

### **PhD Call from Computer Science Department**

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

Applicants must submit a PhD project description (statement of purpose) of 1-2 pages, and must specify which member(s) of the department faculty should be the project supervisor. Applicants are encouraged to contact prospective supervisors beforehand. Applications must satisfy the general IT University requirements.

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

**Contact:** Head of department Peter Sestoft, email [sestoft@itu.dk](mailto:sestoft@itu.dk), or call +45 7218 5083.

**Department:** Computer Science, homepage: <https://computerscience.wikit.itu.dk/>

### **Possibility to apply for more specified projects in Computer Science:**

#### **The high and lows of formally verified software**

Formally verified software has long been a holy grail of computer science. To prove that a program follows its specification to the letter, to ensure that all bugs have been found, and to be certain that all corner cases have been covered is a tantalising prospect. This goal has, however, proven elusive in practice. When building formal verification tools a choice between automation and expressivity must be made — we either want push-button technology that tests a few select features that we are interested in, or we sacrifice automation in order to prove deeper theorems about our programs all the way up to full functional correctness.

This project sits firmly in the second camp. We are currently working on proving full functional correctness of Java programs in the interactive proof assistant Coq. To this end, we have created a small model of Java in Coq where we can verify simple programs. On top of this, we have created an Eclipse plugin, Coqoon, that allows users to develop complete Coq theories in Eclipse, similar to ProofGeneral or CoqIDE. The goal of this project is to tie the Java development environment in Eclipse together with Coqoon to provide one tool where we can write our programs in the standard Java development environment, write our specifications in Coqoon and ultimately prove our software correct. This is a big project with two main focus points — you can either work on the high-level IDE development and create the front-end that the programmers will work with when verifying their programs, or you can work on the low-level model of Java in Coq to verify more interesting classes of programs.

A prospective PhD candidate should have a solid understanding of semantics, proof theory, and formal verification. Proficiency in Eclipse plugin development is a plus, as is familiarity with the Coq proof assistant.

**Contact person:** Jesper Bengtson

**Research Group:** Programming, logics, and semantics group

The available position depends on an available funding by ITU.

### Entertainment Robotics

This project aims to build an understanding of how the specific characteristics of robots broadly interpreted can make them successful in an entertainment context. The project is interdisciplinary and combines insights from computer games research and theories of play with the technological opportunities represented by state-of-the-art robotics research. Through prototyping the project aims to inform a new generation of entertainment robots based on principles from play theory, and make a fundamental contribution to the emerging industry of entertainment robotics.

**Contact:** Professor Kasper Støy ([ksty@itu.dk](mailto:ksty@itu.dk)); Professor Espen Aarseth ([aarseth@itu.dk](mailto:aarseth@itu.dk))

**Research group:** Robotics, Evolution, and Art Lab (REAL), Center for Computer Games Research

The available position depends on an available funding by ITU

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### PhD Call from Business IT Department

The Business IT at the IT University of Copenhagen has one or more vacant PhD positions within information systems and science and technology studies, including social media analytics, IT governance, management information systems, such as 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 1-2 pages, and must specify which member(s) of the department faculty should be the project supervisor. Applicants are invited to contact prospective supervisors in advance. Applications must also satisfy the general IT University requirements.

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

**Contact:** Head of department Peter Eklund, email [petw@itu.dk](mailto:petw@itu.dk), or call +45 7218 5319

**Department:** The Business IT Department homepage is <https://businessit.wikit.itu.dk/>

### Possibility to apply for more specified projects in Business IT:

#### Innovative applications of image recognition technology in business

With the emergence and proliferation of social media and mobile technologies the amount of data stored in the form of images and videos has grown tremendously. At the same time, recent advances in image recognition technology (e.g., the development of convolutional neural networks and the availability of large and open training datasets) make it now possible to build systems that have almost human-like visual perception capabilities. Yet, with a few exceptions (e.g., Facebook, Yelp, Airbnb), companies still struggle to

effectively apply image recognition technology to improve their internal business processes or product/service offerings.

The goal of the intended PhD project is to explore and evaluate innovative applications of image recognition technology in different industries (e.g., retail, tourism, consumer products, media, advertising) and business functions (e.g., marketing, customer service, new product development, e-commerce). The focus is on the application of existing technologies (e.g., Google TensorFlow, IBM Watson, Clarifai) for supporting judgment and decision making in business, not on the development of new algorithms.

The ideal candidate combines an educational background in business/media/communications with strong computational and quantitative skills, or vice versa.

**Contact Person:** Oliver Müller; [olmy@itu.dk](mailto:olmy@itu.dk)

**Research Group:** Business IT, TIME

The available position depends on an available funding by ITU.

### Blockchain-based Solutions for Social Goods

As blockchain technology gains momentum and new avenues are sought to discover alternative solutions this infrastructural technology may afford – it becomes evident that a multi-method research approach to look into the facilitation and constitutive impact of blockchain on the perception of trust is needed. This project constitutes an important aspect for subsequent investigations of the opportunities and challenges inherent in the technical framework of blockchain technologies. Its inception is focused on the use of blockchain technology for public goods, more specifically, for social goods. Social goods can be regarded as public goods delivered by the government or non-governmental agencies and are typically characterized as actions that provide benefit to humanity. More recently, social goods are discussed in the context of unlocking the potential of community collaborations through the use of technology to create positive societal impact.

The purpose of this research project is to identify and analyze use cases, wherein blockchain technologies change existing or create completely new processes to provide social goods. Increasingly, a concern related to blockchain-enabled transparency in transactions has enforced the need to develop alternative measures of trust. More explanatory insights are needed on how blockchain is changing how social organizations operate. Specifically, in this project the PhD student will study the changing role of trust in blockchain-based socio-technical systems for the generation of social goods.

A successful candidate must possess a profile that is situated at the interface between IS and STS. Experience with qualitative research and an aptitude to combine it with foundational information systems architectures is given a preference. The candidate should be able to publish in international outlets and make practical and academic contributions to the research area.

**Contact person:** Professor Roman Beck [beck@itu.dk](mailto:beck@itu.dk)

**Research group:** TIME

The position depends on an available funding.

### Organizational Management and Governance in the Age of Blockchain

This PhD research project explores how blockchain is changing organizations and their governance mechanisms. A blockchain can be described as a cryptographically enabled distributed database that holds immutable data. The technology reconciles issues of uncertainty, risk, and trust, and holds the potential for a paradigmatic shift in how economic activities are organized. The DAO, the first instantiation of a decentralized autonomous organization, already illustrated how organizations put on a blockchain are characterized by governance mechanisms that are radically different from those of more traditional organizations. Decentralized autonomous organizations are steered through decentralized decision-making and governance mechanisms that are technologically implemented as enforceable smart contracts. This PhD research project explores the changes in governance in organizational management that are induced by the advent of blockchain, and their ramifications for organizations and society as a whole.

The research project requires the application of a mixed-method approach, combining qualitative and quantitative research methods to achieve a deeper analytical understanding of the implications that the rise of blockchain poses for organizing economic activity and value.

The applicant is expected to have a strong academic background in Information Systems field and should aim for publishing his or her research in internationally leading journals. Besides making a theoretical contribution, the applicant is also expected to add value to society through research that is not only rigorous, but also relevant.

**Contact person:** Professor Roman Beck [beck@itu.dk](mailto:beck@itu.dk)

**Research Group:** TIME

The position depends on successful funding.

### Innovation and Leadership in the Digital Economy

The objective of this Ph.D. project is to investigate how innovation practices (especially those of leaders) are currently disrupted by Information Systems. The starting point is the question how (Danish / European) companies currently approach innovation, e.g. how do they involve the participation of internal and external stakeholders? Other relevant questions are: That type and how can Information Systems be used to support this? What role can leaders play in this context? What is their take on digitalization? How does it influence their leadership style?

The project will involve close collaboration with companies willing to share their data and insights with us. The applicant is expected to work between theoretical reflections and practice-based explorations.

**Contact person:** Associate Professor Alexander Richter ([aric@itu.dk](mailto:aric@itu.dk))

**Research Group:** TIME, Business IT department

The position depends on successful funding.

### **PhD Call from Digital Design Department**

The Digital Design Department at the IT University of Copenhagen offers one or more vacant PhD positions within the areas of Interaction design, Co-design, Service design, Health & rehabilitation design, Games research, Digital media, culture & communication, and Digital citizenship & democracy.

Applicants must submit a PhD project description (statement of purpose) of 1-2 pages, and must suggest which member(s) of the department faculty should be the project supervisor. Applicants are invited to contact prospective supervisors in advance. Applications must also satisfy the general IT University requirements.

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

**Contact:** Head of department Lone Malmberg, email [malmberg@itu.dk](mailto:malmberg@itu.dk), or call +45 7218 5023.

**Department:** Digital Design, homepage <https://en.itu.dk/research/departments/digital-design-department>

### **Possibility to apply for more specified projects in Digital Design:**

#### **Digital technologies for interactive theater and performances**

Theater performances are increasingly using digital and interactive elements such as facilitation for audience interaction and VR for mixing live and recorded media realtime. This PhD project will focus on combining theater, dancing and other performance arts with the possibilities of new mobile, sensor technologies. Grounded in the field of human-computer interaction the student will contribute with design for expressive, interactive performance experiences through thorough technical knowledge; using social science approaches they will investigate uses and experiences in finished and ongoing productions. Of particular interest is how mobile and sensor technologies can be used to facilitate performing arts and how these can benefit from for example civic participation. The PhD student has the opportunity to frame their own project in relation to interactive theater and performance. It is expected that the student take initiative to facilitate collaboration with theaters and performance groups in Copenhagen and beyond.

**Contact:** Associate Professor Louise Barkhuus [barkhuus@itu.dk](mailto:barkhuus@itu.dk) and Associate Professor Dag Svanæs [dasv@itu.dk](mailto:dasv@itu.dk)

**Research Group:** Interaction Design

The available position depends on an available funding by ITU.

#### **Seeing with Machines**

The Seeing with Machines project is an interdisciplinary research project at the intersection of design, biology and Artificial Intelligence (AI). It investigates the interplay between the design of visual technologies with human perception. It is expected that the examination of and the experimentation with nonhuman

perspectives contribute to a solid understanding of human perception, informs the design of novel visual technologies, and opens up new modalities for human-computer interaction.

The project is collaboratively supervised by Asc. Prof. Daniel Cermak-Sassenrath (interaction, design; main supervisor), Asc. Prof. Laura Beloff (art, biology) and Asc. Prof. Sebastian Risi (AI, robotics); it is located in the Digital Design department, the Pervasive Interaction Technology (PIT) Lab and the Robotics, Evolution and Art Lab (REAL Lab). The availability of the position depends on funding by ITU. The project can also be considered to be done in collaboration with relevant external partners. Start of employment: As soon as possible.

The ideal applicant for this position has a background in digital art, design, media and communication or related fields of study. Candidates who have experience with practice-based research and/or relevant theoretical competence will be prioritized.

**Contact:** Associate Prof. Daniel Cermak-Sassenrath ([dace@itu.dk](mailto:dace@itu.dk))

**Research Group:** Games or the Robotics, Evolution and Art Lab

The available position depends on an available funding by ITU.

### How Video Games Save the World – A Critical Account of Gamification from a Game Studies Perspective

Despite considerable enthusiasm in parts of academia and industry, and the application of tremendous amounts of resources for many years, gamification appears not to deliver on its popular promise to comprehensively transform (and possibly improve) many areas of life (e.g. learning, health, self-image, paid work) – gamification seems to be broken. This project sets out to explore what goes wrong.

The project is located within the field of Game Studies, and employs a selection of its concepts, practices and methods. The emphasis is on the applicant's abilities to structure the research, and to work between theoretical reflections and practice-based explorations. The candidate has extensive experience in creating interactive artefacts (e.g. with *Arduino*) and digital games, and an academic background in design, with a strong and demonstrated focus on play.

Possible angles of research include the implementation of gamification (how, when and why are qualitative approaches superior to object-based approaches and quantitative approaches); the context of gamification (application, location, material, controller, social interaction and target audience); and philosophical considerations (is the idea of gamification a contradiction, and play essentially opposed to be used in a secondary or utilitarian way).

The PhD can also be considered to be done in collaboration with relevant industry.

**Contact person:** Associate Prof. Daniel Cermak-Sassenrath ([dace@itu.dk](mailto:dace@itu.dk)).

**Research group:** Games

The available positions depends on available funding by ITU.

### **Towards More Adaptive and Creative Artificial Intelligence**

Recent artificial intelligence developments have enabled algorithms to outperform humans across a number of surprisingly diverse tasks. However, machine intelligence still cannot match the human brain's capacity for plasticity, intuition, spatial reasoning, and creativity. This research project aims to narrow this decisive gap between artificial and natural systems, targeting applications in games, robotics, and art.

A PhD student is sought to investigate topics such as (1) how to scale bio-inspired AI methods (e.g. neural networks and evolutionary algorithms) towards biological levels of complexity and plasticity, and (2) how to best combine the mutual advantages of human intuition and machine intelligence. The successful candidate will have experience and knowledge in some of the following areas: neural networks, evolutionary algorithms, deep learning, neural plasticity, procedural content generation, and human-machine collaboration.

**Contact person:** Associate Professor Sebastian Risi (sebr@itu.dk)

**Research Group:** Center for Computer Games Research and the Robotics, Evolution and Art Lab

The available position depends on available funding by ITU.

### **Digitalization of service in public sector**

The PhD project will explore the digitalization of service delivery in public sector organizations. It will focus in service design, and especially on how public sector actors are able to respond to the demand of adding digital components to existing service portfolio, or designing and implementing totally new service concepts with use digital assets. The project has a strong emphasis on co-creation and co-design; it will look at methods and conditions where public sector service design can benefit from integration of resources of all service stakeholders, and how to create conditions for successful value co-creation.

The PhD project will start with a literature survey on digitalization of service in public sector. As a result, a theoretical framework for analyzing the phenomena is defined. The project will continue with case study of finished and ongoing service design cases. As a result, the thesis will propose strategies, methods or guidelines for service design in digitalization of service in public sector.

The successful candidate must have a background in Participatory service design or related disciplines. Experience with empirical field studies and explorative use of combined methods is appreciated.

**Contact:** Professor Minna Isomursu, miis@itu.dk

**Research Group:** Digital Design department

The position depends on successful funding.

### **Habilitation of new normal bodies**

In the last third of our lives we encounter different ways in which our bodies deteriorate - some are just small nuisances while others bring on more debilitating consequences. In this research project we will look at new ways in which elderly can begin to live with these transitions of their bodies through the aid of technologies. Usually when we talk of hearing aids or other forms of prostheses we refer to remedies, which can offer a so-so

compensation of the lost abilities. In this project we will re-design these technologies so as to offer something beyond what is lost to instead enable new experiences and new abilities and perhaps even new practices (e.g. a hearing aid that would allow you to hear something from a different source, to hear sounds that is not within the traditional human spectrum, or hear composed sound-interpretations of events not otherwise available to human perception). The abled body is always defined in relation to specific cultural and societal norms and when we cannot live up to those norms (anymore) we tend to get stigmatized. The technological prostheses to be designed within this project aims to explore and expand the concept of a new normal - a cyborg existence with new abilities. People who are experiencing a loss of abilities will instead of re-habilitation have to undergo habilitation - acquiring new skills in union with the new prostheses with the aim to empower people in bodies undergoing transition. We will use a combination of design research, co-design, phenomenology, and inventive methods such as performance ethnography to explore this. We will work in the spectrum speculative extremes to practical solutions.

**Contact person:** Anna Vallgård, [akav@itu.dk](mailto:akav@itu.dk)

**Research Group affiliation:** Interaction Design, IxD lab

The position depends on successful funding.

### **Potential projects in collaboration with industry and ITU - Digital Design:**

#### **Transparency and IoT enabled adaptive feedback in architecture**

KHR Architecture invites applicants for an industrial PhD position in the trans-disciplinary intersection between IoT enabled adaptivity, material studies of transparency and emergent housing topologies. The applicant is expected to develop a research proposal based on his or her own ideas and context of expertise.

Recent developments in transparent building materials open for more dense and sustainable urban developments, especially within low-rise, high-density urban housing. The suggestion is that variation in the transparencies of building materials, that allow for enhanced lighting flux between building elements, and self-adjusting adaptive artificial lighting, will enable radically new topologies and architectural solutions in urban low-rise, high-density developments.

Material transformation, IoT based control and sensor infrastructures and feedback driven adaptivity are all aspects of key operations of contemporary architecture. Space is no longer just a given entity but it is instead constructed through both social and material operations and the experience of environments in a persistent flux. Changes in densities and intensities require ability to – on many levels - re-organise and transform architectures as well as ideas of public space and individualized dwellings. IoT infrastructures will enable architectural designs and indoor climate solutions that adapt to the diversity of peoples living practices and increase indoor climate qualities.

The project will engage with elaborate design processes, building explorative prototypes and testing aesthetics and functions of designs in everyday life contexts in low-rise, high-density housing topologies. The research is people centred and seek to develop architectural suggestions with enched focus on the qualities of



inhabitation and living practices. The research outcome is expected to contribute to architectural practice with visionary architectural design parameters, refined sketching tools, and a well-developed theoretical position.

The project seeks to fill one PhD position with a start at the latest January 1, 2018.

**Industry partner:** KHR Architecture; <http://www.khr.dk/>

**Contact person:** Jan Søndergaard; [JS@khr.dk](mailto:JS@khr.dk)

**Research Group at ITU:** Adaptive Environments <http://adaptive.itu.dk/>

**Contact person:** Kjell Yngve Petersen; [kynp@itu.dk](mailto:kynp@itu.dk)

The available position is dependent on co-funding from Innovation Fund Denmark – Industrial PhD programme with application deadline September 25, 2017; <http://innovationsfonden.dk/en/application/erhvervsphd>

Successful candidates are expected to develop their research projects and final funding applications in close collaboration with supervisors from ITU and KHR.

The PhD fellow will form part of a trans-disciplinary cluster of PhD fellows at BLOXHUB Science with participants from across architecture and design research; <http://www.bloxhub.org/>

### Architecture Shapes Behaviour – understanding behaviour and the built environment

Applicants are invited to establish and fill an industrial PhD position at 3XN architects and GXN innovation in Copenhagen. The positions are part of the newly launched Architecture Shapes Behaviour research cluster in collaboration with the IT University of Copenhagen (ITU) and the Royal Danish Academy of Fine Arts, School of Architecture (KADK). We are looking for excellent candidates with experience from architecture, design and related fields, seeking to develop and refine research and practice around architecture and human behaviour. The applicant is expected to develop a research proposal based on his or her own ideas and context of expertise.

The digitalisation of design tools and management systems has significantly enhanced architects ability to collect, analyze and engage with data throughout design processes. The research aims to foster conceptual and design models for integrating simulation and modeling of building performance into architectural design processes in response to best practices and changing patterns of usage. The PhD fellow will engage in case studies, observing and collecting data on the performance and livability of inhabited projects, and take part in explorative design developments in the architectural studio.

Understanding interactions between behaviour and the built environment is central for creating architectural solutions that support human well-being, performance and productivity. The research can engage this relationship from one or more vantage points including (but not limited to) design thinking and human-centred design strategy; advanced modelling, simulation and CFD; data analysis and visualisation; interaction design; adaptive environments, building systems and materials; social sciences; business strategy.

The project seeks to fill one PhD position with a start at the latest January 1, 2018.

**Industry partner:** GXN Innovation at 3XN Copenhagen; <http://gxn.3xn.com/#/>

**Contact person:** Kåre Stokholm Poulsen; [ksp@3xn.dk](mailto:ksp@3xn.dk)

**Research Group at ITU:** Adaptive Environments: <http://adaptive.itu.dk/>

**Contact person:** Kjell Yngve Petersen; [kynp@itu.dk](mailto:kynp@itu.dk)

The available position is dependent on co-funding from Innovation Fund Denmark – Industrial PhD programme with application deadline September 25, 2017; <http://innovationsfonden.dk/en/application/erhvervsphd>

Successful candidates are expected to develop their research projects and final funding applications in close collaboration with supervisors from ITU and GXN.

The PhD fellow will form part of a trans-disciplinary cluster of PhD fellows at BLOXHUB Science with participants from across architecture and design research; <http://www.bloxhub.org/>