Javier Murgoitio-Esandi

Ph.D. Candidate · University of Southern California

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Profile: Ph.D. Candidate doing research in the theory and application of generative deep learning methods. Thesis: *Generative AI for Anomaly Detection and Uncertainty Quantification*

SKILLS

Machine learning libraries: TensorFlow and PyTorch.

Programming languages: Python and C++.

RESEARCH EXPERIENCE

Focus in developing and applying generative deep learning methods for anomaly detection and uncertainty quantification. The following projects represent my research:

- **Generative models for anomaly detection:** Developing a deep learning-based framework to detect cancer from liquid biopsy samples using denoising auto-encoders and a vision-transformer classifier.
- **Generative models for uncertainty quantification:** Solving inverse problems in biomechanics using conditional generative methods such as conditional score-based diffusion models and GANs.

PROFESSIONAL HISTORY

Uncertainty Quantification and Machine Learning in Physics Models, Intern *September 2023 – May 2024*

Sandia National Laboratories, Livermore, California

- Developed a software library for uncertainty quantification in deep learning and conducted research studying Bayesian deep learning methods.

EDUCATION

Ph.D. in Mechanical Engineering. Research area: Generative AI. *August 2020 – Present*
University of Southern California, Los Angeles, USA

Master of Research, Research area: Fluid mechanics. *September 2017 – September 2019*

Master of Science, Civil Engineering *September 2015 – September 2016*
University College London, London, United Kingdom

Bachelor of Engineering, Civil Engineering *September 2011 – August 2015*
University of Basque Country, San Sebastian, Spain

PATENTS

- Systems and methods for identification of rare events in biological samples. Patent No. 63/716,845. Issued on November 6, 2024. Role: Co-inventor. Description: The patent relates to a rare event identification method that can be used to determine a patient's disease state. The method is based on an unsupervised deep learning approach.

SELECTED PUBLICATIONS

- Murgoitio-Esandi, J., …, Oberai, A. A. (2024). Unsupervised Detection of Rare Events in Liquid Biopsy Assays. (In preparation)
- Ray, D., Murgoitio-Esandi, J., Dasgupta, A., & Oberai, A. A. (2023). Solution of physics-based inverse problems using conditional generative adversarial networks with full gradient penalty. *Computer Methods in Applied Mechanics and Engineering*, *417*, 116338.
- Dasgupta, A., Ramaswamy, H., Murgoitio-Esandi, J., Foo, K., Li, R., Zhou, Q., ... & Oberai, A. (2024). Conditional score-based diffusion models for solving inverse problems in mechanics. *arXiv preprint arXiv:2406.13154*.

SELECTED CONFERENCES

- Dasgupta, A., Murgoitio-Esandi, J., Ray, D., Oberai, A. A. (2023). Conditional score-based generative models for solving physics-based inverse problems. NeurIPS 2023 Workshop on Deep Learning and Inverse Problems.
- Murgoitio-Esandi, J., Ray, D., Oberai, A. A. (2023). A novel conditional Wasserstein Generative Adversarial Network for inverse problems. U.S. National Congress of Computational Mechanics 17.

RESEARCH AWARDS

- (Research award, 3rd price). Murgoitio-Esandi, J., Zhang, J., Zhou, Q. & Oberai, A.A. (2022). An adversarial deep learning approach to measure the biomechanical properties of the optic nerve head. Future Vision Forum.