SEGHAIRI Abderraouf

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Education

École Nationale Supérieure d'Informatique (Top Engineering School) Algiers, Algeria
Engineering and masters degree in Computer Science *2021 — 2026*

- **Specialization** : Artificial Intelligence and Data Science
- **Relevant Coursework**: Data Structures and Algorithms, Object Oriented Programming, Computer Architecture, Software Engineering, Algebra, Calculus, Probability and Statistics, High Performance Computing, Distributed Systems, Machine Learning, Deep learning, Natural Language Processing, Computer Vision, Advanced Database Systems, Business Intelligence, Networking.

Research Experience

Research Intern July 2025 — Present
Jülich Research Center *Aachen, Germany*

- Preparing a research project on **Quantization and Sparsity in State Space Models (SSMs) for efficient deployment on edge and neuromorphic hardware** under the supervision of Pr. Emre Neftci and Dr. Younes Bouhadjer.
- Conducted a comprehensive literature review on recent **SSM architectures (e.g., Mamba, Gated DeltaNet, SPiKE-SSM)** and associated optimization methods, including **quantization-aware training, post-training quantization, and structured sparsity**.
- Experimented with **Triton kernel implementations of SSMs** to evaluate computational efficiency and gain insights into low-level performance characteristics.
- Exploring quantization strategies for SSMs, structured sparsity for efficiency and robustness, and deployment on edge hardware platforms.

Research Intern Jan 2024 — Juin 2024
Laboratoire de Méthodes de Conception des Systèmes (LMCS) *Algiers, Algeria*

- Co-authored the paper **"Stochastic Best Improvement with Progressive Halving Hyperparameter Optimization for Image Classification"** under the supervision of Pr. Malika Bessedik, Pr. Fatima Si Tayeb, and Pr. Karima Benatchba.
- Developed and evaluated a **hyperparameter optimization pipeline** combining Stochastic Best Improvement with Progressive Halving for efficient CNN exploration under resource constraints.
- Proposed a **block-wise transfer learning strategy**, freezing shallow pretrained MobileNetV3 layers while fine-tuning deeper blocks to reduce training costs.
- Introduced a **parameter-bounded neighborhood sampling method**, reducing model size by up to **43%** while preserving competitive accuracy on CIFAR-10.

Research Intern May 2024 — September 2024
New York University Abu Dhabi *Abu Dhabi, UAE*

- Contributed to the development of an **MLIR compiler autoscheduler** for deep learning libraries under the supervision of Pr. Riyadh Baghdadi.
- Proposed and implemented a **Monte Carlo Tree Search (MCTS) exploration strategy** to systematically evaluate loop-level transformations (vectorization, tiling, parallelization).
- Developed core compiler passes in **C++** and reproducible benchmarking pipelines in **Python/Docker**, ensuring robust evaluation and collaboration within a large research team.
- Achieved reproducible performance gains (avg. **+4%** on convolution and matrix multiplication benchmarks), providing a foundation for future publications in compiler optimization for machine learning workloads.

Preprints & Publications

- **Stochastic Best Improvement with Progressive Halving Hyperparameter Optimization for Image Classification**

  Authors: Abderraouf Seghairi, Ibrahim Aboud, Abdelaziz Akeb, Mouaadh Baghdadi, Kamel Brouthen, Imededdine Mokrane, Abdelkrim Aries, Karima Benatchba, Malika Bessedik, Touka Faisal, Fatima Si Tayeb

  https://doi.org/10.13140/RG.2.2.19735.84649

- **An Iterative Beam Search Method for the Flowshop Permutation Problem**

  Authors: Abderraouf Seghairi, Abdelaziz Akeb, Ibrahim Aboud, Kamel Brouthen, Imededdine Mokrane, Mouad Djawad Baghdadi

  https://doi.org/10.5281/zenodo.17116167

Industry Experience

Software Engineering Intern May 2023 — September 2023
Xpertsoft *Annaba, Algeria*

- Improved and implemented a new search functionality for a pharmaceutical software serving 1,500+ customers across Algeria.
- Integrated Elasticsearch into the backend codebase, significantly accelerating query performance and enhancing user experience.
- Deployed containerized environments with Docker and collaborated within a large development team using Git for version control.

Volunteer Experience

Technical departement member May 2022 —
School of AI Algiers *Algiers, Algeria*

- 1st Place Winner in an Ideathon competition (20+ teams) by developing an innovative solution leveraging Natural Language Processing (NLP) and classical search algorithms.
- Implemented Reinforcement Learning agents for Atari gaming environments, experimenting with advanced algorithms including PPO, Q-Learning, and Deep Q-Learning (DQN) to evaluate performance across tasks.

Development departement member May 2024 —
Sports and Entertainment CLub Algiers *Algiers, Algeria*

- Designed and implemented the full backend for a fantasy football app used in university tournaments by 200+ participants.
- Built scalable APIs using Python, Django, Django REST Framework, and MongoDB for data management.
- Ensured smooth collaboration and deployment with Git/GitHub for version control and Docker for containerized environments.

Projects

Khatwa https://github.com/SEGHAIRII/khatwa-search-engine

- Built a full-stack web application that helps parents find and evaluate kindergartens through advanced filters, direct messaging, and time management tools.
- Designed a management dashboard for kindergartens, enabling direct parent communication and a smart event scheduling system.
- Implemented using MongoDB, Node.js, Express, and React (MERN stack).

SciPaper https://github.com/SEGHAIRII/SciPaper

- Developed a web platform for storing, viewing, and analyzing research papers, leveraging deep learning to automatically extract and highlight key information.
- Implemented an intelligent search engine with custom filters, enabling efficient discovery of relevant papers.
- Built using Django, React, Elasticsearch, and PostgreSQL for a scalable and robust system.

Himma https://github.com/SEGHAIRII/Himma

- Designed a social media–style web platform that empowers users with limited capabilities to express their thoughts through speech-to-text, text completion, in-site voice commands, and sentiment analysis.
- Implemented intelligent language features using LangChain alongside a robust backend in Django and frontend in React.
- Integrated PostgreSQL for reliable data storage and management.

GPT From scratch https://github.com/SEGHAIRII/GPT-Clone

- Implemented the GPT-2 model from scratch, including the byte pair encoder, tokenizer, and full transformer architecture.
- Explored fine-tuning strategies, applying both classification and instruction fine-tuning to adapt the model to downstream tasks.
- Integrated LoRA (Low-Rank Adaptation) to enable more efficient parameter-efficient fine-tuning.
- Built with Python and PyTorch.

Skills

- **Machine Learning & AI**: PyTorch, Transformers, Scikit-learn, Supervised & Unsupervised Learning, Deep Learning, NLP, LLMs, Computer Vision, Reinforcement Learning, Quantization, Sparsity, Prompt Engineering.
- **Scientific Computing & Compilation**: C++, MLIR, LLVM, Optimization Techniques, High-Performance Computing, Parallelization, Multithreading, CMake, Docker.
- **Programming & Data Science**: Python, NumPy, Pandas, SciPy, SQL, Matplotlib, Seaborn, OpenAI Gym, LangChain.
- **Backend & Systems Development**: Django, Django REST Framework, Node.js, Express.js, MongoDB, PostgreSQL, Elasticsearch, REST APIs, Software Design, Testing.
- **Additional Skills**: Java, C, Git/GitHub, React, TypeScript, JavaScript, HTML/CSS, Tailwind CSS, SSH, VPN.
- **Soft Skills**: Research Collaboration, Project Management, Teamwork, Leadership, Problem Solving.

Certificates

- Machine learning Specialization,Deep learning ai,Coursera
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