John Stewart Fabila-Carrasco

AI Engineer •NLP & Graph ML •Python & PyTorch •Scalable Data Solutions

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Professional Profile

- **AI engineering focus:** Python-first NLP and graph ML for complex, high-dimensional data, spanning graph representation learning, clustering, and graph signal processing.
- **Hands-on model development:** Built GPU-accelerated PyTorch workflows and scalable experimentation pipelines for large networks, language tasks, EEG, neuroimaging, and sensor data.
- **Solution design & problem solving:** Translate mathematically complex ideas into robust analytics and decision tools, combining research depth with pragmatic engineering delivery.
- **Stakeholder impact:** Two years of government/industry data science delivering dashboards and policy-facing insights for non-technical decision-makers.
- **Research track record:** 15 peer-reviewed papers, 23 invited or refereed talks, multiple competitive research awards; work cited 150+ times.
- **Cross-disciplinary output:** Articles in *Mathematische Annalen* (maths) and *IEEE Transactions* (engineering); papers and presentations at flagship venues — Complex Networks, EUSIPCO, ICASSP, and ICML 2025 (AI/informatics).
- **Awards & grants:** Leverhulme Research Project Grant, Alan Turing Institute Post-Doctoral Enrichment Award, SRUK Professional Development Grant, Outstanding Thesis Award (UC3M).

Education

Ph.D. in Mathematical Engineering (University Charles III of Madrid UC3M) — *Madrid, Spain*

- **Graduated Excellent Grade (10/10) and Cum Laude Distinction.** — *Highest distinction.*
- **International distinction** — *3-month research stay and evaluations by external experts.* — *June 2020*
- **Outstanding Thesis Award.** — *Best Ph.D. thesis in programme, awarded on a bi-annual basis.*
- **Thesis:** *The Discrete Magnetic Laplacian: Geometric and Spectral Preorders with Applications.*

Master in Mathematical Engineering (University Charles III of Madrid UC3M) — *Madrid, Spain*

- **Thesis:** *Spectral gaps of magnetic Laplacian on graphs* — *September 2016*

Master in Mathematical Sciences (National Autonomous University of México UNAM) — *México City, México, 2012*

Bachelor in Mathematics (Autonomous México State University UAEM) — *Toluca, México, 2010*

Skills

Core	Python, NumPy, Pandas, R, MATLAB
ML/AI	PyTorch, Hugging Face, CUDA (GPU), NLP model development
Data/Delivery	Statistical modelling, dashboards (Shiny), reproducible pipelines, decision support
Graph/Signals	Graph representation learning, spectral methods, graph signal processing, network analysis
Tools	Git, Jupyter, LaTeX

AI, Data Science & Research Experience

Postdoctoral Researcher in NLP & Graph Representation Learning

School of Computer Science & Informatics, **University of Cardiff.** Wales, UK. — *September 2025 - April 2027*

- Developed NLP models that integrate graph representation learning and reasoning, building GPU-accelerated training and evaluation workflows in Python/PyTorch for large-scale experiments.
- Translated open-ended research questions into reproducible AI prototypes, experimental plans, and measurable model comparisons for complex language tasks.

School of Informatics, **University of Edinburgh.** Scotland, UK. — *February 2024 - April 2025*

- Designed and implemented spectral-clustering algorithms for large datasets, with a strong focus on scalable Python-based experimentation for complex graph problems.
- Re-engineered computational pipelines for high-dimensional graphs, improving runtime efficiency and enabling scalable community detection on complex networks.

School of Engineering, **University of Edinburgh.** Scotland, UK. — *November 2020 - January 2024*

- Pioneered nonlinear graph-signal analysis methods for multivariate EEG and neuroimaging time-series, advancing biomedical engineering research on brain dynamics.
- Directed the computational work package of a Leverhulme-funded project, shaping analysis strategy and delivering robust processing frameworks for high-dimensional healthcare data.

Institute of Mathematical Sciences **ICMAT.** Madrid, Spain. — *June 2020 - October 2020*

- Applied magnetic-Laplacian and spectral-bracketing techniques to reveal hidden structural patterns in weighted graphs.
- Converted these spectral insights into sharper graph-based classification and clustering routines for large-scale network data.

Academic Teaching & Student Supervision (part-time while PhD / Postdoc) *Spain and UK*

Engineering Department, **University of Edinburgh**, Scotland, UK. *Sep. 2021 - Dec. 2022*
Mathematics Department, Scotland, UK. **University Carlos III of Madrid**, Spain. *Sep. 2015 - May 2020*
Statistics Department, **University Carlos III of Madrid**, Spain *Sep. 2012 - Jan. 2014*

Industry & Government Data Science Researcher *México City, México*

National Institute of Educational Evaluation INEE *February 2014 - September 2015*

- Led the end-to-end statistical modelling of nationwide assessment and census data, applying multilevel regression and graph-based clustering to expose learning-outcome gaps across Mexico's 32 federal states and 2,000+ municipalities.
- Merged school-location and socioeconomic GIS layers to create high-resolution equity maps and priority indices that shaped the agency's 2015–2020 regional-funding strategy and underpinned budget submissions to the Ministry of Education.
- Engineered reproducible R pipelines and Shiny dashboards that let non-technical policymakers explore scenarios, track key performance indicators, and export evidence packs — cutting analysis-to-decision time from weeks to hours.

Peer-Reviewed Publications

I have authored **15 peer-reviewed papers** plus refereed conference and pre-print contributions that fall into three complementary strands:

- **Spectral Graph Theory & Mathematical Foundations** — Advances in magnetic Laplacians, eigenvalue bracketing, and spectral preorders, published in top mathematics venues such as *Linear Algebra and its Applications* (**P02**, **P06**, **P12**) and *Mathematische Annalen* (**P04**), as well as *Analysis and Mathematical Physics* (**P09**).
- **Graph-Signal Processing & Entropy Metrics** — Methods that bridge mathematics, engineering, and AI, presented at flagship conferences—**ICML** (**P13**), **ICASSP** (**P11**), **EUSIPCO** (**P05**, **P08**), and **Complex Networks** (**C01**, **C02**)—and featured in *IEEE TSIPN* (**P07**). Pre-print extensions appear in **S02** and **S03**.
- **Applied Network Analytics & Biomedical / Industrial Uses** — Data-driven studies on EEG/fMRI, two-phase flows, and road-safety analytics, published in interdisciplinary outlets such as *Chaos, Solitons & Fractals* (**P10**), *Symmetry* (**P03**), and the *International Journal of Public Health* (**P01**); see also pre-print **S01**.

Collectively, these works have accrued **150+ citations** and support collaborations across engineering, healthcare, and AI research.

Journal Publications (Served as the first author in all publications except P01.)

P13 J. S. Fabila-Carrasco, and H. Sun, *Signed Laplacians for Constrained Graph Clustering*, Accepted in the Forty-second International Conference on Machine Learning, **ICML** (2025).

P12 J. S. Fabila-Carrasco, F. Lledó, and O. Post, *Isospectral graphs via spectral bracketing*, **Linear Algebra and its Applications** (2024). DOI:10.1016/j.laa.2024.04.027.

P11 J. S. Fabila-Carrasco, A. Campbell-Cousins, M. A. Parra-Rodriguez, and J. Escudero, *Graph-based permutation patterns for the analysis of task-related fMRI signals on DTI networks in mild cognitive impairment*, **ICASSP**, IEEE International Conference on Acoustics, Speech and Signal Processing, pp. 2076-2080 (2024). DOI: 10.1109/ICASSP48485.2024.10447332.

P10 J. S. Fabila-Carrasco, C. Tan, and J. Escudero, *Dispersion Entropy for Graph Signals*, **Chaos, Solitons & Fractals**, 175, 113977 (2023). DOI: 10.1016/j.chaos.2023.113977.

P09 J. S. Fabila-Carrasco, F. Lledó, and O. Post, *A geometric construction of isospectral magnetic graphs*, **Analysis and Mathematical Physics**, 13(64), pp. 64 (2023). DOI: 10.1007/s13324-023-00823-9.

P08 J. S. Fabila-Carrasco, C. Tan, and J. Escudero, *Graph-based Multivariate Multiscale Permutation Entropy: Study of Robustness to Noise and Application to Two-Phase Flow Data*, **EUSIPCO**, 31st European Signal Processing Conference, pp. 1599-1603 (2023). DOI: 10.23919/EUSIPCO58844.2023.10289890.

P07 J. S. Fabila-Carrasco, C. Tan, and J. Escudero, *Permutation Entropy for Graph Signals*, **IEEE Transactions on Signal and Information Processing over Networks**, 8, pp. 288-300 (2022). DOI: 10.1109/TSIPN.2022.3167333.

P06 J. S. Fabila-Carrasco, F. Lledó, and O. Post, *Matching number, Hamiltonian graphs, and magnetic Laplacian matrices*, **Linear Algebra and its Applications**, 642, pp. 86-100 (2022). DOI: 10.1016/j.laa.2022.02.006.

P05 J. S. Fabila-Carrasco, C. Tan, and J. Escudero, *Multivariate permutation entropy, a Cartesian graph product approach*, **EUSIPCO**, 30th European Signal Processing Conference, pp. 2081-2085 (2022). DOI: 10.23919/EUSIPCO55093.2022.9909930.

P04 J. S. Fabila-Carrasco, F. Lledó, and O. Post, *Spectral preorder and perturbations of discrete weighted graphs*, **Mathematische Annalen**, 382, pp. 1775-1823 (2020). DOI: 10.1007/s00208-020-02091-5.

P03 J. S. Fabila-Carrasco and F. Lledó, *Covering graphs, magnetic spectral gaps and applications to polymers and nanoribbons*, **Symmetry**, 11(9), 1163 (2019). DOI: 10.3390/sym11091163.

P02 J. S. Fabila-Carrasco, F. Lledó, and O. Post, *Spectral gaps and discrete magnetic Laplacians*, **Linear Algebra and its Applications**, 547, pp. 183-216 (2018). DOI: 10.1016/j.laa.2018.02.006.

P01 A. Cervantes-Trejo, I. Leenen, J. S. Fabila-Carrasco, and R. Rojas-Vargas, *Trends in traffic fatalities in Mexico: examining progress on the decade of action for road safety 2011-2020*, **International Journal of Public Health**, 61, pp. 903-913 (2016). DOI: 10.1007/s00038-016-0867-z.

Conference papers (peer-reviewed and served as first author)

C02 J. S. Fabila-Carrasco, C. Tan, and J. Escudero, "Multivariate permutation entropy via the Cartesian graph product to analyse two-phase flow", *The 11th International Conference on Complex Networks and Their Applications*. *File*

C01 J. S. Fabila-Carrasco, C. Tan, and J. Escudero, "Entropy metrics for graph signals", *The 10th International Conference on Complex Networks and Their Applications*. *File*

Submitted papers

S03 O. Roy, A. Campbell-Cousins, J.S. Fabila Carrasco, M. Parra, and J. Escudero, *Graph Permutation Entropy: Extensions to the Continuous Case, A step towards Ordinal Deep Learning, and More*, 2024. *ArXiv:2407.07524*

S02 J. S. Fabila-Carrasco, C. Tan, and J. Escudero, *Graph-Based Multivariate Multiscale Dispersion Entropy: Efficient Implementation and Applications to Real-World Network Data*, 2024. *ArXiv:2405.00518*

S01 B. Zhang, J.S. Fabila-Carrasco, D. Garcia Cava, and J. Escudero *Dispersion transition network and the quantification of transition information in time series*, (2025).

Conferences, Seminars and Talks

Since 2016 I have delivered **20 + research talks** in **9 countries**, spanning mathematics, signal-processing, and network science. These include keynote or fully funded invitations at ASPECT'22 (Oldenburg), the Combinatorial and Algebraic Enumeration workshop (Waterloo), and the Symposium of Mexican Students in the UK. I have presented new results at flagship venues such as **ICML 2025**, **ICASSP 2024**, **EUSIPCO 2022 & 2023**, and the **International Linear Algebra Society**, demonstrating my ability to communicate complex ideas to multidisciplinary audiences and to build internationally recognised collaborations.

2024

20 Mar	**Analysis on fractals and networks, and applications**, *Dynamics on Graph Signals.*	*Marseille, France*

2023

7 Sep	**31st European Signal Processing Conference, EUSIPCO 2023**, *Graph-based Multivariate Multiscale Permutation Entropy: Study of Robustness to Noise and Application to Two-Phase Flow Data.*	*Helsinki, Finland*
30 June	**XIX Symposium of Mexican students and studies in the UK**, *Data Analysis and Graphs.*	*Brighton, England*
22 Jun	**IDCOM Seminar**, *Dispersion Entropy for Graph Signals.*	*Edinburgh, Scotland*
14 Jun	**The 25th Conference of the International Linear Algebra Society**, *Graph Signals and Dispersion Entropy.*	*Madrid, Spain*
2 Feb.	**Complex Systems Networking**, *Data Analysis and Spectral Graph Theory.*	*Edinburgh, Scotland*

2022

10 Nov.	**The 11th International Conference on Complex Networks and their Applications**, *Multivariate permutation entropy via the Cartesian graph product to analyse two-phase flow*.	*Palermo, Italy*
27 Sep.	**Asymptotic Analysis and Spectral Theory, ASPECT'22**, **Invited talk with expenses paid.** *Permutation entropy for graphs and the Cartesian graph product.*	*Oldenburg, Germany*
31 Aug.	**30th European Signal Processing Conference, EUSIPCO 2022**, *Multivariate permutation entropy, a Cartesian graph product approach.*	*Belgrade, Serbia*
27 July	**XIX Symposium of Mexican students and studies in the UK**, **Invited talk.** *Nonlinear Analysis of Graph Signals.*	*Aberdeen, Scotland*
11 July	**Early career researchers conference PGCon 2022**, *Dynamics on graphs.*	*Edinburgh, Scotland*
23 June	**The 24th Conference of the International Linear Algebra Society**, *The Cartesian product of graphs and entropy metrics of graph signals*	*Galway, Ireland*
25 May	**Combinatorial and Algebraic Enumeration**, **Invited talk with expenses paid.** *Counting isospectral magnetic graphs*	*Waterloo, Ontario, Canada*

2021

30 Nov.	**The 10th International Conference on Complex Networks and their Applications**, Talk supported by SRUK. *Entropy metrics for graph signals*.	*Madrid, Spain*

2020

10 June	**Q-Math Seminar, University Charles III of Madrid**, *The discrete magnetic Laplacian: geometric and spectral preorders with applications*.	*Madrid, Spain*

2019

24 Sep.	**13th Workshop of Young Researches in Mathematics at Universidad Complutense**, *Construction of cospectral graphs*.	*Madrid, Spain*
14 Sep.	**Discrete Mathematics Seminar at Universidad de Valladolid**, *Construction of isospectral graphs*.	*Valladolid, Spain*

2018

27 Nov.	**Analysis Seminar at the University of Trier**, *Construction of families of isospectral graphs*.	*Trier, Germany*
28 Sep.	**Analysis Seminar at the University of Trier**, *Spectral ordering of discrete weighted graphs*.	*Trier, Germany*
16 May	**Talk for BA students from USA, University Charles III of Madrid**, *Maths for future engineers*.	*Madrid, Spain*
16 Jan.	**Q-Math Seminar at University Charles III of Madrid**, *Comparing graphs using the spectrum of the magnetic Laplacian*.	*Madrid, Spain*

2017

13 Sep.	**11th Workshop of Young Researches in Mathematics at Universidad Complutense**, *Spectral gaps and discrete magnetic Laplacians*.	*Madrid, Spain*

2016

17 Mar.	**Q-Math Seminar at University Charles III of Madrid**, *Spectral gaps and the magnetic Laplacian on graphs*.	*Madrid, Spain*

Academic Teaching and Mentorship

Over the past **12 years** I have delivered more than **250 contact-hours** of teaching across mathematics, statistics, and engineering programmes in both the UK and Spain. My portfolio ranges from first-year Calculus to advanced Engineering Mathematics, reaching cohorts in engineering, informatics, and social-science degrees at the **University of Edinburgh** and **Universidad Carlos III de Madrid**. I have co-supervised three MSc dissertations on graph-signal processing and mathematical engineering, and my classroom practice earned a **Teaching Excellence Award** for outstanding student evaluations (see certificate).

Teaching experience

University of Edinburgh — *Edinburgh, UK*

- **Engineering Mathematics 2B** (2022-2023) 2nd Semester. *School of Engineering.*
- **Engineering Mathematics 2B** (2021-2022) 2nd Semester. *School of Engineering.*

University Charles III of Madrid — *Madrid, Spain*

- **Linear Algebra.** (2019 - 2020) 1st Semester. *Degree in Energy Engineering.*
- **Linear Algebra.** (2019 - 2020) 1st Semester. *Industrial Electronics & Automatic Engineering.*
- **Calculus II.** (2018-2019) 2nd Semester. *Industrial Electronic Engineering.*
- **Calculus II.** (2018-2019) 2nd Semester. *Engineering in Industrial Technologies.*
- **Linear Algebra.** (2017- 2018) 1st Semester. *Mechanical Engineering.*
- **Calculus I**. (2017- 2018) 1st Semester. *Electrical Engineering.*
- **Calculus I**. (2016- 2017) 1st Semester. *Electrical Engineering.*
- **Econometrics II.** (2013-2014) 1st Semester. *Bachelor in Finance and Accounting.*
- **Statistics.** (2013-2014) 1st Semester. *Bachelor in Employment and Labor Relations.*
- **Industrial Statistics.** (2012-2013) 2nd Semester. *Industrial Technologies Engineering.*
- **Statistics.** (2012-2013) 2nd Semester. *Systems Audiovisual Engineering.*
- **Statistics.** (2012-2013) 2nd Semester. *Systems and Communications Engineering.*

Supervision and co-supervision

- **2022**. Robin Guo. *Efficient computational algorithms for signal processing on graphs.*
  MSc. in Signal Processing and Communications. University of Edinburgh. Co-directed with Dr. Javier Escudero.
- **2021**. Yaoshan Miao. *Algorithms for signal processing on graphs.*
  MSc. in Signal Processing and Communications. University of Edinburgh. Co-directed with Dr. Javier Escudero.
- **2018**. Adrián Carrasco. *Ramanujan expanders as 2-lifts and applications.*
  MSc. in Mathematical Engineering. University Carlos III of Madrid. Co-directed with Dr. Fernando Lledó.

Funding and Recognitions

My work has been recognised by **national-level funding bodies in both the UK and Spain**. I have secured a series of highly competitive grants that support international research mobility, post-doctoral enrichment, and professional development—from the **Alan Turing Institute**, the **Society of Spanish Researchers in the UK**, and **Universidad Carlos III de Madrid**. These awards sit alongside institutional honours for scholarly excellence, including UC3M's **Outstanding Thesis Award** (best PhD of the year) and a **Teaching Excellence Award** based on perfect student-feedback scores.

Grants

2022	**The Alan Turing Institute Post-Doctoral Enrichment Awards**, £2,000	*UK*
2021	**Professional Development Grant**, by the Society of Spanish Researchers in the UK (SRUK), £400	*UK*
2018	**Grants for Researcher Mobility**, by the University Charles III of Madrid **UC3M**, €4,000	*Madrid, Spain*
2017	**Pre-doctoral Research Training Scholarship (PIPF)**, by the Department of Mathematics at UC3M	*Madrid, Spain*
2015	**Full Grant for Master's Study**, by the Department of Mathematics at UC3M	*Madrid, Spain*

Awards

2021	**Outstanding Thesis Award**, Best PhD of the year by the University Charles III of Madrid **UC3M**	*Madrid, Spain*
2020	**Teaching Excellence Award**, Achieved a **5/5 student rating** from student evaluations. (Certificate Link)	*Madrid, Spain*

Accreditations

2020	**Doctoral Lecturer**, Accredited by **ANECA** (National Agency for Quality Assessment and Accreditation), in recognition of my academic and research qualifications for faculty appointments in Spanish universities.	*Madrid, Spain*

Research visit

Universität Trier — *Trier, Germany*

Host: Prof. Dr. Olaf Post — *Sep. 2018 - Dec. 2018*

- Three-month, fully funded visit that seeded **P4** (Mathematische Annalen) and launched a collaboration on isospectrallity.
- Delivered two invited talks in the *Analysis Seminar* series.
- Broadened expertise by attending *Fractal Geometry & Stochastics 6* (Bad Herrenalb) and *Geometric Singular Analysis & Mathematical Physics* (Oldenburg).

Professional Engagement and Academic Network

Reviewer for journals

- **Mathematics:** Mathematische Annalen, Analysis and Mathematical Physics, Indian Journal of Mathematics
- **Engineering:** IEEE Access, Scientific Reports, Measurement and Control
- **Conference papers:** Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), IEEE International Conference on Acoustics, Speech, & Signal Processing (ICASSP)

My profiles

- **University of Edinburgh:** https://www.research.ed.ac.uk/en/persons/john-stewart-fabila-carrasco
- **Google Scholars:** https://scholar.google.com/citations?user=5xrmd_YAAAAJ
- **Researchgate:** https://www.researchgate.net/profile/John_Fabila_Carrasco
- **Linkedin:** https://www.linkedin.com/in/john-stewart-fabila-carrasco-19077987/
- **ORCID:** https://orcid.org/0000-0003-3290-391X

References

1. **Prof. Dr. Fernando Lledó**. (PhD advisor) Associate Professor of the Department of Mathematics, University Charles III of Madrid and Instituto de Ciencias Matemáticas (ICMAT), Spain. E-mail: *flledo@math.uc3m.es*
2. **Prof. Dr. Olaf Post**. Associate Professor. Mathematik. Universität Trier, Germany. E-mail: *olaf.post@uni-trier.de*
3. **Dr. Javier Escudero Rodriguez**. Senior Lecturer, School of Engineering. University of Edinburgh. E-mail: *javier.escudero@ed.ac.uk*
4. **Prof. Dra. Natalia Saburova**. Head of the Department of Mathematical Analysis, Algebra and Geometry, Northern (Arctic) Federal University, Russia. E-mail: *n.saburova@narfu.ru*