

Post-doctoral Research Fellow - Testbed design for AI-enabled networks

About the position

A fixed-term 100 % position is available at the University of Agder, Faculty of Engineering and Science, as a Post-doctoral Research Fellow in Information and Communication Technology, for a period of 2 years. The position is located, at the present, at the Campus Grimstad. The starting date is as soon as possible or to be negotiated with the Faculty.

The Postdoctoral researcher will be supervised by researchers from the [Center Intelligent Signal Processing and Wireless Networks \(WISENET\)](#), Faculty of Engineering and Science, UiA. Information about why UiA provides an excellent working environment can be found [here](#).

This postdoctoral researcher position is offered in the area of Testbed design (hardware and software) and experimental evaluation for reproducible research, covering scenarios related to distributed networked sensor systems for industrial environments, as well as future Artificial Intelligence-enabled advanced wireless networks.

The herein announced position will be part of the Center Intelligent Signal Processing & Wireless Networks (WISENET), whose activities span across both the Department of Information and Communication Technology and the Department of Engineering. The WISENET Center is recognized and funded by the national NFR TOPPFORSK Programme, Research Council of Norway. The WISENET Center has a strong expertise in a wide range of areas, among them, Data Analytics, Machine Learning, In-Network Processing and Distributed Intelligence, Networked Cyber-Physical Systems, Artificial Intelligence for Wireless Networks and Embedded Systems, having led a number of large research projects, funded by the Research Council of Norway, the EU research Programmes FP7 and H2020, as well as national and international industries. The WISENET Center is now in full expansion phase, having at the present ten PhD students, three postdoctoral researchers, working on different cutting-edge research projects, such as FRIPRO FRINATEK, SFI, PETROMAKS, INFRASTRUCTURE and IKTPLUSS Projects, among others. The WISENET Center is committed to achieving international research excellence; please see the [notes about prospective Postdoctoral researchers](#) at WISENET before applying.

A postdoctoral research position should function as an intermediate step in the research career following the completion of a PhD degree and preceding a faculty position in a university. For this reason, the WISENET Center is committed to offering the suitable environment and activities that allow the postdoctoral researcher to (i) consolidate her/his research maturity, (ii) develop her/his teaching and advising skills, and (iii) build up a solid resume that facilitates her/his incorporation to the academia as an assistant or associate professor.

Responsibilities

The new demanding applications in different domains (smart sensing and controlling systems remotely, remote monitoring of environments, machine learning for industrial applications, distributed intelligence in Industry 4.0, IoT, Artificial Intelligence-enabled unmanned aerial vehicles, computer vision for autonomous drones, video analytics for autonomous traffic management, etc...) require the design of novel and heterogeneous Wireless Sensor and Communication Networks composed of various types of nodes with different local processing and wireless communication capabilities, diverse sensing and actuation functionalities.

Experiments in wireless sensor and communication networking are of paramount importance since the scientific community has not reached a consensus on a reference model due to the extremely large number of parameters to be considered. As a consequence, the gap between simulation and experimentation may lead to significant differences between the performance of the simulated system and that of the real system. Most of the existing Testbeds dedicated to wireless sensor and communication assessments are composed of homogeneous devices. They are built using mature technologies, however, the experimental validation of the transmission, sensor and networking techniques that are developed in the theoretical research works, requires the construction of a Testbed made up of heterogeneous nodes not only devoted to transmission, acquisition and processing of wireless signals, but also to spectrum, context-aware sensing and node positioning.

This postdoctoral position will involve the complete design and detailed evaluation of a novel Testbed, which will be composed of devices having wireless re-programming capabilities, as well as a complete software architecture and protocol stack to maximize the reproducibility of Algorithms and Protocols for research. This Testbed will also include both indoor and outdoor nodes with proper packaging and protection for robust operation in hostile terrain, corrosive environments or inclement weather.

The two key elements of our Testbed will be: a highly customizable and flexible hardware and software infrastructure to interconnect, configure, control and monitor all Testbed nodes, as well as an efficient, flexible and powerful software architecture to enable high-level and homogeneous access to each element of the Testbed (nodes, sensors, servers and services). Our Testbed will serve also as a platform (based on completely realistic measurements) for experimentation and to evaluate extensively some of the algorithms and networking techniques developed in [several projects led by the WISENET Center](#).

In terms of tasks related to spectrum sensing, environmental sensing or energy harvesting, we will always use state-of-the-art hardware modules and develop highly efficient customizable wireless nodes (e.g. transceiver nodes based on state of the art FPGAs [Field Programmable Gate Arrays] or GPUs [Graphics Processing Units]) and various types of nodes according to the performance needs in different scenarios. The planned wireless nodes will be specifically tailored to meet the ambitious goals in terms of minimal hardware complexity, low processing delay, lower power dissipation, energy efficiency, energy harvesting and re-programmability.

In order to extract information from the physical world and make it accessible remotely, different types of devices will be used. Although the majority of these devices will be low-cost and low-power devices, other nodes with higher capabilities will be also used. The low-cost devices, generally devices with low-computational resources (e.g. LoRa nodes), will be in charge of sensing the environment and performing some low-level computation. The devices with higher capabilities (e.g. USRP, NUTAQ platforms) will be in charge of more complex tasks, such as node coordination, data aggregation, more complex distributed signal processing tasks and machine learning algorithms, among others. All this hardware heterogeneity leads to the necessity of several research tasks of software design, integration and validation in order to achieve a full operative platform. For example, different devices may present different radio models and communication protocols, which may require developing new interfaces and drivers.

The hardware infrastructure will be composed of the following types of nodes:

- High-performance nodes with real-time processing capabilities (e.g. NUTAQ nodes).
- Medium-performance nodes (e.g. USRP nodes) with limited transmission and limited real-time signal processing capabilities.
- Sensor and actuator nodes (e.g. LoRa nodes) capable of gathering information from the environment, which can perform some local processing and communicate with other nodes in the network. The choice of sensors and actuators will depend on the applications considered (e.g. smart water networks, autonomous vehicles, smart agriculture, robotic applications, etc...).

The main topics for this Postdoctoral position will be:

- Design of a novel heterogeneous Testbed, implementation of advanced algorithms and extensive experimental evaluation. While the software architecture viewed as a whole will be the same for all testbed elements, each particular element of the heterogeneous network will have a different implementation of the lower-level layers constituting the software architecture.
- Development of novel network and software architectures for the experimental evaluation of communication and sensor networking techniques. This will involve also investigating the design of Software-Defined-Radio platforms that are capable of operating simultaneously with multiple wireless standards.

Required qualifications

To be regarded as an eligible applicant, the candidates must have:

- A PhD in Electrical Engineering, Computer Engineering, Computer Science, Telecommunication Engineering, or similar. Having a PhD Thesis on a related topic is an advantage. It is desirable that the applicant has defended his/her doctoral thesis within the last four years. PhD students are also welcome to apply if their defence is scheduled for the next few months. The PhD Thesis must be approved within the deadline for applying for this position.
- Solid understanding and experience in (some of) the following areas:
 - Software-Defined-Radio implementation of network protocols in real scenarios.
 - Experience with USRP nodes, mote-like devices (e.g. LoRa) and Testbed setup.
 - Circuit design using FPGAs (LabView, Verilog or VHDL).
 - Implementation of algorithms in GPU architectures.
 - Analog, digital and mixed signal circuit design for Embedded Systems (especially PCB design).
 - Analog and digital signal processing.
 - Statistical signal processing.
 - Communications interfaces: SPI, I2C, UART, PCI-X, Ethernet, and USB.
 - Interfaces with sensors, actuators and signal processing blocks.
 - Background in using sensors such as ultrasound, LiDAR, multispectral cameras and mmWave sensors.
 - Mathematical Analysis and Advanced Algebra.
 - Optimization techniques.
 - Strong programming skills mainly in Matlab, Python, C/C++ and Java.
 - Familiar with some of these libraries: Tensorflow, PyTorch, Keras, FFMPEG, OpenCV and NumPy.

Moreover, it would be considered an advantage to have additional knowledge and experience in:

- D2D wireless communications.
- Radio resource management, interference management, dynamic spectrum access, cognitive radios.
- RF measurements, spectrum sensing.
- Localization and navigation techniques.
- Data science, machine learning, deep Learning.
- Graph signal processing.
- Automation and control in Industrial environments.

The publication of scientific papers on high impact journals and first-class international conferences related to these topics will be taken into account positively, as well as the previous participation in national or European projects related to the topics above.

Further provisions relating to the positions as Post-doctoral Research Fellows can be found in the [Regulations Concerning Terms and Conditions of Employment for the post of Post-Doctoral Research Fellow, Research Fellow, Research Assistant and Resident](#).

Personal qualities

- Scientific ambition.
- Motivation and strong interest in cutting-edge research.
- Good analytical and problem-solving skills.
- Capacity for goal-oriented work and ability to concentrate.
- Good communication and team-working skills, inventiveness and a proactive attitude.
- Capacity also to perform independent research.
- Strong academic credentials, written and spoken English proficiency.

Personal qualities and suitability for the position will be emphasised.

We offer

- the opportunity to work in a world-class research organisation with an excellent research environment. You will collaborate with top scientists in your field and have excellent prospects for personal development in an innovative working environment for aspiring researchers. The environment will also provide opportunities for personal development in a diverse environment, modern facilities and a comprehensive set of welfare offers.
- professional development in a large, exciting and socially influential organisation
- a positive, inclusive and diverse working environment
- modern facilities and a comprehensive set of welfare offers
- membership of the [Norwegian Public Service Pension Fund](#)

Short-listed applicants will be invited for interviews. With the applicant's permission, UiA will also conduct a reference check before the appointment.

The University of Agder is an open, friendly and professional employer, with a Scandinavian view on life/work balance, and with a clear vision to do research to enlighten human understanding.

[More about working at UiA.](#)

The position is remunerated according to the State salary scale, salary plan 17.510, code 1352 Post-Doctoral Research Fellow, salary NOK 544 400 - 658 300 gross per year. A compulsory pension contribution to the Norwegian Public Service Pension Fund is deducted from the pay according to current statutory provisions.

General information

A good working environment is characterised by its diversity. We therefore encourage all qualified candidates to apply for the position, irrespective of gender, age, disability or cultural background. The University of Agder is an IW (Inclusive Workplace).

Women are strongly encouraged to apply for the position.

The successful applicant will have rights and obligations in accordance with the current regulations for the position, and organisational changes and changes in the duties and responsibilities of the position must be expected. Appointment is made by the University of Agder's Appointments Committee for Teaching and Research Positions.

[Read more about the employment process.](#)

In accordance with the Freedom of Information Act § 25 (2), applicants may request that they are not identified in the open list of applicants. The University, however, reserves the right to publish the names of applicants. Applicants will be advised of the University's intention to exercise this right.

Application

The application and any necessary information about education and experience (including diplomas and certificates) are to be sent electronically. Use the link "**Apply for this job**".

The following documentation must be uploaded electronically:

- Certificates with grades (Bachelor, Master and PhD).
- Up to 10 scientific publications and/or R&D projects which the candidate wishes to particularly emphasise for the assessment process. For the scientific publications, include summary and links to them.
- An electronic copy of your PhD thesis and Master's thesis (if applicable).
- Justification (maximum five pages) of the background of the candidate for each of the requirements of the position (see description above about the knowledge areas that a candidate should have).
- Project plan (maximum two pages) proposed by the candidate in relation to this postdoctoral position.
- Any other relevant documentation.

The applicant is fully responsible for submitting complete digital documentation before the closing date. We draw your attention to the fact that we cannot, unfortunately, include you in the assessment process if attachments are missing. All documentation must be available in a Scandinavian language or English.

Application deadline: 07.10.19

Contact

For questions about the position:

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For questions about the application process:

- HR Advisor Nina Rønningen, tel. +47 38 14 20 16, e-mail nina.ronningen@uia.no

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Jobbnorge-ID: 170296, Søknadsfrist: 7. oktober 2019