

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 machine Learning and artificial intelligence 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.

- Strategize and execute research initiatives within the scope of the EU DAIS project.
- Employ machine learning methodologies to address networking challenges in wireless embedding systems.
- Validate research findings using simulation tools, predominantly leveraging the Contiki-NG operating system, C code, Python, and PyTorch.
- Disseminate research outcomes through presentations at conferences, workshops, industrial gatherings, and open days.
- Craft and publish research articles in reputable journals to contribute to the academic discourse.
- Co-lead the university's supply chain management efforts.
- Represent DTU and actively participate in project meetings to ensure effective collaboration and communication.
- Co-supervise both undergraduate and postgraduate students, 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 investigate the challenges and benefits of Software Defined Wireless Sensor Networks (SDWSNs) as a solution to flexible resource management and reconfiguration of WSNs.

- Design, model and implement a software-defined management solution for WSNs.
- Propose a mathematical model of energy consumption for SDWSNs in an effort to examine the implications for network performance when making the WSN reprogrammable.
- Propose an innovative energy-aware routing algorithm and new control overhead reduction technique for prolonging the network lifetime of software-defined multihop WSNs.
- Present research outcomes in various 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 at Years 9 and 10. This project was supported by Google Australia.

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

Support Engineer**Jan 2016 - Dec 2016**

Emcali (Empresas Municipales de Cali)

Cali, Colombia

Description: I play a pivotal role in actively contributing to the conceptualization, design, and execution phases of a ground-breaking project. The project was centered around the development and deployment of prepaid energy services within smart grid systems.

- To work with other team members to plan, execute and deliver service to the prepaid electricity project.
- To ensure the seamless integration and robust performance of the innovative energy solutions.
- To troubleshoot and provide technical support, and collaborate with cross-functional teams to enhance the overall efficiency and reliability of the prepaid energy services.
- To elaborate the project's documentation.

Research Intern**Jan 2015 - Jun 2015**

Networked Society Institute (NSI)

Department of Electrical and Electronic Engineering (EEE)

Melbourne, Australia

Description: Conceptual study and implementation of architectures and technologies used in IoT.

- To investigation of different publish-subscribe communications protocols
- To work with multiple Unix-based operating systems.
- To develop the program for the systems.

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

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Research Intern**Jan 2015 - Jun 2015**

Networked Society Institute (NSI)

Department of Electrical and Electronic Engineering (EEE)

Melbourne, Australia

Description: Conceptual study and implementation of architectures and technologies used in IoT.

- To investigation of different publish-subscribe communications protocols
- To work with multiple Unix-based operating systems.
- To develop the program for the systems.

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:

- Deliver engaging and informative presentations.
- Share insights into operating systems tailored for the IoT.
- Facilitate 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:

- Develop and implement a comprehensive workshop delivery plan for the Electrical Network Analysis and Design course.
- Facilitate engaging and informative workshops, elucidating complex concepts in electrical networks and hardware design.
- Utilize various hardware tools, including Analog Discovery 2, and simulation tools such as LTspice.
- Provide guidance to students on theoretical principles and practical applications in electrical networks and hardware design.
- Address and resolve students' queries while maintaining meticulous records through the University's learning management system.
- Lead a team of demonstrators by assigning responsibilities and establishing marking criteria for workshops.
- Manage records of students' assessment results, ensuring accuracy and confidentiality.
- Contribute to the grading process for final exams, maintaining high standards of evaluation.

Head Tutor, Embedded System Design (ESD)

Jul 2020 - Nov 2020

Postgraduate coursework

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

Jul 2019 - Nov 2019

Jul 2018 - Nov 2018

Responsibilities:

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

Head Tutor, Analog and Digital Electronics Concepts (ADEC)

Mar 2019 - Jun 2019

Undergraduate coursework

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

Mar 2018 - Jun 2018

Responsibilities:

- Provide 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.
- Supervise and mentor students in designing, constructing, and testing passive and active electrical networks, ensuring they achieve specified linear time-invariant behavior.
- Instruct students on utilizing software tools for simulating the behavior of linear electrical networks, enhancing their practical skills.
- Oversee and guide students in applying fundamental concepts and tools for the analysis and design of combinational and sequential logic systems.
- Foster an appreciation for the role and limitations of crucial digital abstractions.
- Train students in configuring and testing digital hardware development platforms within laboratory settings.
- Maintain 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) The University of Melbourne Australia	2018
Ph.D. Studentship (AUD \$25,000 per year) Networked Society Institute (NSI) Australia	2017
Melbourne Fee Remission Scholarship (Full tuition fee waiver) The University of Melbourne Australia	2017
Colciencias Doctoral Scholarship (AUD \$153,000) Minciencias Colombia	2017
Research Internship () Networked Society Institute (NSI) Australia	2015
Santander Formula Scholarship (GBP \$4,200 - not taken) University of Leicester UK	2014
Postgraduate Scholarship (USD \$50,000) Colfuturos Scholarship Colombia	2014
Distinguished Student Award (Full tuition fee waiver) Universidad del Valle Colombia	2011

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

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

Language

Spanish (Native) English (Proficient)

Progammimg

C Code

Contiki-NG

Git

Java

MATLAB

PyTorch

Python

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

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