RESEARCH SCHOOL

PhD Opportunity

Determining cyber attacks by using machine learning to detect message anomalies.

Supervisory team
Dr Andrew Tomlinson, Dr Hayder Alwattar

Director of Studies:
Dr Andrew Tomlinson, Worcester Business School, University of Worcester

Supervisors:
Dr Hayder Alwattar, Worcester Business School, University of Worcester

Research Group: Digital Innovation & Intelligent Systems Research Group

The PhD Opportunity
We are interested in finding ways to determine internal and external attacks on cyber systems such as IoT devices, wireless sensor networks (WSN), car electronic components, or connected computer systems. Such attacks often involve the alteration, fabrication, deletion or injection of data messages. Detecting anomalies in data message streams is therefore an important aspect of any intrusion detection system deployed for cyber security.

Attacks might alter the timing, quantity or payload contents of the messages. Although some attacks might affect the message flows in ways that can be predetermined and hence identified in signature databases, there are also attacks that are either not predictable or are difficult to formally define against the natural behaviour of the system.

An example of the latter is the controller area network in cars, where the message properties are likely to be unique to the car model and secret to the car manufacturer, which makes formally defining a normal profile, and hence conversely an abnormal profile, a difficult prospect.

This PhD would therefore determine and evaluate methods for detecting attacks, such as using machine learning to detect abnormal behaviour in the messages. A project would involve determining and evaluating suitable detection methods as well as developing suitable data sets and message attack simulations.

Application Process
To begin the application process please go to Business MPhil/PhD Webpage and click on 'How to Apply' in the top menu. This PhD could be caried out on a part time or full time basis so please select the relevant application link. On the application form, please make it clear that you are applying for one of our advertised projects so we can direct it straight to the relevant people.

The Interview
All successful applicants will be offered an interview with the proposed Supervisory Team. You will be contacted by a member of the Research School Team to find a suitable date. Interviews can be conducted in person or over Microsoft Teams.

Funding your PhD
For more information about Doctoral Loans please visit:
https://www.worc.ac.uk/study/fees-and-finance/doctoral-loans.aspx

During your PhD you can access the Research Student Support Scheme to support dissemination costs associated with your research, up to £500 a year.

Research at the University of Worcester
Research is central to the University's mission to make a difference in everything that we do. We are committed to delivering excellent research which extends the boundaries of human knowledge but which also improves people's lives by enabling better health outcomes, improving food security, developing environmentally sustainable solutions for crop production and socially sustainable solutions to our ageing population, enhancing public knowledge and understanding of the past and present.

The University hence focuses its research around five high-level challenges facing society, locally, nationally and globally:

- **Human Health and Wellbeing**
- **Sustainable Futures**
- **Digital Innovation**
- **Culture, Identity and Social Exclusion**
- **Professional Education**

The success of our research is reflected in our continuous improvement in external research assessment processes. In the most recent Research Excellence Framework, REF 2021, the University saw a near 50% increase in the scale of its research and 12% increase in quality, building on its performance in REF 2014 when it was the UK's most improved university in terms of Research Power, a combination of scale and quality.

Research Degrees at Worcester
Our research students are central to our overall mission for research. They are working at the cutting edge of their disciplines and driving forward the quality of our research whilst enriching our research culture. We are looking to increase our research student numbers as a strategic imperative.

Our commitment to our students is reflected in the results of the Postgraduate Research Experience Survey 2023 in which we ranked 3rd for overall research student satisfaction nationally. Key to our success in his area is the Research School, a focal point for all our research students.

It provides:

- day-to-day support for our students, both administrative and practical, through our dedicated team
- a Research Student Study Space with both PCs and laptop docking station
- a comprehensive Researcher Development Programme for students and their supervisors
- a programme of student-led conferences and seminars

Research Group / Unit / Centre

Digital Innovation and Intelligent Systems Research Group
The Digital Innovation Research Group is focussed on the application of intelligent systems to real world problems. This incorporates the design, creation and research of technological systems that dynamically respond to the world around them to address practical issues in a wide variety of applied domains. This includes computational approaches such as machine learning, artificial intelligence, modelling and simulation, data mining and pattern recognition.

Intelligent Systems are becoming more important in everyday life as their use expands and adoption increases. With this expansion comes many key challenges that must be addressed as new application areas are found.

Widening Participation
As part of its mission statement the University is committed to widening participation for its higher degrees. Although most candidates will have an undergraduate and/or a Masters degree, the University is happy to accept applications from candidates with relevant professional qualifications and work related experience.

For further information or an informal discussion on this project, please contact Dr Andrew Tomlinson (Director of Studies) via email at a.tomlinson@worc.ac.uk