# Hamza Abdelhedi

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## CURRENT POSITION

- **Mila - Quebec AI Institute; Cognitive & Computational Neuroscience Lab** — Montreal, Quebec, Canada
  *Graduate Research Assistant; Advisor: Dr. Karim Jerbi* — *February 2022 - Present*

## EDUCATION

- **Faculty of Medecine, UdeM - Université de Montréal** — Montreal, Quebec, Canada
  *PhD - Biomedical Engineering* — *September 2024 - Present*
  Advisor: **Dr. Karim Jerbi**
  **Courses:** *Biomedical Engineering Fundamentals: bio-statistics and bio-ethics.*

- **Mila - Quebec AI Institute, UdeM - Université de Montréal** — Montreal, Quebec, Canada
  *Master of Science - Computer Science: Artificial Intelligence* — *September 2022 - Ausgust 2024*
  Advisors: **Dr. Karim Jerbi** and **Dr. Shahab Bakhtiari**
  **Courses:** *Machine Learning for Biomedical Data, Applied Machine Learning, Representation Learning, Towards AGI: Scaling, Alignment and Emergent Behaviors in Neural Nets, Data Structures, Algorithmic.*

- **SUP'COM - Higher School of Communication of Tunis** — Ariana, Tunisia
  *Engineering Diploma - Telecommunication: Smart Image Applications* — *September 2018 - October 2021*
  **Courses:** *Image & Signal Processing, Deep Learning, Medical Imaging, Computer Vision, Graph Theory, Information Theory.*

- **IPEIS - Sfax Preparatory Institute for Engineering Studies** — Sfax, Tunisia
  *Pre-Engineering Studies - Mathematics and Physics; National Rank: 150/1500* — *September 2016 - June 2018*
  **Courses:** *Linear Algebra, Advanced Calculus, Physics, Chemistry.*

- **LPSFH - Sfax Pioneer High School: Farhat Hached** — Sfax, Tunisia
  *Baccalaureate Degree: Mathematics.* — *September 2012 - June 2016*

## WORK AND RESEARCH

- **Systems Neuroscience and AI Lab (Led by Dr. Shahab Bakhtiari)** — Montreal, Quebec, Canada
  *Graduate Research Assistant (Co-supervision Master Thesis) / Collaborator* — *January 2023 - Present*

- **Unifying Neuroscience and Artificial Intelligence in Quebec - UNIQUE** — Remote
  *Engineering Graduation Internship (M.Eng Thesis; Advisor: Dr. Karim Jerbi)* — *April 2021 - October 2021*
    - **Title**: Linking human and artificial neural representations underlying face recognition

- **SFM Technologies** — Tunis, Tunisia
  *Machine Learning Summer Intern (Full-time)* — *July, August 2020*
    - **Electronic devices identification using Machine Learning**:
      - Detect the change of states (On/Off) of appliances in an electric circuit.
      - Compute the harmonics, signature and features of electronic devices & develop an algorithm to identify them.

- **HEXASTACK** — Ariana, Tunisia
  *Natural Language Processing Summer Intern (Full-time)* — *July, August 2019*
    - **Intent Extraction & Sentence segmentation for Tunisian dialect using NLP**:
      - Clean and explore a dataset of Tunisian dialect phrases.
      - Extracte keywords using NER to assign an intent for each phrase & implement a sentence segmentation algorithm.

## TEACHING

- **Methods in cognitive neuroscience 1 - PSY2008;** Psychology Department, UdeM — Montreal, Canada
  *Teaching Assistant*
  Sessions: Autumn 2023 and 2024

- **Laboratory 1 - PSY2007;** Psychology Department, UdeM — Montreal, Canada
  *Teaching Assistant*
  Sessions: Autumn 2024
    - Mentor students to conduct research in a specific field
    - Literature review, experimentation, Report writing

- **Indigenous Pathfinders in AI;** Mila, Université de Montréal — Montreal, Canada
  *Teaching Assistant*
  Sessions: Summer 2024
    - Designed, planned, and taught complementary TA sessions to indigenous-identifying recent graduates
    - Gave an introduction to programming lecture and held office hours for students

**Comp. Neuroscience Summer School;** Arabs In Neuroscience                                          Online
- *Teaching Assistant*
  Sessions: Summer 2024
    - Guide students through coding sessions and tutorials for probability, calculus, algebra and statistics
    - Mentor Students in a 2-day project where they ML to decode fMRI data

## PUBLICATIONS

- *[In Prep]* **La reconnaissance faciale par l'IA et par les humains: une étude comparative combinant réseaux de neurones artificiels et l'imagerie cérébrale**
  ***Abdelhedi. H***. 2024,  [Master Thesis]

- *[In Prep]* **Temporal dynamics of face recognition: Insights from combining MEG and Artificial Neural Networks**
  ***Abdelhedi. H***, *Bakhtiari. S, and Jerbi. K.* 2024,  [Journal Paper]

- *[Accepted]* **Temporal dynamics of face recognition: Insights from combining MEG and ANNs**
  ***Abdelhedi. H***, *Bakhtiari. S, and Jerbi. K.* 2024, Conference on Cognitive Computational Neuroscience, [Conf. Article]

- *[Submitted]* **Intrinsic neural oscillation patterns predict performance and preferred encoding strategy in verbal learnin**
  *Oswald. V, Landry. M,* ***Abdelhedi. H***, *et al.* 2024, The Journal of Neuroscience, [Journal Paper]

- *[Submitted]* **Prediction of cognitive decline by clinical markers in idiopathic REM sleep behavior disorder: a machine learning approach**
  *Berrad. L. M, Dehgan. A, Postuma, R. B, Harel. Y,* ***Abdelhedi. H***, *et al.* 2024,   [Journal Paper]

- *[In prep]* **Artificial Neural Networks for Magnetoencephalography: A review of an emerging field**
  *Dehgan. A,* ***Abdelhedi. H***, *Rish. I, Jerbi. K.* 2024,  [Journal Paper]

- *[Accepted]* **Class imbalance should not throw you off balance: Choosing the right classifiers and performance metrics for brain decoding with imbalanced data**
  *Thölke. P, Mantilla-Ramos. Y,* ***Abdelhedi. H***, *et al.* 2023, NeuroImage, [Journal Paper]

- *[Accepted]* **Linking human and artificial neural representations underlying face recognition: Insights from MEG and CNNs**
  ***Abdelhedi. H*** *and Jerbi. K.* 2022, Conference on Cognitive Computational Neuroscience, [Conf. Article]

## TALKS AND PANELS

- **Unique Student Symposium:** Moderator                                          Quebec City, Quebec, Canada
  *Panel: DEI and Ethics in Neuro-AI*                                                                 *May 2024*
- **CIRCA Scientific Day:** Speaker                                                  Montreal, Quebec, Canada
  *Title: Linking human and artificial neural representations underlying face recognition*             *April 2024*
- **4th Scaling Workshop:** Speaker                                          Mont-Tremblant, Quebec, Canada
  *Title: Brain Similarity Scaling*                                                              *November 2023*
- **UNIQUE Fellows Get together:** Speaker                                           Montreal, Quebec, Canada
  *Title: Linking human and artificial neural representations underlying face recognition*         *November 2023*
- **UNIQUE Scientific Retreat:** Speaker                                             Montreal, Quebec, Canada
  *Title: Linking human and artificial neural representations underlying face recognition*          *October 2023*
- **Montreal AI and Neuroscience Conference:** Moderator                             Montreal, Quebec, Canada
  *Student Panel: Career perspectives in Neuro-AI*                                               *December 2022*

## SELECTED POSTER PRESENTATIONS

- **Conference on Cognitive Computational Neuroscience 2024**                    August 2024 - Boston, USA
  *Title: Temporal dynamics of face recognition: Insights from combining MEG and Artificial Neural Networks*
- **Cognitive Neuroscience Society 2024 Annual Meeting**           April 13-16, 2024 - Toronto, Ontario, Canada
  *Title: Neural Representations of face recognition in biological and artificial systems: Insights from MEG and CNNs*
- **Computational and Systems Neuroscience (COSYNE) 2024**  February 29-March 5, 2024 - Lisbon, Portugal
  *Title: Neural Representations of face recognition in biological and artificial systems: Insights from MEG and CNNs*
- **Organization for Human Brain Mapping (OHBM) 2023 Annual Meeting**   July, 2023 - Montreal, Canada
  *Title: Linking human and artificial neural representations underlying face recognition* [Poster]

- **Montreal AI and Neuroscience 2022 Conference**                    December, 2022 - Montreal, Canada

  *Title: Linking human and artificial neural representations underlying face recognition: A Spectro-temporal Analysis*
  [Poster]
- **Conference on Cognitive Computational Neuroscience 2022**         August 2022 - San Francisco, USA

  *Title: Linking human and artificial neural representations underlying face recognition: Insights from MEG and CNNs*

## CONFERENCES

- 2024: CNS (Cognitive Neuroscience Society), COSYNE (Computational and Systems Neuroscience), CCN (Conference on Cognitive Computational Neuroscience).

- 2023: OHBM (The Organization for Human Brain Mapping) Annual Meeting, Neuro-AI workshop, CuttingEEG Montreal Garden, 4th Scaling Workshop.

- 2022: MAIN (Montreal AI and Neuroscience conference), USS (UNIQUE Students Symposium), CCN.

- 2021: MAIN, IEEE TSYP (Tunisian Students and Young Professionals).

- 2020: MAIN, IEEE TSYP Congress, Smart Green Island makeathon.

- 2019: IndabaX Tunisia: (African deeplearning AI conference), IEEE TSYP Congress.

## SKILLS SUMMARY

- **Programming Languages**:    Python, C++, Java, SQL, Bash
- **Libraries**:                Scikit-learn, Keras, Pytorch, Python-MNE, NiBabel, OpenCV
- **Tools & Platforms**:        Linux, GIT, Github, cuda, LaTeX, Windows
- **Languages**:                English: Professional Proficiency (C2), French: Professional Proficiency, Arabic: Native
- **Soft Skills**:              Leadership, Event Management, Writing, Public Speaking

## HONORS AND AWARDS

- *[Scholarship]:* **25000CAD/year;** Merit Scholarship from the AI Research Fund of the Faculty of Medicine (3 years)                    September, 2024

- *[Scholarship]:* **3000CAD;** Computer Science Merit Scholarship for Excellent Students          April, 2024

- *[Travel Grant]:* **500CAD;** To attend CNS2024 by R-BIQ conference program          April, 2024

- *[Travel Grant]:* **1000CAD;** To attend COSYNE2024 by UNIQUE Travel Grants Program          March, 2024

- *[Travel Grant]:* **1000USD;** COSYNE2024 New Attendee Travel Award          March, 2024

- *[Scholarship]:* **8000CAD;** CIRCA Master Level Scholarship Program          September, 2023

- *[Scholarship]:* **3000CAD;** Computer Science International Student Scholarship          April, 2023

- *[Scholarship]:* **5000CAD;** Cerebrum Scholarship Program          March, 2023

- *[Scholarship]:* **10000CAD;** UNIQUE Excellence Scholarship (MSc level)          January, 2023

- *[Award]:* **200CAD;** The Institut Intelligence and Data best poster award during MAIN2022          December, 2022

- *[Scholarship]:* **10000CAD;** Université de Montréal graduate tuition fee exemption - Master Level          August, 2022

- *[Scholarship]:* **6000CAD;** Mitacs Globalink Award for a research internship          April, 2021

- *[Award]:* **Certificate;** Best Ambassador for the IEEE R8 (EMEA) entrepreneurship Initiative          November, 2020

- *[Award]:* **2500TND;** Third Prize in the SUP'COM Entrepreneurial Challenge          July, 2020

- *[Travel Grant]:* **500EURO;** Spain Smart Green Island Makeathon          March, 2020

## MENTORING

- *[Undergraduate]:* **Anis Abdeladim;** Research Internship          Summer 2024

- *[Undergraduate]:* **Maryem Benslimane;** Graduation Internship          Summer 2024

- *[Undergraduate]:* **Meriem Rebaani;** Graduation Internship          Summer 2024

## MEDIA

- *[Interview]:* **Do Interviews Series;** by Insat Press          January 2021

## Volunteering

- **Harms and Risks of AI in the Military Workshop** — Montreal, Canada
  *Organizer* — *2-3 December 2024*
  - A cross-disciplinary workshop fostering an open and inclusive discussion on the harms and risks of using AI for military purposes.

- **Against Military AI Reading Group** — Montreal, Canada
  *Organizer* — *March 2024 - Present*
  - Bi-weekly meetings to discuss the misuse of AI in military applications.

- **UNIQUE Student Activities Committee** — Montreal, Canada
  *Student Representative within the scientific committee of UNIQUE* — *September 2022 - August 2024*
  - Contribution to the organization of MAIN, USS, UNIQUE Fellows Get-Together, UNIQUE Scientific retreat, and other UNIQUE activities.
  - Discussion of students' interests with UNIQUE's scientific committee.

- **CuttingEEG Montreal Garden** — Montreal, Canada
  *Organizer* — *16-18 October 2023*
  - An event to bring together experts and enthusiasts studying the brain using MEG and EEG.

- **IEEE SUP'COM Student Branch** — Ariana, Tunisia
  *Mentor* — *June 2020 - December 2023*
  - Help the executive committees setting the SB major plans and provide feedback and tutoring on projects.
  - Present the SB plan in 2021 competition to host the TSYP (Secured 2nd place).

  *Chairman* — *June 2019 - May 2020*
  - Preside executive committee meetings and General Assemblies.
  - Plan, manage and organize multiple events, workshops and projects as well as units activities.
  - Ranked 3rd Best Student Branch in Tunisia, got 2 awards from IEEE Region 8 & won several competitions.

  *Member* — *September 2018 - May 2019*
  - Participate in workshops and help organize events like IEEEXtreme and Coding 101.

- **Tunisia Entrepreneurship Summit** — Tunis, Tunisia
  *Event Manager* — *November 2020*
  - A one month bootcamp on entrepreneurship as part of the IEEE R8 Entrepreneurship Initiative, included keynotes, workshops and a competition.
  - Won the best Entrepreneurship Initiative award by IEEE R8.

- **Higher School of Communication of Tunis - SUP'COM** — Ariana, Tunisia
  *Student Representative* — *March 2019 - February 2020*
  - Represent students within the the scientific council, relay suggestions to the Director and Secretary of the school.

- **Smart Green Island Makeathon** — Gran Canaria, Spain
  *Competitor* — *March 2020*
  - An educational event in which several teams (400 students from different countries and backgrounds) work on new innovative solutions over 4 days; participated thanks to a travel grant.

- **Hack for Earth** — Ariana, Tunisia
  *Event Manager* — *November 2019*
  - A one-day hackathon in collaboration with Zindi where technology meets ecology, in which the participants worked and helped solve an environmental challenge that aims to establish solutions for the common good.

- **Smart Green TUNISIA Makeathon** — Tunis, Tunisia
  *Organizer* — *September 2020*
  - A special live-event where 120 participants created, developed, designed, and pitched a software or hardware green project they have built from scratch.

- **RightsCon Tunis 2019** — Tunis, Tunisia
  *Volunteer* — *June 2019*
  - Facilitate logistics and answer attendees questions.
  - An international Human Rights conference in the digital age organized by access now.

- **Deep Learning IndabaX Tunis 2019** — Ariana, Tunisia
  *Organizer* — *April 2019*
  - Co-Led the organization of the deeplearning Indaba first local edition in Tunisia.
  - A one day event with AI related keynotes, workshops by leading scientists in the field.

- **PACTE PROJECT**                                 Kef, Tunisia
  *Organizer*                                       *February 2019*
  - Organized a breast cancer sensibilization day for underprivileged women at the rural areas of el Kef city.
- **Coding 101**                                      Ariana, Tunisia
  *Volunteer*                                       *October 2018*
  - A 3-day coding event for primary school students to teach them scratch with a focus on girls in STEM.

## Selected Projects

- **Algorithms, Artificial Neural Networks and Machine Learning models implemented from scratch** :
  (September 2022 - April 2023)
  - Descion Tree and kNN with application on messiodor and heptatis datasets.
  - Multi Layer Perceptron (ANN) with different types of layers with application on MNIST Digits dataset.
  - Log Regression (Binary and multiclass), Linear Regression and Gradient Descent (SGD, ADAProp, ADAM) with application on IMDB dataset.
  - Data Structures (Lists, Queues, Piles...) and Algorithms (Dijkistra, BFS, DFS ...) and apply them on real world applications.
  - SimSiam model, Generative Difussion model and Variational-Autoencoder.
  - MLPMixer, ResNet18, GRU and Transformer.

- **Masked-Face ID recognition**:
  (October 2020 - December 2020)
  - Engineering a dataset of masked faces where each person have several pictures with different masks.
  - Combining two CNN architectures to develop an ID detection algorithm.