



# Malek Senoussi, PhD

AI Engineer / ML Researcher

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## PROFILE

Deep Learning Engineer with a PhD in Applied Mathematics, specializing in neural architectures, high-dimensional modeling, and large-scale experimentation. Experienced in applying deep learning to biological and environmental datasets, with a strong interest in AI-driven optimization and sensor-based monitoring systems. Passionate about open-source and deploying research into real-world applications.

## SKILLS

**Programming:** Python, SQL, Bash

**Libraries/Tools, Visualization:** PyTorch, Scikit-learn, Pandas, NumPy, Dask, Plotly, Dash, Streamlit

**Deep Learning & Architectures:** CNNs, RNN/LSTM/GRU, Transformers (basic), autoencoders, tabular neural networks, time-series deep learning, forecasting networks, anomaly detection

**Computer Vision:** Image classification, segmentation, weak supervision, augmentation pipelines

**Model Development:** Model design, hyperparameter tuning, training loops, early stopping, cross-validation, batch processing, GPU acceleration

**Infrastructure:** Docker, Git, HPC / SLURM, Remote training

**Data Science, Analysis & Domains:** Environmental data modeling, multi-variate time-series analysis, large dataset preprocessing, feature extraction, sensor data cleaning, Machine Learning, Deep Learning, Data Analysis, Statistical Modeling, HPC, Biological systems, environmental modeling, sensor data, industrial processes, time-series monitoring

**Cloud & DevOps:** AWS / Azure (foundations level), CI/CD concepts

**Soft Skills:** Communication with interdisciplinary teams, explanation of complex methods, teaching experience, coordination of small research groups

**Languages:** French (Native), English (C1), Italian (B1)

## SELECTED PROJECTS

### Machine Learning Pipeline for Large-Scale Classification

- Designed and deployed ML and Deep Learning models handling high-dimensional noisy transcriptomic data.
- Conducted large-scale benchmarking and comparative analysis across multiple algorithms to optimize performance.
- Built automated labeling and evaluation pipelines to improve annotation consistency and reduce manual data curation time by 95%.
- Achieved a 3–20% accuracy gain by developing and optimizing a custom deep learning classification architecture.

### Multimodal & Temporal Cross-Domain Translation via coupled Autoencoders (Deep Learning Project)

- Designed and implemented coupled autoencoders to integrate multiple biological modalities (images, videos, scRNA-seq, multi-omics) into a shared latent space using adversarial alignment and divergence minimization.
- Built modality-specific deep architectures (CNNs, RNNs/LSTMs, MLPs) and unified them through a latent-space alignment loss, enabling cross-modal translation (e.g., image → RNA-seq, RNA-seq → image).
- Added a temporal modeling component by enforcing time-ordered latent trajectories, allowing forecasting of future states in a target modality from past observations in another.
- Developed pipelines for data preprocessing, reconstruction, cross-modal generation, and clustering evaluation, validating alignment via AUC, neighbor preservation, and differential signal recovery.

### Environmental Forecasting & Resource Optimization

- Built an end-to-end ML pipeline including preprocessing, feature engineering, forecasting models (Random Forest, LightGBM), and evaluation.
- Predicted energy consumption trends for optimization scenarios .
- Developed a business-oriented interactive dashboard for monitoring KPIs, predictions and resource optimization scenarios.

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## WORK EXPERIENCES

<b>PhD Researcher — Machine Learning &amp; Computational Biology</b> <i>Aix-Marseille University — Laboratoire Informatique et Systèmes &amp; Centuri.</i>	<b>10/2020 — 07/2024</b> <i>Marseille</i>
<ul style="list-style-type: none"><li>Collaborated with interdisciplinary teams (biologists, data scientists, engineers) to ensure analytical insights.</li><li>Presented results to both technical and non-technical audiences, developed dashboards, and delivered reproducible ML pipelines integrated into real research workflows.</li><li>Reduced data preprocessing time using automated Python pipelines.</li><li>Improved classification accuracy through feature engineering and model selection</li><li>Designed and trained deep learning models (CNNs, shallow networks, and hybrid architectures) for biological data, including noisy and high-dimensional measurements.</li><li>Built pipelines to process environmental parameters, growth patterns, and temporal variations, enabling predictive insights for biological growth processes — transferable to cultivation optimization. Accelerated model experimentation by 3x using GPU + SLURM parallelization.</li><li>Performed large-scale experimentation using SLURM clusters for architecture search, hyperparameter optimization, and model evaluation.</li><li>Developed predictive deep learning models capturing complex nonlinear behaviors in biological systems, improving forecasting accuracy and early anomaly detection.</li><li>Published 4 peer-reviewed papers and collaborated with multidisciplinary teams.</li></ul>	
<b>Research Supervisor</b> <i>Laboratoire Informatique et Systèmes</i>	<b>09/2021 — 06/2023</b> <i>Marseille</i>
<ul style="list-style-type: none"><li>Acted as technical lead for student ML projects.</li><li>Adapted explanations to varied technical backgrounds.</li><li>Reviewed code and contributed to architectural decisions.</li><li>Communicated model insights to interdisciplinary collaborators and improved model interpretability for domain experts.</li></ul>	
<b>Mathematics Professor</b> <i>Thiers High School</i>	<b>09/2021 — 06/2023</b> <i>Marseille</i>
<ul style="list-style-type: none"><li>Oral examination in preparatory classes MPSI.</li><li>Taught advanced mathematics, algorithmic reasoning and analytical thinking.</li><li>Developed strong presentation skills and structured explanations.</li></ul>	
<b>Research Intern — Mathematical Modeling</b> <i>Laboratoire Informatique et Systèmes</i>	<b>03/2020 — 08/2020</b> <i>Marseille</i>
<ul style="list-style-type: none"><li>Probabilistic and statistical modeling of embryogenesis in <i>C. elegans</i>.</li><li>Produced data-driven insights and contributed to scientific reports.</li></ul>	

## PUBLICATIONS

<b>Partial Label Learning for Automated Classification</b> Built scalable ML models for noisy-label classification on high-dimensional datasets.	<b>2024</b>
<b>Hierarchical Novel Class Discovery</b> Developed algorithms for discovering unknown patterns in unlabeled data environments.	<b>2024</b>
<b>Network Analysis &amp; Random Walk Visualization</b> Built interactive visualization tools for large-scale network simulations.	<b>2023</b>
<b>Weakly Supervised Learning Systems</b> Designed hierarchical classifiers for real-world partially labeled data.	<b>2022</b>

## EDUCATION

<b>PhD in Mathematics and Computer Science</b> <i>Aix-Marseille University</i>	<b>2024</b> <i>Marseille</i>
<ul style="list-style-type: none"><li>Led research and produce academic manuscript: <a href="#">Classification of single cell RNA sequencing</a>.</li><li>Learning with missing and ambiguous labels, High-dimensional data modeling, Algorithm design and evaluation</li></ul>	
<b>Master's Degree in Mathematics and Applications</b> <i>Aix-Marseille University</i>	<b>2020</b> <i>Marseille</i>
<ul style="list-style-type: none"><li>Statistics, Probability, Machine Learning, Brain Imaging, Pharmacology.</li></ul>	