

F. Fernando Jurado-Lasso

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Summary

I am a postdoctoral researcher at the Department of Applied Mathematics and Computer Science (DTU Compute) within the Embedded Systems Engineering (ESE) section of the Technical University of Denmark (DTU). I received the Ph.D. degree in Engineering and the M.Eng. degree in Telecommunications Engineering both from The University of Melbourne, Australia, in 2020 and 2015, respectively; a B.Eng. degree in Electronics Engineering in 2012 from the Universidad del Valle, Colombia.

Research Interests

I am passionate about exploring the dynamic realm where Software-Defined Wireless Sensor Networks (SDWSNs) intersect with the power of Machine Learning (ML). This unique fusion of technologies serves as the focal point of my research endeavors. My goal is to address the burgeoning challenges posed by the ever-increasing number of Internet of Things (IoT) devices and applications. My research is dedicated to overcoming the technological barriers associated with resource management and reconfiguration complexities prevalent in current IoT applications. Delving into the intricacies of networked embedded systems, SDWSNs, ML, and IoT protocols and applications.

Beyond this, my curiosity extends to the application of ML/AI for communications and networking. I am enthusiastic about harnessing the potential of these cutting-edge technologies to enhance the efficiency and intelligence of communication systems.

Keywords

- Internet of Things (IoT)
- Networked Embedded Systems
- Machine Learning (ML) and Artificial Intelligence (AI) for Communications and Networking

Education

PhD in Engineering & IT

The University of Melbourne

Thesis: A software-defined networking framework for IoT.

Advisor: Prof. Ampalavanapillai Nirmalathas and Mr. Ken Clarke.

Jan 2017 - Dec 2020

MEng in Telecommunications

The University of Melbourne

First Class Honours

Advisor: Mr. Ken Clarke.

Jul 2014 - Aug 2015

BEng in Electronics

Universidad del Valle

Thesis: Design and implementation of an AVR (Automatic Voltage Regulator) using programmable hardware for a synchronous generator of up to 4MW.

First Class Honours

Advisor: Prof. Jaime Velasco-Medina.

Aug 2006 - May 2012

Work Experience

Postdoctoral researcher

Oct 2021 - present

Technical University of Denmark (DTU)

Department of applied mathematics and computer science (DTU compute)

Embedded Systems Engineering (ESE) section

Copenhagen, Denmark

Description: I serve as the co-Principal Investigator (co-PI) for the Distributed Artificial Intelligence Systems (DAIS) project, a collaborative effort involving 48 partners from 11 European countries. In this pivotal role, I contribute significantly to the project's success by overseeing and actively participating in various key responsibilities and duties including:

- Developing research strategies and executing initiatives within the scope of the EU DAIS project.
- Utilizing machine learning methodologies to address networking challenges in wireless embedding systems.
- Validating research findings through simulation tools such as Contiki-NG operating system, C code, Python, and PyTorch.
- Presenting research outcomes at conferences, workshops, industrial gatherings, and open days.
- Publishing research articles in reputable journals to contribute to the academic discourse.
- Co-leading the university's supply chain management efforts.
- Representing DTU and actively participating in project meetings to ensure effective collaboration and communication.
- Co-supervising undergraduate and postgraduate students and providing mentorship and guidance in their academic pursuits.

Ph.D. Researcher

Jan 2017 - Dec 2021

The University of Melbourne

Department of Electrical and Electronic Engineering (EEE)

Melbourne, Australia

Description: I investigated the challenges and benefits of Software Defined Wireless Sensor Networks (SDWSNs) as a solution to flexible resource management and reconfiguration of WSNs. My main responsibilities included:

- Designing, modeling, and implementing a software-defined management solution for WSNs.
- Formulating a mathematical model of energy consumption for SDWSNs to examine the impact on network performance when reprogramming the WSN.
- Developing an innovative energy-aware routing algorithm and a new control overhead reduction technique for extending the network lifetime of software-defined multihop WSNs.
- Presenting the research findings in industrial gatherings, department level meetings, and highly-regarded peer-reviewed venues.

Hardware Engineer Intern

Jan 2017 - Jun 2018

Networked Society Institute (NSI)

Department of Electrical and Electronic Engineering (EEE)

Melbourne, Australia

Description: The project involved the development and evaluation of an online open-source educational resource to support the teaching and learning of STEM high-school education in Years 9 and 10. This project was supported by Google Australia. My main responsibilities included:

- Developing a sensor system to measure environmental temperature, humidity, pressure, and other environmental parameters using Raspberry Pi.
- Developing a communication interface to send the collected data to a remote server using the MQTT protocol.
- Collaborating with other interdisciplinary team members to plan, execute, and test the system.

Support Engineer

Jan 2016 - Dec 2016

Empresas Municipales de Cali (EMCALI)

Cali, Colombia

Description: I played a crucial role in a groundbreaking project. The project aimed to develop and implement prepaid energy services within smart grid systems. Main tasks in this role included:

- Collaborating with other team members to plan, execute, and deliver prepaid electricity services.
- Ensuring seamless integration and robust performance of innovative energy solutions.
- Providing technical support and troubleshooted issues to enhance the overall efficiency and reliability of prepaid energy services.
- Elaborating on the project's documentation.

Research Intern**Jan 2015 - Jun 2015**

Networked Society Institute (NSI)

Department of Electrical and Electronic Engineering (EEE)

Melbourne, Australia

Description: I conducted a conceptual study and implemented architectures and technologies related to the Internet of Things (IoT). Main tasks included:

- Investigating various publish-subscribe communication protocols.
- Working with multiple Unix-based operating systems.
- Developing software for the system.

Ph.D. Researcher**Jan 2017 - Dec 2021**

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Department of Electrical and Electronic Engineering (EEE)

Melbourne, Australia

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- Working with multiple Unix-based operating systems.
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Teaching Experience

Guest Lecturer, Operating Systems for IoT

Undergraduate coursework

Department of Applied Mathematics and Computer Science (DTU Compute)
Technical University of Denmark (DTU)

Nov 2023

Nov 2022

Nov 2021

Responsibilities:

- Delivering engaging and informative presentations.
- Sharing insights into operating systems tailored for the IoT.
- Facilitating discussions to enhance students' understanding of key concepts in this dynamic field.

Head Tutor, Electrical Network Analysis and Design (ENAD)

Jul 2020 - Nov 2020

Undergraduate coursework

Department of Electrical and Electronic Engineering (EEE)
The University of Melbourne

Responsibilities:

- Designing and implementing a comprehensive workshop delivery plan for the coursework.
- Facilitating informative workshops, elucidating complex concepts in electrical networks and hardware design.
- Utilizing various hardware tools, including Analog Discovery 2, and simulation tools such as LTspice.
- Providing guidance to students on theoretical principles and practical applications in electrical networks and hardware design.
- Addressing and resolving students' queries while maintaining meticulous records through the University's learning management system.
- Leading a team of demonstrators by assigning responsibilities and establishing marking criteria for workshops.
- Managing records of students' assessment results, ensuring accuracy and confidentiality.
- Contributing to the grading process for final exams, maintaining high standards of evaluation.

Head Tutor, Embedded System Design (ESD)

Jul 2020 - Nov 2020

Postgraduate coursework

Jul 2019 - Nov 2019

Department of Electrical and Electronic Engineering (EEE)
The University of Melbourne

Jul 2018 - Nov 2018

Responsibilities:

- Providing students with comprehensive guidance on theoretical concepts in embedded systems, hardware design, and simulation problems.
- Utilizing C language, Visual Studio, Eclipse, and LabVIEW.
- Addressing students' queries effectively and maintaining meticulous records through the University's learning management system.
- Leading a team of demonstrators by assigning responsibilities and establishing marking criteria in workshops, fostering a collaborative and effective learning environment.
- Managing accurate records of students' assessment results, ensuring confidentiality and precision.
- Contributing to the grading process for final exams, upholding rigorous standards of evaluation.

Responsibilities:

- Providing expert guidance to students in the modeling and analysis of linear time-invariant behavior in electrical and electronic systems, spanning both time and frequency domains.
- Supervising and mentoring students in designing, constructing, and testing passive and active electrical networks, ensuring they achieve specified linear time-invariant behavior.
- Instructing students on utilizing software tools for simulating the behavior of linear electrical networks, enhancing their practical skills.
- Overseeing and guiding students in applying fundamental concepts and tools for the analysis and design of combinational and sequential logic systems.
- Fostering an appreciation for the role and limitations of crucial digital abstractions.
- Training students in configuring and testing digital hardware development platforms within laboratory settings.
- Maintaining meticulous records of students' assessment results and diligently grade final exams.

Supervision

Master (1)

- **Daniel Borislavov, Niels Georg, and Andreas Work** (2023). A Software-Defined based Approach for Mobile IoT.. Master of Science in Engineering (MScEng). Technical University of Denmark (DTU). Department of Applied Mathematics and Computer Science (DTU Compute).

Bachelor (2)

- **Qixin Ma** (2023). Design and Implementation of a GUI for a SDWSN Architecture.. Bachelor of Engineering (BEng). Technical University of Denmark (DTU). Department of Applied Mathematics and Computer Science (DTU Compute).
- **Christopher Acosta** (2022). Comparison of TSCH schedulers for WSNs in Contiki-NG.. Bachelor of Engineering (BEng). Technical University of Denmark (DTU). Department of Applied Mathematics and Computer Science (DTU Compute).

Grants and Awards

Melbourne School of Engineering Conference Travel Scholarships (AUD \$1,500)

2018

The University of Melbourne

Australia

Ph.D. Studentship (AUD \$25,000 per year)

2017

Networked Society Institute (NSI)

Australia

Melbourne Fee Remission Scholarship (Full tuition fee waiver)

2017

The University of Melbourne

Australia

Colciencias Doctoral Scholarship (AUD \$153,000)

2017

Minciencias

Colombia

Research Internship ()

2015

Networked Society Institute (NSI)

Australia

Santander Formula Scholarship (GBP \$4,200 - not taken)

2014

University of Leicester

UK

Postgraduate Scholarship (USD \$50,000)

2014

Colfuturos Scholarship
Colombia

Distinguished Student Award (Full tuition fee waiver)

2011

Universidad del Valle
Colombia

Publications

My research output consists of **8** publications in **6** different sources, including **4** journals, **1** conferences, and **3** preprints. I am first author in **8** of them.

Links notation: 🏠= project website, 📄= preprint, 📄= pdf, 🔄= code, 📺= video, and 🖥= slides.

Preprints (3)

Jurado-Lasso, F. F., Orfanidis, C., Jurado, J. F., & Fafoutis, X. (2024). HRL-TSCH: A Hierarchical Reinforcement Learning-based TSCH Scheduler for IIoT. *arXiv*. 📄

Jurado-Lasso, F. F., Jurado, J. F., & Fafoutis, X. (2024). A Centralized Reinforcement Learning Framework for Adaptive Clustering with Low Control Overhead in IoT Networks. *arXiv*. 📄 🔄

Jurado-Lasso, F. F., Barzegaran, M., Jurado, J. F., & Fafoutis, X. (2023). ELISE: A Reinforcement Learning Framework to Optimize the Slotframe Size of the TSCH Protocol in IoT Networks. *TechRxiv*. 📄 🔄 🖥 🏠

Journal Articles (4)

Jurado-Lasso, F. F., Marchegiani, L., Jurado, J. F., Abu-Mahfouz, A. M., & Fafoutis, X. (2022). A survey on machine learning software-defined wireless sensor networks (ml-SDWSNs): Current status and major challenges. *IEEE Access*, vol. 10, pp. 23560-23592. 📄 📄

Jurado-Lasso, F. F., Clarke, K., Cadavid, A. N., & Nirmalathas, A. (2021). Energy-aware routing for software-defined multihop wireless sensor networks. *IEEE Sensors Journal*, vol. 21(8), pp. 10174-10182. 📄

Jurado-Lasso, F. F., Clarke, K., & Nirmalathas, A. (2019). Performance analysis of software-defined multihop wireless sensor networks. *IEEE Systems Journal*, vol. 14(4), pp. 4653-4662. 📄

Jurado-Lasso, F. F., Clarke, K., & Nirmalathas, A. (2019). A software-defined management system for IP-enabled WSNs. *IEEE Systems Journal*, vol. 14(2), pp. 2335-2346. 📄

Conference Papers (1)

Jurado-Lasso, F. F., Clarke, K., & Nirmalathas, A. (2018). A software-defined networking framework for IoT based on 6LoWPAN. *Proceeding of Wireless Telecommunications Symposium (WTS)*. 📄

Software

- **Contiki-NG-SDWSN**: The OS for Next Generation SDN-IoT network. Contiki-NG-SDWSN is an SDN-based solution for WSNs. It focuses in making the sensor network reprogrammable. [code]
- **ELISE**: The SDN-based solution for the next generation of IoT networks. ELISE is built upon multidisciplinary research efforts of Software-Defined Networking (SDN), Wireless Sensor Networks (WSNs), and Machine Learning (ML). [code] [web]
- **PyNetSim**: PyNetSim stands out as a robust wireless sensor network simulator specifically crafted for the evaluation of LEACH-based protocols, including traditional LEACH and its variants like LEACH-C. Developed in Python, this tool provides a versatile and accessible platform for researchers and students to test, analyze, and refine their clustering algorithms in the context of wireless sensor networks. [code]

Skills

Applications

Altera Quartus, Altium Designer, LATEX, LabVIEW, MS Office, OrCAD PSpice, Wireshark

Language

- English:

ML

DDQN, DQN, Feed-Forward, LSTM, NN, PPO, Reinforcement Learning

OS

Linux, MacOS, Windows

Platforms

ATMEL, Analog Discovery 2, Arduino, Beaglebone, CC2650 SensorTag, RPi, TelosB, cc2538dk

Programming

- C Code:

- MATLAB:

- Git:

- PyTorch:

- Java:

- Contiki-NG:

- Node.js:

- VHDL:

Professional Service

Journal Reviewer

- IEEE Internet of Things Journal
- IEEE Sensors Journal
- Journal of Network and Computer Applications
- Ad Hoc Networks, Elsevier
- Sensors, MDPI
- Electronics, MDPI
- Transactions on Emerging Telecommunications Technologies, Wiley
- International Journal of Communication Systems, Wiley
- IEEE Journal of Selected Areas in Sensors
- IEEE Access

Conference Reviewer

- IEEE Internet of Things Journal
- IEEE Sensors Journal
- Journal of Network and Computer Applications
- Ad Hoc Networks, Elsevier
- Sensors, MDPI
- Electronics, MDPI
- Transactions on Emerging Telecommunications Technologies, Wiley
- International Journal of Communication Systems, Wiley
- IEEE Journal of Selected Areas in Sensors
- IEEE Access
- IEEE Global Communications Conference (GLOBECOM)
- National Conference on Communications (NCC)

Professional Memberships

- IEEE Member (since 2021)

- National Professional Council of Electrical, Mechanical Engineering and Related Professions, Colombia (since 2012)

References

Assoc. Prof. Xenofon Fafoutis
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xefa@dtu.dk

Prof. Ampalavanapillai Nirmalathas
The University of Melbourne
nirmalat@unimelb.edu.au

Prof. Paul Pop
Technical University of Denmark (DTU)
paupo@dtu.dk