Pablo Lara - *Ph.D.*

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About me

I hold a PhD in Earth and Universe Sciences. During my PhD, I developed Machine Learning tools for the detection and rapid characterization of earthquake sources, which have been implemented in the earthquake early warning system of Peru, benefiting over 18 million people. I am now enrolled in a postdoctoral position in earthquake seismology at Los Alamos National Laboratory (LANL), where I aim to expand my research while continuing to focus on the development of Machine Learning algorithms.

Education

2020 – 2024 **Ph.D. in Earth and Universe Sciences,** Université Côte d'Azur, France.
Advisors: Quentin Bletery and Jean-Paul Ampuero
Thesis title: *Detection of seismological signals based on artificial intelligence*
https://theses.fr/s314147

2018 – 2020 **Master of Science in Electrical Engineering and Computer Science,** Universidade Federal do Ceará, Brazil.
Thesis title: *Automatic multichannel volcano-seismic classification using Machine Learning and EMD*
http://www.repositorio.ufc.br/handle/riufc/51894

2017 **Electrical Engineer Certification,** Universidad Nacional de Ingenieria, Peru. Approved with honors.
Thesis title: *Design of a monitoring system for the satellite seismic network of Peru in real-time*
http://hdl.handle.net/20.500.14076/13260

2007 – 2014 **Bachelor in Science in Electrical Engineering,** Universidad Nacional de Ingenieria, Peru.

Professional experience

2020 – 2024 **Research Scientist,** Instituto Geofísico del Perú.

- Developed real-time volcanic event classification system for Ubinas volcano using Machine Learning.
- Designed the AI algorithm of the Peruvian Earthquake Early Warning System (SASPe) to detect earthquakes, pick the P-phase, and estimate magnitudes and hypocentral location in real-time based on 3 seconds of P-wave recorded by the nearest station.
- Led the implementation, testing, and validation of the SASPe AI algorithm.

Professional experience (continued)

2014 – 2017 **Software Engineer,** Instituto Geofísico del Perú.

- Designed a real-time monitoring system for the National Seismic and Accelerometric Network, including:
  - a decoding system for instruments with satellite and internet telemetry,
  - a data acquisition system,
  - a monitoring platform to display the state of health of remote stations,
  - an alert system to report operational status.
- Designed intensity maps (ShakeMaps) in real time when an earthquake occurs.
- Developed software for Power Spectral Density estimation of seismic noise in real time.
- Built software to monitor servers managing the National Seismic Network in real time.

Teaching experience

2019 Winter (6 months) **Lecturer,** Universidade Federal do Ceará, Sobral, Brazil. Pattern Recognition.

Research Publications

Journal Articles

1. **P. Lara**, H. Tavera, Q. Bletery, J.-P. Ampuero, A. Inza, D. Portugal, B. Orihuela, and F. Meza, "Implementation of the peruvian earthquake early warning system," *Bulletin of the Seismological Society of America*, vol. 115, no. 1, pp. 191–209, Dec. 2024.
2. A. A. T. Peixoto, C. A. R. Fernandes, **P. Lara**, and A. Inza, "Low-correlation multilinear dimensionality reduction applied to volcano-seismic classification," *Pattern Recognition*, vol. 158, p. 110 946, 2024.
3. **P. Lara**, Q. Bletery, J.-p. Ampuero, A. Inza, and H. Tavera, "Earthquake early warning starting from 3 s of records on a single station with machine learning," *Journal of Geophysical Research: Solid Earth*, vol. 128, no. 11, e2023JB026575, 2023.
4. E. Calais, S. Symithe, T. Monfret, B. Delouis, A. Lomax, F. Courboulex, J. P. Ampuero, **P. Lara**, Q. Bletery, J. Chèze, *et al.*, "Citizen seismology helps decipher the 2021 haiti earthquake," *Science*, vol. 376, no. 6590, pp. 283–287, 2022.
5. A. A. T. Peixoto, C. A. R. Fernandes, **P. Lara**, A. Inza, J. I. Mars, J.-P. Metaxian, M. Dalla Mura, and M. Malfante, "Tensor-based learning framework for automatic multichannel volcano-seismic classification," *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, vol. 14, pp. 4517–4529, 2021.
6. **P. Lara**, C. A. R. Fernandes, A. Inza, J. I. Mars, J.-P. Métaxian, M. Dalla Mura, and M. Malfante, "Automatic multichannel volcano-seismic classification using machine learning and emd," *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, vol. 13, pp. 1322–1331, 2020.

Conference Proceedings

1. A. Inza, **P. Lara**, and N. Baella, "Volcano monitoring: Hazard assessment methodology based on probabilistic analysis of ubinas volcano eruption 2006-2009," in *AGU Fall Meeting Abstracts*, vol. 2023, 2023, pp. V11D–0081.
2. **P. Lara**, Q. Bletery, J.-P. Ampuero, and I. Adolfo, "E3ws: Earthquake early warning starting from 3 seconds of records on a single station with machine learning," in *ERC – Tectonic Workshop*, Rome, Italy, Sep. 2023.

3. **P. Lara**, Q. Bletery, J.-P. Ampuero, and I. Adolfo, "Earthquake early warning with 3 seconds of records on a single station," in *EGU General Assembly 2023*, EGU23-6433, Vienna, Austria, Apr. 23–28, 2023.

4. **P. Lara**, Q. Bletery, J.-P. Ampuero, and A. Inza, "Earthquake early warning with 3 seconds of records on a single station," in *AGU Fall Meeting Abstracts*, vol. 2022, 2022, S53A–03.

5. **P. Lara**, Q. Bletery, J. P. Ampuero, A. Inza, and H. Tavera, "Earthquake early warning system based on 3 seconds of p wave: A machine learning approach for rapid detection, estimation magnitude and location," in *The physics of earthquake faulting: machine learning to illuminate earthquakes precursors and predict laboratory earthquakes*, 2021.

6. A. Inza, **P. Lara**, C. Alexandre, J. P. Metaxian, J. I. Mars, M. Malfante, and M. Dalla Mura, "Sismo-volcano classification in real time based on empirical mode decomposition (emd) and machine learning," in *American Geophysical Union, Fall Meeting 2020*, 2020.

7. **P. Lara**, A. Inza, H. Tavera, and C. A. R. Fernandes, "Efficient p-wave detection in real time for earthquake early warning system based on artificial intelligence," in *AGU Fall Meeting 2020*, 2020.

Skills

Languages	Spanish (native), English (advanced), Portuguese (advanced), French (basic).
Artificial Intelligence	TensorFlow, PyTorch, Keras, Scikit-learn.
Programming	C, C++, Python, Bash, C-Bash, HTML, PHP, Matlab, Latex.
Computer Software	MySQL, MariaDB, Linux, MongoDB, Clusters, Supercomputers.
Seismic Software	GMT, Earthworm, Seedlink, Nanometrics, Reftek, Guralp, Seiscomp3, Proxmox VM.

Awards and Honors

2024 **Laureate of the 2024 Innovation Trophy.** Winner in an international competition organized by the *Institut de Recherche pour le Développement* (IRD) on its 80th anniversary. Awarded at the *Science4Action* Forum in Marseille, France, recognizing pioneering interdisciplinary projects with significant global impact. `https://www.ird.fr/trophees-de-linnovation-2024-decouvrez-les-trois-laureats`

2020 **Doctoral Scholarship.** Awarded scholarship for doctoral thesis preparation on "Detection of seismological signals using artificial intelligence" by IRD.

2018 **Master Scholarship.** Received scholarship for outstanding research proposals from the Organization of American States (OAS) and the Coimbra Group of Brazilian Universities.

2001 **Second Place, UNI - PUCP - TRILCE - Peruvian Mathematical Society - International Commission of the Mathematics Olympics.** Achieved second place in the "National Mathematics Contest."

Second Place, TRILCE. Second place prize in the "6th Mathematics Olympiad."

2000 **First Place, National University of Santa.** First place prize in the "I Mathematical Logic Contest."

First Place, Editorial Active School and Ministry of Education. First place award in the "VIII Mathematics Olympiad SIGMA 2000."

1997 **Honorable Mention, UNASAM.** Awarded for achievements in the "V Regional Mathematics Olympiad, Chavín Region."