Juan Romero

Ph.D. Candidate in Earth Science and Engineering - ML Track

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in jdromerom

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Research interests

Computational Geoscientist specializing in solving complex inverse problems by integrating deep learning with geophysical and optical imaging. Expertise spans both physics-based modeling and advanced machine learning, with a strong focus on generative AI and foundation models for scientific data reconstruction. Proficient in Bayesian deep learning for uncertainty quantification and in leveraging high-performance computing (HPC) for large-scale model training. Recognized for applying state-of-the-art AI techniques to address challenging geoscientific problems, demonstrating adaptability, creativity, and strong analytical skills.

Education

Ph.D. in Earth Science and Engineering – Machine Learning Track   *2023 - 2026*
King Abdullah University of Science and Technology (KAUST)
Advisors: Prof. Wolfgang Heidrich and Dr. Matteo Ravasi

- Member of the KAUST Computational Imaging Group, focusing on diffusion models as generative priors for scientific imaging, leveraging HPC.
- Extended *IntraSeismic* to a Bayesian formulation (B-IntraSeismic) using deep variational inference with conditional normalizing flows.
- Developed *IntraSeismic*, a novel hybrid seismic inversion framework that combines implicit neural representations with physical modeling, achieving high reconstruction quality and rapid convergence in both static and dynamic settings.

M.S. in Earth Science and Engineering – Machine Learning Track   *2021 - 2023*
King Abdullah University of Science and Technology (KAUST)
Advisors: Dr. Matteo Ravasi

- Adapted a proximal optimization algorithm for GPU acceleration using CUDA by Numba.
- Developed a joint inversion–segmentation framework for 4D post-stack seismic inversion.
- Applied Plug-and-Play regularization in seismic inverse problems.

B.S. in Geology   *2013 - 2018*
Universidad Nacional de Colombia

Work Experience

Data Assimilation Intern   *Nov 2024 - Apr 2025*
Equinor ASA

- Built a comprehensive framework for Assisted History Matching with probabilistic seismic data, focusing on enhancing predictive modeling for CO_2 storage monitoring.

Research and Development Intern *Jun 2022 - Aug 2022*
Earth Science Analytics IKE

- Engineered and deployed a novel self-supervised seismic denoising model into a commercial software platform, achieving superior signal preservation on large-scale field data and directly enhancing product capabilities.

Junior Exploration Geophysicist *2019 - 2021*
Exploration Vice Presidency, Ecopetrol S.A. - SGS Contractor

- Matured exploration prospects by leading 3D seismic interpretation, structural mapping, and volumetric analysis to define drillable targets.
- Characterized reservoirs through quantitative interpretation, including AVO analysis and seismic inversion.
- Designed and implemented a convolutional neural network for the semantic segmentation of mud diapir bodies in 3D seismic volumes.

Skills & Expertise

Programming	Python, Shell, MATLAB, LaTeX
Software	DSG Landmark, Petrel, Paleoscan, Hampson-Russel
Languages	Spanish (native), English (bilingual), French (elementary)

Certifications & Training

NVIDIA *2025*
Certificate of Competency: *Building RAG Agents with LLMs*

Teaching Experience

Teaching Assistant *Feb 2024 - May 2024*
Machine Learning in Geoscience, King Abdullah University of Science and Technology (KAUST)

- Designed and delivered hands-on laboratory sessions, covering key topics such as supervised learning, neural networks, and data preprocessing techniques.
- Provided mentorship and technical support for student final projects, guiding project design, model development, and evaluation.

Honors & Awards

2025   **Dean's Award**, King Abdullah University of Science and Technology. Recognized for exceptional academic performance and impactful research contributions during doctoral studies.

2023   **Best Paper Award**, *The Leading Edge* journal, Society of Exploration Geophysicists (SEG)

2022   **Winner**, KAUST-NVIDIA Hackathon – Project: GPU-accelerated segmentation algorithm

2020   **Best Presentation in Geophysics and Geomechanics**, 1st Virtual Exploration Congress, Ecopetrol S.A.

2018   **Travel Grant**, SEG/Chevron Student Leadership Symposium and SEG Annual Meeting

2018   **Second Place**, American Association of Petroleum Geologists (AAPG) Imperial Barrel Award Competition, Latin America and Caribbean Region

Professional Service

2024–Present	Reviewer, *Acta Geophysica*
2024–Present	Reviewer, *GEOPHYSICS*
2023–2024	Board Member, Society of Exploration Geophysicists (SEG) KAUST Chapter
	Organized and led the first Geophysical Acquisition Bootcamp (Theory and Processing), an educational initiative where over 20 KAUST students and community members gained hands-on experience and theoretical knowledge in geophysical data acquisition and processing techniques.

Publications

- **Romero, J.**, Fu, Q., Ravasi, M., & Heidrich, W. (2025). "Uncertainty Quantification in HSI Reconstruction using Physics-Aware Diffusion Priors and Optics-Encoded Measurements." *arXiv preprint arxiv:2511.18473*

- **Romero, J.**, Heidrich, W., & Ravasi, M. (2025). "Bayesian seismic inversion with implicit neural representations." *Geophysical Journal International*.

- **Romero, J.**, Heidrich, W., Casasanta, L., Akcelik, V., & Ravasi, M. (2025). "High-resolution seismic time-strain estimation." *86th EAGE Annual Conference & Exhibition*, Toulouse, France, June 2025.

- **Romero, J.**, Heidrich, W., & Ravasi, M. (2025). "B-IntraSeismic: Uncertainty quantification in seismic inversion via implicit neural representations." *86th EAGE Annual Conference & Exhibition*, Toulouse, France, June 2025.

- **Romero, J.**, Heidrich, W., Luiken, N., & Ravasi, M. (2024). "Seismic reservoir characterization with implicit neural representations." *Journal of Geophysical Research: Machine Learning and Computation*, 1(3), e2023MS004049.

- **Romero, J.**, Heidrich, W., Luiken, N., Ravasi, M., (2024). "4D-IntraSeismic: Simultaneous 4D Seismic Inversion with Coordinate-Based Learning" *85th EAGE Annual Conference & Exhibition*, 2024

- Ravasi, M., **Romero, J.**, Corrales, M., Luiken, N., & Birnie, C. (2024). "Chapter Six - Striking a balance: Seismic inversion with model- and data-driven priors." In *Developments in Structural Geology and Tectonics* (pp. 125-154). Elsevier.

- Corrales, M., **Romero, J.**, Luiken, N., Hoteit, H., & Ravasi, M. (2024). "Regularization strategies for Seis2Rock-based petrophysical inversion of prestack seismic data." *Fourth International Meeting for Applied Geoscience & Energy*, Houston, USA, August 2024.

- **Romero, J.**, Luiken, N., & Ravasi, M. (2023). "Seeing through the CO_2 plume: Joint inversion-segmentation of the Sleipner 4D seismic data set." *The Leading Edge*, 42(5), 352-359.

- Ravasi, M., Luiken, N., **Romero, J.**, & Corrales, M. (2023). "Deep learning to replace or augment model-based seismic inversion?" *84th EAGE Annual Conference & Exhibition*, 2023(1), 1-5.

- **Romero, J.**, Corrales, M., Luiken, N.A., & Ravasi, M. (2022). "Plug and play post-stack seismic inversion with CNN-based denoisers." *2nd EAGE Subsurface Intelligence Workshop*, Bahrain, October 2022.

- Izzatullah, M., Alkhalifah, T., **Romero, J.**, Corrales, M., Luiken, N.A., & Ravasi, M. (2022). "Posterior sampling with convolutional neural network-based plug-and-play regularization with applications to poststack seismic inversion." *GEOPHYSICS*, 89(2), 1-42. https://doi.org/10.1190/geo2021-0515.1

- **Romero, J.**, Oikonomou, D., & Ibrahim, O. (2022). "A novel approach to train self-supervised seismic denoising DNN architectures." *First Break*, 40(1), 75-82. https://doi.org/10.3997/1365-2397.fb2022007

- Luiken, N., Ravasi, M., & **Romero, J.** (2022). "Robust regularized regression using a modified ADMM." *83rd EAGE Annual Conference & Exhibition*, Madrid, Spain, June 2022.