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PhD student in Scientific Computing focusing on Cybersecurity and Machine Learning for Critical Infrastructures

Published: 2022-04-27

Uppsala University is a comprehensive research-intensive university with a strong international standing. Our ultimate goal is to conduct education and research of the highest quality and relevance to make a long-term difference in society. Our most important assets are all the individuals whose curiosity and dedication make Uppsala University one of Sweden's most exciting workplaces. Uppsala University has over 54,000 students, more than 7,500 employees and a turnover of around SEK 8 billion.

The Department of Information Technology has a leading position in research and all levels of higher education. Today the department has 280 employees, including 120 academic staff and 110 full-time PhD students. The Department comprises research and education in a spectrum of areas within Computer Science, Information Technology and Scientific Computing. More than 4000 students take one or several courses offered by the Department each year.

The position is hosted by the **Division of Scientific Computing** within the Department of Information Technology. As one of the world's largest focused research environments in Scientific Computing the research and education has a unique breadth, with large activities in classical scientific computing areas such as mathematical modeling, development and analysis of algorithms, scientific software development and high-performance computing. The division is currently in an expansive phase in new emerging areas such as cloud and fog computing, data science, and artificial intelligence, where it plays key roles in several new strategic initiatives at the University. The division currently hosts 20 PhD students and have awarded more than 80 doctorates. Several PhD alumni from the division are successful practitioners in the field of scientific computing and related areas, in industry as well as in academia around the world.

The Department of Information Technology also heads the Strategic Research Area (SFO) effort eSSENCE. It is a collaborative research programme in e-science between three Swedish universities with a strong tradition of excellent e-science research: Uppsala University, Lund University and Umeå University.

Our research group specializes in developing theory, methods and software for distributed computing infrastructures and machine learning. We have a wide network of collaborators, and there will be opportunities to work together with excellent researchers within Sweden and abroad.

This PhD position is part of the eSSENCE - SciLifeLab graduate school in data-intensive science. The school addresses the challenge of data-intensive science both from the foundational methodological perspective and from the perspective of data-driven science applications. It is an arena where experts in computational science, data science and data engineering (systems and methodology) work closely together with researchers in (data-driven) sciences, industry and society to accelerate data-intensive scientific discovery.

Project Description
Software applications and reliable communication are key to offer regular and mission critical services online. Mission critical services are part of critical infrastructure sectors like healthcare, finance, communications, and power generation and distribution. To support a reliable, secure, and efficient offering of software services for critical infrastructures, the cybersecurity and trustworthiness of software and computing infrastructures are vital. In 2020, 56% of energy utility facilities reported cyberattacks on their installations, a number that is likely to increase as novel machine learning-based services are deployed within these critical infrastructures.

A possible way forward to secure these systems is to design and develop a comprehensive and proactive vulnerability analysis framework for software applications running on critical infrastructures. Effective vulnerability analysis is a highly challenging task requiring real-time processing of massive datasets based on millions of reported vulnerabilities available in public databases, traces coming from underlying software frameworks and libraries, and data based on application development and execution processes.

Vulnerability analysis for critical infrastructures requires a focused, data-driven approach that covers all aspects that are crucial to ensuring a reliable, secure, and efficient offering of uninterrupted services. The proposed project is a cross-disciplinary effort between data science and cybersecurity with 3 focus areas. Develop a firm understanding of the dynamics of the vulnerability landscape for critical

infrastructures (focus area 1). Design explainable predictive vulnerabilities analysis frameworks (focus area 2). And to develop a methodology for knowledge transfer between different infrastructures (focus area 3).

The project will run in a close collaboration between Assoc. Prof. Salman Toor from the Division of Scientific Computing as main supervisor and Assoc. Prof. André Teixeira from the Division of Systems and Control as co-supervisor.

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Duties
The duties of a PhD student are primarily directed at their own research education, which lasts four years. The work may also involve, to a limited extent (ca 20%) other departmental duties, such as teaching undergraduate courses and administrative tasks – in which case the position may be extended to a maximum of five years.

Requirements
A PhD position at the Division requires a Master of Science or equivalent in a field that is relevant to the topic of the project, good communication skills and excellent study results, as well as sufficient proficiency in oral and written English. Additional requirements for this position include knowledge of computer science, with a focus on security, distributed systems, and machine learning, as well as proficiency in programming (preferably in Python and C).

Additional qualifications
Extra merits with equal weights include familiarity with the nature of common vulnerabilities and exposures, knowledge and experience in numerical optimization, Bayesian methods, and best practices in software engineering.

Rules governing PhD students are set out in the Higher Education Ordinance chapter 5, §§ 1-7 and in Uppsala University's rules and guidelines.

About the employment
The employment is a temporary position according to the Higher Education Ordinance chapter 5 § 7. Scope of employment 100 %. Starting date 2022-09-01 or as agreed. Placement: Uppsala.

For further information about the position, please contact: Associate Professor Salman Toor, Salman.Toor@it.uu.se.

Please submit your application by 16 May 2022, UFV-PA 2022/1494.

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Please do not send offers of recruitment or advertising services.

Submit your application through Uppsala University's recruitment system.

Placement: Department of Information Technology

Type of employment: Full time , Temporary position longer than 6 months

Pay: Fixed salary

Number of positions: 1

Working hours: 100 %

Town: Uppsala

County: Uppsala län

Country: Sweden

Union representative: ST/TCO tco@fackorg.uu.se
Seko Universitetsklubben seko@uadm.uu.se
Saco-rådet saco@uadm.uu.se

Number of reference: UFV-PA 2022/1494

Last application date: 2022-05-16

Apply for position

HR EXCELLENCE IN RESEARCH

The HR Excellence in Research logo is a seal of quality that lets you know Uppsala University is committed to implementing the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers.

More about Uppsala University's work with the EU Charter and Code

EMPLOYEE BENEFITS

As an employee at Uppsala University, you receive a number of great benefits. Here we have listed the most important ones.

Benefits for Uppsala University employees