT design is currently a hot topic. While the term 'sustainability' remains highly contested with regard to its definition and meanings, e.g. whether it relates to economic, social, environmental, cultural or security matters, many would probably agree that time forms one of its central dimensions. The temporal reach of sustainable development was defined already in the so called Brundtland report (1987) as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". The proposed PhD project is motivated by the current state of IT design fields; both sustainability and temporal matters are under-researched.

In this doctoral project sustainability in IT design and management is addressed via a temporal interest, looking holistically at design and organization of open data services and infrastructures. The research design brings together an empirical field, design approaches and theoretical perspectives that subscribe to different temporal assumptions in order to be able to explore their meeting in practice.
The empirical case is Long Term Ecological Research network in Denmark (LTER-DK). LTER science aims for sustainability of the Earth by employing a long-term temporal paradigm in research, data management and infrastructure work. The project's design method(ologie)s of Service Design and Participatory Design are -akin to most IT design approaches - either time agnostic or shortterm future-oriented. The chosen theoretical perspectives of infrastructures/infrastructuring and commons/communing, in turn, recognize extended temporal scopes of design.

This PhD project asks how will sustainability take shape and be shaped in relation to the myriad of temporalities present in the infrastructuring of open data commons for LTER research by employing participatory and service design approaches? What temporalities are at play? How to bring them into alignment for creating sustainable IT design and management?

Theoretical framing
The key theoretical perspectives relevant to this PhD project are infrastructures and infrastructuring as well as commons and commoning. They provide an analytical frame based on relational and processual ontologies for studying the empirical case, LTER-DK. In addition, the project draws on interdisciplinary studies of time and temporality.

Methods
Integration of ethnography and participatory/service-design

Empirical case: Participatory Design of Open Data Services in LTER-DK
The study finds main focus with the Long Term Ecological Research (LTER) network of Denmark (https://deims.org/networks/e3911e8ace9b-46ce-8265-c2dc9676ad03; chair prof. Inger Kappel Schmidt, University of Copenhagen) but also reaches to the European LTER network with its ESFRI funded eLTER Research Infrastructure (https://elter-ri.eu/) to understand the European research infrastructure policy context that gives framing for national LTER networks' infrastructuring efforts. This is a fertile empirical ground where the long-term thinking of the LTER science and network meets with the time agnostic or short-term future-oriented methods and procedures of Service Design in order to collaboratively engage
in infrastructuring sustainable data commons for LTER-DK.

Expected contributions
*   The PhD project's chosen thematic angle on temporalities of sustainable IT design promises theoretical and conceptual findings and contributions widely relevant for IT design fields.
*   Practical contributions to LTER-DK network and research infrastructure via promoting participatory design and service design within the network.
*   Methodological contributions for IT Design and Management
*   Science Policy relevant findings

Successful candidates
The project is looking for a successful candidate to work within the field of Service Design and Participatory Design. Concretely, the Service Design approach is applied to address how to co-design and organize data management and curation of digital services to various key stakeholders, including e.g., data description and submission, and data accessibility.

The successful candidate should have experience in some of the following research areas:
*   Service Design and Management
*   Participatory Design
*   Science and Technology Studies
*   Organizational Design and Management
*   Research Infrastructures and Policy
*   Open Data and Open Research

The ideal candidate should also have:
*   Commitment to work collaboratively on an interdisciplinary project
*   Good skills on human-centered methodologies
*   Theoretical and practical knowledge and experience qualitative research methods and ethnographic research methods
*   Practical knowledge and experience of collaborative/participatory design

Research Environment
The successful candidate works with the Responsible Infrastructuring research group within the Digital Design department and in close collaboration with LTER Denmark.

The Responsible Infrastructuring group works with an understanding of design of IT and services as engaging, intervening and including, that always involves people, non-human participants and empirical settings.

LTER Denmark applies long-term observation, experiments, and modeling to understand how ecological systems function, and in turn, contributes to better understanding of ecosystem processes and the services they can provide to society.

All applications are welcome, especially those from members of underrepresented groups are encouraged.

Start date: 1 September 2022

Proposed supervisor: Helena Karasti, Sanna Marttila

Contact: Helena Karasti: hkar@itu.dk

Research Group: Responsible Infrastructuring, Digital Design Department

If successful, the position is fully financed by ITU

Data-Driven Debate for Digital Societies

The current pandemic and global warming crises have emphasized the need for contemporary democratic societies to be able to engage in data-informed public debates. Contemporary societies collect increasing amounts of data to allow policy makers to make informed decisions. However, current technologies lack ways for different stakeholders to take part in these decisions on similar terms.

This PhD aims to contribute visualization technologies that enable people to partake in data-based discussions, with the aim to improve democratic processes rather than pave the way for technocracy. Doing so, we build on prior work on collaborative and social visualization to identify shortcomings when considered in the context of argumentation and disagreement.

During the project, we will study technologies in societal use, and we will create novel technologies that support in-person and online data debate. To create a rich understanding of the phenomena that might be involved in data debates, we will first conduct studies in our lab that construct close-to natural situations where participants engage in in-person data discussions based on data visualizations. We will also study how people use existing tools to participate in online data discussions in parallel to our lab-based efforts and compare the insight from our two approaches. We plan to use our study insights to identify promising directions for designing new visualization techniques and technologies for online, interactive, data-based discussions and will explore possibilities for evaluating these in lab studies and studies that offer higher degrees of external validity.

Start date: 1 September 2022

Proposed supervisor: Luca Rossi, Søren Knudsen

Contact: Søren Knudsen: soekn@itu.dk

Research Group: Human-Centered Data Science

If successful, the position is fully financed by ITU

Data Visualization and Natural Languages

Data visualization has been suggested to be a form of language. To that end, several connections between knowledge of data visualization and natural languages have been noted by the visualization research community, to the point that it is now commonplace to discuss how people might "read" a visualization. Notable examples of such connections include knowledge of literacy, which has strongly inspired the notion of data visualization literacy; language acquisition in early childhood, which plays an important role in the concept of constructive visualization; active reading, which was studied in the context of working with data visualizations; rhetoric, which has inspired work on visualization rhetoric; and critical text analysis, which has given way to critical "readings" of data visualizations that build on the rich traditions of humanistic scholarship.

However, these many ways to use the rich knowledge that we have about our natural languages to inform visualization research and design currently exists as isolated islands of knowledge. To date, the work to collect these different approaches, to connect them, and to uncover what we might have missed in terms of knowledge translation between these two knowledge domains remains.

This PhD aims to contribute insights from considering the domains of data visualization and natural languages together. It asks, what are the parallels between the domains, what are the unexplored areas, what are the strong examples of inspiration, and how might we build from those?

The project will survey existing research that intersect the two domains to establish a framework that help to understand and think about the two domains. The framework, readings within the domains, and consultations with language experts will help uncover unexplored areas and incongruencies between the domains and provide opportunities for grand breakthroughs. For example, in visualization, "authoring" means to manually create a well-known visualization design, while in the context of natural languages, "authoring" has a different meaning. Might there be other ways to consider visualization authoring that can be fruitfully applied in visualization research? Based on the opportunities identified in the framework, the project will explore promising directions in combining the two knowledge domains.

We envision this work to lead to new insights about visualization authoring, visualization production, and visualization reading. While we imagine most of this work to contribute to the emerging body of work in data visualization, it will consider contributions to the rich existing body of work on languages that are inspired from data visualization knowledge.

The candidate for this project should have a strong background in:

- The field of digital design or computer science. The candidate should have a good understanding of data visualization, and might possess the skills needed for development of research prototypes, or

- The field of social sciences and humanities (such as, but not limited to, language, linguistics, or cognition). The candidate should be interested in pursuing more technical research and a particular interest in data and data visualization.

Ideally, the candidate presents a relevant and interesting profile that intersects the two mentioned fields, or a strong background in one of the two and a genuine interest in and understanding of the other.

Start date: 1 September 2022

Proposed supervisor: Lone Malmborg, Søren Knudsen

Contact: Søren Knudsen: soekn@itu.dk

Research Group: Human-Centered Data Science

If successful, the position is fully financed by ITU

Mobile Diary Sensing for Postnatal Depressing Screening

The PhD Project

Upwards 33% of parents suffer from postnatal depression following childbirth. Early diagnosis is commonly done with a 10-item multiple-choice questionnaire known as EPDS (Edinburgh Postnatal Depression Scale). The questionnaire is a simple-to-administer and inexpensive tool, but the drawback is that 10% of depressive patients are not diagnosed and upwards half of the subjects are misdiagnosed as depressed. Misdiagnosing postnatal depression is profoundly critical for parents, children, and the health care system in general.

The goal of this PhD project is to develop a novel digital system and clinical methodology to support early diagnosis of postnatal depression with high accuracy. The project will leverage methodologies and theories from interaction design, behavioral psychology, natural language processing, and general data science.

A mobile diary application will be devised, designed, and developed. A daily reminder asks parents to input meaningful data, such as writing about their mental health or answering questions. The system screens for depression cues by combining techniques from natural language processing (NLP), mobile sensing, and psychometrics.

Following participatory design practices, the mobile application, the sensing technique, and the postnatal depression scoring are developed and evaluated in close collaboration with parents, infants, and health care professionals.

The project has potential for high impact publications in the fields of human-computer interaction, behavioral psychology, and digital health at venues such as CHI, UIST, IMWUT, and DIS. Furthermore, the project can have ample impact on the wellbeing of the participants, providing better early diagnoses of affective disorders following childbirth.

The research environment

The project is truly interdisciplinary, and it draws on a unique combination of research topics. The PhD student will therefore collaborate with several researchers at ITU that have expertise within these topics, such as affective computing, behavioral modeling, participatory design, and data science.

The PhD student will be employed at the Digital Design department and be a key member of the research groups Human-Centered Data Science and AIR LAB. The interdisciplinary nature of the project will ensure collaborative synergies across the department.

Start date: 1 September 2022

Proposed supervisor: Jonas Fritsch, Aske Mottelson

Contact: Aske Mottelson: asmo@itu.dk

Research Group: Human-Centered Data Science, AIR LAB

If successful, the position is fully financed by ITU

International Flows of Problematic Information

Over the last few years, the online propagation of problematic, misleading and false information emerged as a serious threat to democratic processes all over the world.

Despite the global and transnational nature of the menace most of the existing research focuses on national cases and specific temporal moments (e.g. elections, referendums, etc.).

This project proposes to move beyond the existing research by focusing on the transnational flows of problematic information by studying how specific problematic content or themes emerge in different countries over a longer period.

From a methodological point of view the project, grounded in computational communication science, will build on Network Analysis and NLP techniques.

Start date: 1 September 2022

Contact: Luca Rossi: lucr@itu.dk

Research Group: Human-Centered Data Science, NERDS

If successful, the position is fully financed by ITU

Exploring the Design of Welfare Technology as Smart Connected Products

The so-called demographic challenge and projections of an accelerated aging of societies in the western world highlights an ever-growing societal demand to bring about new welfare technological solutions that can help empower senior citizens stay active and engaged as they grow older. This PhD project explores how the design of hitherto predominantly mechanical welfare technological aids can embrace the possibilities for innovation and rethinking presented by technologies such as Internet-of-Things, Cloud Computing and Artificial Intelligence/ Machine Learning - in other words, this project investigates how welfare technology can be designed as smart connected products?

In particular, using mobility aids (e.g. wheeled walkers) as a concrete example and research vehicle, the PhD project explores how an existing welfare technological product can be re-envisioned and re-designed as a smart connected product offering opportunities for human action and assistance as part of the fully networked city of the future. The PhD project investigates how the wheeled walker can present itself as an interface to the services, networked devices, and in general, the ecology of digital and non-digital resources in a smart city. As such, the project adheres to the vision of the Smart City as an inclusive environment inviting all citizens to become first class participants, both actively contributing to, and taking advantage of, the city infrastructure.

The PhD project continues a line of investigation previously carried out at ITU in a series of smaller pilot projects exploring how the re-design of wheeled walkers for navigation in complex indoor and outdoor settings, inner city transportation, shopping, sightseeing, visits to hospitals, and ad-hoc social networking with peers can help encouraged users of wheeled walkers to embrace resources part of the fully connected cities of the future.

The project draws upon a number of concepts and frameworks from within the research fields of interaction design and applied computer science: IoT/Ubiquitous/Pervasive computing, Cloud computing, Embodied interaction, Augmented reality, Location-based-services, Proxemic interaction, Opportunistic crowd sensing and in general the notion of existing physical artifacts electronically instrumented to become part of an ecology of fully interconnected computational resources.

Expected outcome of the PhD project is presented as an articulation of the design space for welfare technology designed as smart connected products. The design space articulation will be centered around the demonstrators and experience prototypes designed, implemented and evaluated at the core of the 3-year PhD study.

Role of the PhD student

As PhD student you will design and implement a series of experience prototypes / demonstrators that, in parallel, helps discover and define, the design space (space of possible solutions) of mobility aids designed as smart connected products to be used within a smart city context.

The experience prototyping activities, aiming to make the interaction envisioned available for direct human experience, will cut across the use of basic soft - and hardware construction and include the use of single-board computers, sensors and actuators when exploring novel interaction modalities and interfaces.

In general, work will be guided by a research-through-design approach propelled by hands-on exploratory investigations. All work will be carried out in close collaboration with the main supervisor and take place within a network of stakeholders from NGO's , private industry and Danish municipalities.

Lab Affiliation: As PhD student you will become a full member of the Affective Interactions&Relations (AIR) lab with privileged access to lab and workshop resources . And important, as member of the AIR lab you will be invited to participate in ongoing collaborative lab activities , in direct support of , and beyond, the your own own PhD research.

The candidate

Masters degree in Interaction design, Computer Science or Software Engineering with a specialisation towards a human centered approach to the construction of novel interfaces in the design for human interaction with digital technology.

Candidates with one or more of the following additional competences will be preferred: (1) familiarity with basic concepts and technologies of internet-of-things, (2) skilled in one or more high-level programming languages (e.g JavaScript, Java, C#) (3) experience with basic use of single-board computers (e.g. Raspberry Pi, Arduino, etc) to interface with digital and analog sensors and actuators.

Start date: As soon as possible

Proposed supervisor: Tomas Sokoler, Signe Yndigegn

Contact: Tomas Sokoler: sokoler@itu.dk

If successful, the position is fully financed by ITU

Exploring the Design of a Smart Connected Wheeled Walker in Support of Out-of-Clinic Physical Rehabilitation

Background

Societies all over the western world are faced with an ever-growing number of citizens in need of physical rehabilitation and, in turn, a need to come up with new less resource demanding ways to support these processes. In general, there is a search door for successful strategies that can bring down societal cost through an increased level of citizen responsibility as major parts of the rehabilitation processes is moved from the clinic to private homes. We currently see reports worldwide of failed attempts to implement out-of-clinic rehabilitation process - while cost is reduced so is, most often, the success of the rehabilitation processes. This is often attributed to a lack of motivation on behalf of the rehabilitee in between the period face-to-face consultations at the clinic. However, based on our prior studies, we would like to further explore a very different position concerning the alleged lack of rehabilitee motivation.

The Project

Rather than a lack of motivation and lack of willingness to take responsibility on the part of the rehabilitee we will work from the hypothesis that the lack in question is a lack of means to express rehabilitee motivation and a lack of means to engage in rehabilitation exercises as an integral part of the environments and activities that makes up everyday rehabilitee living beyond the clinic and beyond the 'role' as patient in progress'. Recognizing this challenge, and using the wheeled walker as case, this project explores the broader vision of how tools for

out-of-clinic physical rehabilitation can be (re-)designed as 'smart connected tools' allowing for a stronger integration of rehabilitation processes and exercises with activities of everyday living. In particular, the project explores how a 'smart connected wheeled walker' can be designed to help turn everyday walking routines (e.g. going to the local store), into legitimate parts of an out-of-clinic post hip surgery habilitation regimen agreed upon by the rehabilitee and her professional rehabilitator.

Designed as an IoT edge device the smart walker seeks to take advantage of state-of-the-art sensing, actuator, and cloud-based technologies using machine learning to analyze the quality (e.g. gait analysis) of walking activities and evaluating these against exercises and rehabilitation goals set by the rehabilitee and her rehabilitator. This in turn making possibly for the smart wheeled walker to both, inform the rehabilitee on the go and possibly nudge changes of behavior to adjust her patterns of walking and, at the same time, allowing the rehabilitator (in the remote) to better prepare for the periodic face-to-face meetings with the rehabilitee. A such, the project will pursue the notion of concordance from contemporary rehabilitation research aiming for an informed dialogue and negotiation between rehabilitator and rehabilitee when adjusting goals for the ongoing rehabilitation process. In particular, this project investigates the use of semi-supervised machine learning and sensor fusion as a feasible approach when aiming to support rehabilitation processes with scarce resources. Semi-supervised learning combines a small amount of labeled data with a large amount of unlabeled data during training. Furthermore, expanding on ideas of crowd sensing, the project will explore how combining fusion of sensor data (e.g. gyro+accelerometer, load cells, cameras etc.) and semi-supervised learning as part of distributed and federated learning processes would allow data collection and model building in distributed practices across individual rehabilitation processes.

The project draws upon a number of concepts and frameworks from within the research fields of interaction design and applied computer science: IoT/Ubiquitous/Pervasive computing, Cloud computing, Augmented reality, sensor fusion and machine learning.

Work will be guided by a research-through-design approach propelled by hands-on exploratory investigations. All work will be carried out in close collaboration with supervisors and take place within a network of stakeholders from NGO's, private industry and Danish municipalities.

Lab Affiliation

As PhD student you will become a full member of the Affective Interactions&Relations (AIR) lab with privileged access to lab and workshop resources. And important, as member of the AIR lab you will be invited to participate in ongoing collaborative lab activities, in direct support of, and beyond, your own PhD research.

The Candidate

Masters degree in Interaction design, Computer Science or Software Engineering combining an affinity towards construction-oriented human centered interaction design with formal math and machine learning skills. Candidates with one or more of the following additional competences will be preferred: (1) familiarity with concepts and technologies of cloud computing and internet-of-things, (2) experience with basic use of single-board computers (e.g. Raspberry Pi, Arduino, etc) to interface with digital and analog sensors and actuators.

Start date: As soon as possible

Proposed supervisor: Tomas Sokoler, Dan Witzner

Contact: Tomas Sokoler: sokoler@itu.dk

Research Group: AIR LAB

If successful, the position is fully financed by ITU