Víctor Toscano Durán

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Victor Toscano-Duran
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Work Experience

11/2025 - now **Researcher.** Neurovascular research group. Working at the intersection of data analysis and machine learning applied to stroke.

- Data analysis using statistical techniques.
- Produced reports and visualizations that facilitated communication of results to medical teams.
- Application and dashboards development and deployment.
- Trained and validated machine and deep learning models, as well as deploying it in applications.

12/2023 - 10/2025 **Researcher.** Department of Applied Mathematics I, University of Seville. Working at the intersection of machine learning, energy optimization, and applied topology in AI, within the European project REXASI-PRO.

- Applied data reduction techniques, decreasing the training data volume by 75% while maintaining accuracy and significantly reducing energy consumption in computer vision (YOLO for people and wheelchair detection) and tabular datasets. [10].
- Applied innovative topological metrics to evaluate dataset representativeness, enabling the selection and use of representative subsets of data. [11].
- Used persistent entropy to analyze robot fleets, quantifying spatial diversity and identifying complex behavioral patterns. [9].
- Implemented persistent entropy as an explanatory variable in explainable AI models (safety region definition), distinguishing between safe/efficient and unsafe/inefficient simulations, surpassing previous results. [6].
- Coordinated dissemination activities: managed the project's LinkedIn channel, wrote outreach content, and organized scientific communication events.

04/2025 - 06/2025 **Research Stay.** AIDOS Lab, University of Freiburg. Collaboration with Prof. Dr. Bastian Rieck on the use of topological tools in medical computing.

- Developed a novel molecular descriptor based on the Euler Characteristic Transform for molecular learning tasks, achieving competitive results and even outperforming traditional methods. [5].

10/2024 - 10/2024 **Research Stay.** Consiglio Nazionale delle Ricerche, Institute of Electronics, Computer and Telecommunication Engineering (CNR-IEIIT), Genoa. Collaboration with Dr. Maurizio Mongelli and his team at the intersection of topology and XAI.

- Developed approaches to integrate topological data analysis with explainable AI models, creating efficient safety regions to distinguish between safe and unsafe simulations, improving previous results. [6].

Work Experience (continued)

12/2022 - 12/2023 **Data Scientist.** Glucube (formerly Igluco Tech). Development of AI models for blood glucose prediction.

- Trained and validated deep learning models (RNN, CNN, Transformers) for real-time prediction.
- Applied preprocessing techniques to extract enhanced features for model input.
- Designed interactive reports and visualizations to facilitate communication and interpretation of results.
- Conducted data extraction, transformation, and loading (ETL) from SQL databases.

09/2022 - 12/2022 **Software Developer.** Solera. Worked on software development and quality assurance projects in Python.

- Implemented software modules and automated test suites to improve the reliability of production products.

01/2022 - 03/2022 **Data Science Intern.** FISEVI. Supported data analysis projects in collaboration with medical teams.

- Applied statistical techniques to patient data analysis.
- Produced reports and visualizations that facilitated communication of results to medical teams.

Education

06/2025 **Statistical Optimal Transport** summer graduate workshop, Simons Laufer Mathematical Sciences Institute (SLMath), between June 09 and June 20, in Berkeley, California. Granted by SLMath.

06/2024 **GATMAID (Geometric, Algebra and Topology in Machine learning, Artificial Intelligence and Big data) EMS summer school**, Centre de Recerca Matemàtica, between June 25 and June 29, in Barcelona, Spain.

2022 – 2023 **Master's Degree in Logic, Computation and Artificial Intelligence.** University of Seville. Thesis title: *Applications of artificial intelligence in predicting blood glucose levels using non-invasive techniques.*

2018 – 2022 **Bachelor's Degree in Statistics.** University of Seville
Thesis title: *Statistical indicators associated to the living conditions survey.*

Technical Skills

Machine Learning & Data Engineering	Machine learning algorithms (e.g., decision trees), deep learning architectures (MLP, CNN, RNN), topological data analysis, statistical methods, data import, cleaning, and preprocessing.
Programming Languages	Python (primary), R.
Frameworks & Libraries	TensorFlow, PyTorch, Keras, Scikit-learn, NumPy, Pandas, Matplotlib, Dash, Shiny.
Development Tools	Git, Jupyter Notebooks, Amazon SageMaker, Google Colab.
Data Visualization	Power BI, Shiny (R), Dash (Python).
Databases	SQL (MySQL, PostgreSQL).

Languages

Spanish	Native.
English	Overall B2 Listening C Reading B2 Writting B2 Speaking B2.

Achievements

Participation in Mining and Learning with Graphs workshop at European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECMLPKDD2025). [8] was presented with a poster titled *A Topological Molecular Representation for Molecular Learning Based on the Euler Characteristic Transform.*

Participation in the Computational Intelligence methods for Bioinformatics and Biostatistics conference (CIBB 2025). A poster titled *Molecular Machine Learning Using Euler Characteristic Transforms* was presented.

Participation in "II Jornadas de Topología de Datos" (TDA2025) with a talk titled "Interpolation and Function Approximation Using Neural Networks and Barycentric Coordinates".

Seminar titled "Topological Data Analysis for data analysis and AI in robotics" in Scuola di Robotica, Genova.

Participation in the Centre for Topological Data Analysis 2024 conference, organized by the University of Oxford. A poster titled "Representative measure approach to assess decision trees reliability" was presented.

Participation in The 2nd World Conference on eXplainable Artificial Intelligence. Oral presentation on the paper published in this conference [11], and in doctoral consortium with poster.

Participation in the GATMAID EMS Summer School, organized by the Centre de Recerca Matemàtica from June 25 to 29, 2024. A poster titled "Representative measure approach to assess decision trees reliability" was presented.

Participation in the ETSII Research Days (JIETSII 2024) with the talk titled "Topological Data Analysis for Trustworthy Artificial Intelligence".

NVIDIA DLI Certificate - "Fundamentals of Accelerated Data Science". Credential ID Jkg8E3DnSZu7hLnQfgBLDQ.

NVIDIA DLI Certificate - "Fundamentals of Deep Learning". Credential ID ToLN84tLTUKly-6eRmtGqA.

Directed final project of studies

Bachelor's thesis of the bachelor's degree in Computer Engineering, academic year 25/26. *Evaluación de la respuesta al tratamiento mediante delta-radiómica y aprendizaje automático en estudios TC (Assessment of treatment response using delta-radiomics and machine learning in CT studies),* carried out by Pablo Olivencia Moreno. Co-directed with Prof. Rocío González Díaz. Mark: 9.5.

Bachelor's thesis of the bachelor's degree in Computer Engineering, academic year 25/26. *Diseño e implementación de una plataforma para la integración y explotación de bases de datos de imagen médica orientada a investigación oncológica (Design and implementation of a platform for the integration and utilisation of medical image databases for cancer research),* carried out by José Coronil Álvarez. Co-directed with Prof. Rocío González Díaz. Mark: 9.2.

Master's thesis of the master's degree in Biomedical Engineering and Digital Health, academic year 24/25. *Predicción de la respuesta al tratamiento de inmunoterapia para el cáncer de pulmón no microcítico mediante modelos de inteligencia artificial y características radiómicas (Prediction of immunotherapy treatment response in non-small cell lung cancer using artificial intelligence models and radiomic features),* carried out by Jesús Vías Torres. Co-directed with Prof. Rocío González Díaz. Mark: 9.

Directed final project of studies (continued)

Bachelor's thesis of the bachelor's degree in Computer Engineering, academic year 24/25. *Extracción y evaluación de características radiómicas a partir de tomografía computarizada en el estudio del cáncer de pulmón (Extraction and evaluation of radiomic features from computed tomography in the study of lung cancer),* carried out by Rúben Pérez Garrido. Co-directed with Prof. Rocío González Díaz. Mark: 9.4.

Research Projects

12/2023 – 10/2025 **Researcher of the "REliable & eXplAinable Swarm Intelligence for People with Reduced mObility" european project (REXASI-PRO, GRANT AGREEMENT NO.101070028).** University of Seville.

02/2023 – 11/2024 **Member of the work team of the "Topología Computacional para el ahorro de energía y la optimización de métodos de aprendizaje profundo para alcanzar soluciones verdes de Inteligencia Artificial" project (TED2021-129438B-I00).** University of Seville.

Research Teams

2023 – now **Team member of the Combinatorial IMage Analysis research group (CIMAgroup)**

2025 – now **Team member of the AIDOS Lab**.

Publications

You can check my publications in my profile of Google Scholar.

1. M. A. Perez et al., "Predictive modeling of platelet reactivity during clopidogrel tapering in endovascular treatment of asymptomatic cerebral aneurysms: The dosis model," *European Stroke Journal*, vol. 11, no. Supplement$_1$, pp. i805–i805, May 2026, ISSN: 2396-9881. DOI: 10.1093/esj/aakag023.1477.
2. S. P. Sánchez et al., "Effects of a polyphenol-rich salicornia extract on lipid profiles: A pooled analysis in stroke patients," *European Stroke Journal*, vol. 11, no. Supplement$_1$, pp. i225–i226, May 2026, ISSN: 2396-9881. DOI: 10.1093/esj/aakag023.385.
3. S. P. Sánchez et al., "Targeting post-stroke cognitive impairment with a polyphenol-rich salicornia extract," *European Stroke Journal*, vol. 11, no. Supplement$_1$, pp. i25–i25, May 2026, ISSN: 2396-9881. DOI: 10.1093/esj/aakag023.035.
4. **V. Toscano-Duran** et al., "Validation of a machine learning model to predict patient clinical outcome 90 days after stroke," *European Stroke Journal*, vol. 11, no. Supplement$_1$, pp. i647–i648, May 2026, ISSN: 2396-9881. DOI: 10.1093/esj/aakag023.1157.
5. **V. Toscano-Duran**, F. Rottach, and B. Rieck, "Molecular machine learning using euler characteristic transforms," pp. 391–405, Jan. 2026. DOI: https://doi.org/10.1007/978-3-032-10661-2_30.
6. **V. Toscano-Duran**, S. Narteni, A. Carlevaro, J. Guzzi, R. Gonzalez-Diaz, and M. Mongelli, "Safe and efficient social navigation through explainable safety regions based on topological features," in *Explainable Artificial Intelligence*, R. Guidotti, U. Schmid, and L. Longo, Eds., Cham: Springer Nature Switzerland, Oct. 2025, pp. 396–421. DOI: 10.1007/978-3-032-08324-1_18.
7. **V. Toscano-Duran**, R. Gonzalez-Diaz, and M. Á. Gutierrez-Naranjo, "Barycentric neural networks and length-weighted persistent entropy loss: A green geometric and topological framework for function approximation," *arXiv preprint arXiv:2509.06694*, Sep. 2025. DOI: 10.48550/arXiv.2509.06694.
8. **V. Toscano-Duran** and B. Rieck, "A topological molecular representation for molecular machine learning based on the euler characteristic transform," *ECML-PKDD workshop on 'Mining and Learning with Graphs' (MLG)*, Sep. 2025.

9 J. Perera-Lago, **V. Toscano-Duran**, A. Torras-Casas, and R. Gonzalez-Diaz, "Topology-based analysis and optimization for agent fleet behavior," *Open Research Europe*, vol. 5:200, Jul. 2025. DOI: 10.12688/openreseurope.20760.1.

10 J. Perera-Lago, **V. Toscano-Duran**, E. Paluzo-Hidalgo, R. Gonzalez-Diaz, M. A. Gutiérrez-Naranjo, and M. Rucco, "An in-depth analysis of data reduction methods for sustainable deep learning," *Open Research Europe*, vol. 4:101, Sep. 2024. DOI: 10.12688/openreseurope.17554.2.

11 J. Perera-Lago, **V. Toscano-Duran**, E. Paluzo-Hidalgo, S. Narteni, and M. Rucco, "Application of the representative measure approach to assess the reliability of decision trees in dealing with unseen vehicle collision data," in *Explainable Artificial Intelligence*, L. Longo, S. Lapuschkin, and C. Seifert, Eds., Cham: Springer Nature Switzerland, Jul. 2024, pp. 384–395, ISBN: 978-3-031-63803-9. DOI: 10.1007/978-3-031-63803-9_21.