

Xurxo Rigueira

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EDUCATION

University of Vigo

Master of Science in Mining Engineering.

Thesis: Design and simulation of a solar carport on MATLAB/Simulink.

Advisers: Prof. Pablo Eguia Oller & David Lopez Mera.

Relevant course work: Statistics, Advanced Mathematics, Electrical Engineering, Computing.

Vigo, Spain

Sep. 2018 – Jul. 2020

California State University, East Bay

Bachelor of Science in Environmental Engineering. Exchange Program.

Hayward, CA, USA

Sep. 2017 – Jun. 2018

University of Vigo

Bachelor of Science in Mining and Energy Engineering, Minor in Energy Technology.

Vigo, Spain

Sep. 2014 – Apr. 2018

RESEARCH EXPERIENCE

Research Assistant

University of Vigo

Feb. 2021 – Present

Vigo, Spain

Advisers: Prof. Maria Araujo Fernandez, Prof. Javier Martinez Torres & Prof. David Nicholas Olivieri

Graduate Research: Functional Data Analysis - Multivariate

- Proposed the use of an estimator for **quantile cross-spectral density** to identify shape-outlying functions in **multivariate** environmental functional data.
- Developed a **case-adaptive method** for the detection of outliers via a **magnitude analysis** of the functional data.
- Designed and validated a **new multivariate outlier detector** for the proposed methodology through the detection of verified outliers and a Monte Carlo simulation.

Graduate Research: Functional Data Analysis - Univariate

- Advanced the implementation of **directional outlyingness** for the detection of anomalous events in **univariate** environmental functional data.
- Validated the presented methodology** on air quality data with verified outliers such as those induced by the COVID-19 restrictions.
- Developed and validated, with a Monte Carlo simulation, an accurate **algorithm** for **outlier detection** based on the magnitude-shape functional values with an efficiency of 90%.

Graduate Research: Computer Vision - Feature Detection

- Developed a **computer vision algorithm** with OpenCV for the detection and **decryption of color codes** on granite slabs.
- Designed and implemented the **training and validation processes** for the computer vision program achieving an **accuracy of 75%** in the testing phase.
- Suggested new research ideas based on the **Harris corner detector and bilateral filtering** to help advance the development of the algorithm and achieve higher efficiency rates.

Graduate Research: Applied Bayesian Networks

- Proposed the use of **Bayesian networks** to identify the geological factors with a higher negative impact on the slate rock quality index.
- Implemented supervised learning on the network with the **tree augmented naive Bayes algorithm** and validated the results with **k-fold cross validation**.
- Incorporated the Kullback–Leibler divergence to calculate the arc force between the different nodes.
- Collaborated and coordinated with advisers, faculty staff, and fellow graduate students to **organize, write and send the manuscript** for peer review.

Published manuscripts:

- **Rigueira, X.**, Araujo, M., Martinez, J., Garcia-Nieto, P.J. and Ocaranza, I. "Functional data analysis for the detection of outliers and study of the effects of the COVID-19 pandemic on air quality: A case study in Gijón, Spain". *Mathematics* **2022**, 10(14), 2374; doi.org/10.3390/math10142374

Submitted manuscripts:

- Comesaña, M., **Rigueira, X.**, Janeiro, A., Martinez, J. and Ocaranza, I. "Impact, applications, and opportunities for artificial intelligence (AI) in education". (Manuscript in review in Comunicar).
- Giraldez, E., Gerassis, S., Pazo-Rodriguez, M., **Rigueira, X.**, Saavedra, A. and Taboada, J. "Introducing information theory to assess roofing slate deposits". (Manuscript in review in Acta Montanistica Slovaca).

CONFERENCES AND TALKS

- **Rigueira, X.**, Martinez, J., Araujo, M. and Giraldez, E. "Directional outlyingness for the detection of functional outliers in water quality data". 6th International Congress on Water, Waste, and Energy Management. Rome, Italy. July, 2022. [Abstract](#).
- **Rigueira, X.**, Martinez, J., Araujo, M., Pazo-Rodriguez, M. and Taboada, J. "Multivariate functional data analysis for outlier detection in environmental data". 14th Congress on Mathematical Modelling in Engineering and Human Behaviour. Valencia, Spain. July, 2022. [Abstract](#).
- **Rigueira, X.**, Araujo, M., Martinez, J., Giraldez, E. and Recaman, A. "Computer vision application for improved product tracking and manufacturing efficiency in the granite industry". 5th International Conference on Production Economics and Project Evaluation. Castelo Branco, Portugal. September, 2022. arxiv.org/abs/2207.01323.

RESEARCH GRANTS

Spanish Ministry of Science and Innovation

Sep. 2021 – Present

*University of Vigo**Vigo, Spain**Principal investigators: Prof. Maria Araujo Fernandez & Prof. Javier Taboada Castro**Title: Improving water quality management: functional analysis and machine learning solutions.**PID2020-116013RB-I00, €103,100**Role: co-author. My work in this research project consists in the development of Python and R libraries for functional data analysis and the improvement of machine learning models to facilitate the decision-making process in water-quality management.*

TEACHING/TUTORING EXPERIENCE

Outreach Speaker

Apr. 2021 – Present

*European Union Research Group**Galicia, Spain*

- Presented a panel to multiple groups of young STEM generations regarding the day-to-day activities of a researcher.
- Promoted panels by visiting multiple high schools and giving a presentation on Artificial Intelligence or Smart Materials.
- Prepared all the materials needed for the presentation and adapted its content to a broad range of academic levels.
- Helped students with their questions about college, differences between majors, and the admission process.

This program was financed by the European Union through grant H2020-EU.1.3. - Marie Skłodowska-Curie Actions with a total budget of 636,100€ and organized by the University of Vigo.

After-school Tutor

Dec. 2018 – Present

*Self-employed**Vigo, Spain*

- Tutored students from middle school to high school level in mathematics, chemistry, physics, and English.
- Taught problem-solving skills, how to study more efficiently, and perform better in tests and final exams.
- Helped all students increase their grades by an average of 2.5 points on a 10-point scale in their respective classes.
- Collaborated with teachers to address the issues each student had and helped them in those areas where they required more academic reinforcement.

HONORS AND AWARDS

International Student Scholarship (\$25,000), International Student Exchange Program (ISEP)	2017
Salutatorian, Class of 2018, University of Vigo	2018
Graduated with honors, Class of 2020, University of Vigo	2020
Arizona State University Fulton Fellowship	2022

VOLUNTEERING

Hackathon participant	Oct. 2022
<i>HackForGood</i>	<i>Vigo, Spain</i>
• Winners of the special prize: Innovation for Energy and Sustainability. • Teamed up to develop a project aimed to increase energy savings in buildings through a predictive and adaptive heating control system. • Developed and presented the original idea in front of a jury.	
Science Contest Judge	Apr. 2018
<i>MESA Program, California Regional Championship</i>	<i>Hayward, CA</i>
• Attended different project presentations from high school students. • Reviewed every science project following the provided guidelines. • Reported the official scores to the contest coordinator.	

NON-ACADEMIC EXPERIENCE

Industrial and Production Engineer	Jul. 2020 – Dec. 2020
<i>Soltec Ingenieros</i>	<i>Vigo, Spain</i>
• Successfully completed 57 energy audits for shopping malls in Spain. • Developed studies on renewable energy for large areas of territory. • Designed a thermal multi-process device for the food industry as part of an R&D project. • Defined the mathematical basis of software designed for financial risk analysis of renewable energy projects.	
The renewable energy project developed for the town of As Pontes, Galicia, Spain was published on El Periódico de la Energía .	
Engineering Intern	Jun. 2019 – Sep. 2019
<i>Soltec Ingenieros S.L.</i>	<i>Vigo, Spain</i>
• Development of sustainable urban mobility plans. • Design of monitoring systems for water usage in industrial plants. • Completed projects with senior engineers and offered insight. • Drawn, reviewed, and interpreted engineering blueprints and designs.	

TECHNICAL SKILLS

Languages: Python, R, C/C++, MATLAB, JavaScript, HTML/CSS, SQL, LaTeX.
Developer Tools: Git, Docker, VS Code, PyCharm.
Libraries: OpenCV, Scikit-learn, Pandas, NumPy, Matplotlib, TensorFlow, PyTorch, tidyverse, fda.usc, mlmts.

Prof. Dr. Maria Araujo Fernandez

Professor at the University of Vigo

Department of Natural Resources and Environmental Engineering

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Prof. Dr. Javier Martinez Torres

Professor at the University of Vigo

Department of Applied Mathematics I

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Prof. Dr. Pablo Eguia Oller

Professor at the University of Vigo

Department of Mechanical Engineering, Heat Engines and Thermal Machines, and Fluids

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Prof. Dr. David Nicholas Olivieri

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Prof. Dr. Eduardo Liz Marzan

Professor at the University of Vigo

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