

# Homer Durand

Portfolio: [homerdurand.github.io](https://homerdurand.github.io)  
Github: [github.com/homerdurand](https://github.com/homerdurand)

Email: [durand.homer@gmail.com](mailto:durand.homer@gmail.com)  
Mobile: +33 697 991 367

## EDUCATION

- **Universitat de València** València, Spain  
*PhD in remote sensing* Nov 2022 - Nov 2025  
*Causal Inference for the Detection and Attribution of Climate Change*  
*Project:* Develop robust causal inference methodologies for the detection and attribution (D&A) of climate change, considering the entire causal chain from global climate changes to localized impacts of extreme events. Applied these methodologies to analyse recent extreme climate events and identify climate response to external forcing at regional and local scales.
- **Sorbonne University** Paris, France  
*Master's degree in mathematics and applications* Sept 2021 - Nov 2022  
*Specialisation in Statistics*  
*Courses:* Nonparametric inference, High dimensional linear models, Statistical learning, Sequential convex optimization, Bayesian statistics, Statistical analysis of graphs, Statistical models for ecology.
- **Polytech Sorbonne** Paris, France  
*Master's degree in engineering* Sept 2018 - Sept 2021  
*Specialisation in Applied Mathematics and Computer Science*  
*Courses:* Functional analysis, Numerical analysis, Probability, Statistics, Machine Learning, Data Analysis, Convex and non-convex optimization, High Performance Computing

## SKILLS SUMMARY

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|---|---|
| • <b>Languages:</b> Python, R, Matlab, SageMath, C++, Cuda, C               | • <b>French:</b> Mother Tongue            |
| • <b>Frameworks:</b> Scikit-Learn, Pytorch, TensorFlow, Keras, NLTK, SpaCy  | • <b>English:</b> Fluent (C1 - TOEIC 925) |
| • <b>Tools:</b> Markdown, L <sup>A</sup> T <sub>E</sub> X, Git, Bash, MySQL | • <b>Spanish:</b> Upper-intermediate (B2) |

## EXPERIENCE

- **Image Processing Lab - Causal Representation Learning for Climate Science**  
*Internship* Jun 2022 - Nov 2022
  - **Topic of research:** Learning *causal representation* for spatio-temporal data with machine learning
  - **Applications:** Biosphere-Climate interaction - understanding of the *causal effect* of ENSO on *vegetation in Africa*  
Teleconnection patterns - Analysis of the *confounding effect* of ENSO on Southern Hemisphere jet stream and the Solar Polar Vortex
  - **Outcome:** Master thesis
- **Locean-IPSL Laboratory - Statistical learning for climate models calibration**  
*Internship* Mar 2021 - Sept 2021
  - **Topic of research:** Dynamical model calibration with *History Matching* methodology using *Gaussian Process*, *Random Forest* and *Bayesian Neural Network* regressions
  - **Outcome:** Paper published in AGU JAMES journal and Master thesis
- **Kyntus comp. - Web app developpement**  
*Internship* Jul 2019 - Aug 2019
  - **Project:** Web app development for schedules management (*PHP*, *SQL*, *HTML*)
  - **Outcome:** Web applications automating schedules and projects management

## PROJECTS

- **Statistical Learning - Robust Machine Learning - The Median of Mean estimator:** (4 months - Sorbonne University) *Study of the application of the **median of mean** estimator for **robust machine learning** as proposed in Lecue & Lerasle, 2017.* See project report.
- **Data Challenge - Land cover predictive modeling from satellite images:** (4 months - Sorbonne University) *Image segmentation using **Unet** and **Linknet** architecture for land cover segmentation.* See project more.
- **Nonparametric estimation - Censoring models for nonparametric density estimation:** (2 months - Sorbonne Université) *Study of the results presented in: Brunel & al. 2016.* See project report.
- **Explainable Artificial Intelligence - Lung cancer image detection:** (3 months - Sorbonne University) *Explainable deep learning for **lung cancer detection**. Use of Grad-CAM and Layer-Wise Relevance Propagation for explainability.*
- **Medical Image Processing - Deep learning for deficient MMR crypts detection:** (6 months - Polytech Sorbonne) *Statistical learning for the detection of deficient MMR crypts to aid in the **diagnosis of Lynch disease**. **Pairwise ranking** with **Siamese convolutional neural networks**.* See project report.
- **Natural Language Processing - Statistical analysis of political content:** (10 months - Polytech Sorbonne) *Statistical analysis of letters from MPs to ministries for the **study of mechanisms of political influence**. Use of NLP tools (TF-IDF, cooccurrence matrix, ngram models) and time series statistical analysis (anomaly detection, classification, dimensionality reduction).*

## PUBLICATIONS

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- **Learning Causal Response Representations through Direct Effect Analysis:**

In revision

Homer Durand, Gherardo Varando, Gustau Camps-Valls

2025 - <https://www.arxiv.org/abs/2503.04358>

- **Improving generalisation via anchor multivariate analysis:**

Accepted in International Conference on Artificial Intelligence and Statistics (AISTATS 2025)

Homer Durand, Gherardo Varando, Nathan Mankovich, Gustau Camps-Valls

2025 - <https://arxiv.org/abs/2403.01865>

- **Semi-Automatic Tuning of Coupled Climate Models With Multiple Intrinsic Timescales: Lessons Learned From the Lorenz96 Model:**

AGU - Journal of Advance in Modeling Earth Systems

Redouane Lguensat, Julie Deshayes, Homer Durand, Venkatramani Balaji

2023 - <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2022MS003367>

## TEACHING

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- **Uncertainty quantification and probability interpretation in earth system modelling:**

ISP Group Courses

Universitat de valencia

- **Advanced machine learning for climate change detection:**

Student Project Supervision

Polytech Sorbonne - Applied Mathematics and Computer Science (1st year MSc students)

sept 2024 / april 2025 - Student report

- **Attributing the 2023 heatwave in france:**

Student Project Supervision

Polytech Sorbonne - Applied Mathematics and Computer Science (3rd year BSc students)

march 2024 / may 2024 - Student report

## INTEREST

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### Recent readings

- **J. Pearl (2018):** The Book of Why : The New Science of Cause and Effect
- **J. Woodward (2004):** Making Things Happen: A Theory of Causal Explanation
- **M. S. Moore (2009):** Causation and Responsibility: An Essay in Law, Morals, and Metaphysics
- **N. Silver (2012):** The Signal and the Noise: Why So Many Predictions Fail-but Some Don't
- **E. T. Jaynes (2012):** Probability Theory: The Logic of Science
- **E. Kolbert 2015:** Field Notes from a Catastrophe: Man, Nature, and Climate Change

### Music

- **Personal project:** Language models for music generation
- **Piano:** 5 years