AYMEN HAMROUNI

Artificial Intelligence Researcher, Deep Learning and Algorithm Design, M.Sc. @ KAUST
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Aymen Hamrouni* (01/1996) received his Diplome d'Ingenieur/B. Eng. (*summa cum laude*) in Telecommunication Engineering from the École Supérieure des Communications de Tunis (SUP'COM), Tunis, Tunisia, in 2019. Before that, he recieved his CPGE degree in advanced theoretical mathematics and physics (*Hons.*) from Institut Préparatoire aux Etudes d'Ingénieur de Sfax, in 2016. Aymen is an autonomous, passionate, and self-motivated engineer with a multidisciplinary background in information technologies. He is equipped with thorough mathematical knowledge, data-structures and graph theory expertise, and advanced data science skills. Fluent in Python, C++, and Matlab, Aymen's current work interests* lay in the intersection of intelligent algorithm design, artificial intelligence, computer vision, segmentation and generative models.

EDUCATION

King Abdullah University of Science and Technology (KAUST) *Aug. 2021 - Dec 2022*
Ivy League University Thuwal, Saudi Arabia

Pursuing M.S. in Electrical and Computer Engineering with minor in Computer Science
Affiliated as an AI researcher (Co-founder) with Innovative Technologies Laboratories* (Est. 2021)
Working on versatile computer vision projects including image quality assessment, artifact de-noising, and camera-based autonomous navigation systems.
GPA: 3.93
Advisor: Prof. Yehia Massoud and Dr. Hakim Ghazzai

Higher School of Communication of Tunis (SUP'COM) *Sep. 2016 - Jan 2020*
Bachelor of Engineering (Diplome D'ingénieur) in Telecommunication Ariana, Tunisia
Minor in Computer Science
Graduated with Honors *(summa cum laude)* with the best graduation project in 2020
GPA: 3.81

Sfax Preparatory Engineering School (IPEIS) *Sep. 2014 - May 2016*
French CPGE Degree Sfax, Tunisia
Intensive 2-year program of theoretical Math and Physics
Obtained the preparatory diploma with flying colors and ranked among 3% national wide in the National Entrance Contests for Engineering Training Cycle in Tunisia

EXPERIENCE

Supermind Technology Inc. October 2022 - January 2023
Founding Data Science Engineer/ Team Lead *Remote*

- Led the Data Science Department at Supermind to tackle various cutting-edge problems around NLP applied for Web3.
- Designed NLP architectures and feed-forward pipelines to overcome training data scarcity and enable keyword extraction, sentence classification, semantic search, etc.
  Key-words: Transformers, Bert, Sentence Similarity, Token Classification, Zero-shot Learning, Data Analysis

Stevens Institute of Technology October 2020 - July 2021
AI Research Scholar *Hoboken, NJ, USA*

· Designed low-complexity meta-heuristic algorithms for team formation and task recommendation in collaborative mobile crowdsourcing using social Internet-of-Things networks.
· Worked on enabling innovative Graph Neural Network techniques for service discovery and resource recommendation in social IoT.
· Affiliated with the "Smart Cities" laboratory at SSE, NJ, USA.
Key-words: Recommendation systems, Particle Swarm Optimization, Genetic algorithm, Graph Neural Network, Approximation algorithms

Stevens Institute of Technology January 2019 - September 2020
Research Intern *Hoboken, NJ, USA*

· Enabled spatial and collaborative mobile crowdsourcing applications in smart cities and large-scale networks by the means of optimization, graph theory, and deep learning techniques.
Key-words: Mixed/Integer Linear Programming, Bayesian optimization, Bipartite Graph, Feature Matching, Dynamic Programming, Greedy Algorithms, Constrained Programming

Aprico Consulting June 2018 - September 2018
*Big Data Intern** *Sfax, Tunisia*

· Designed I-Monitor, a data analytic tool that provides actionable insights to take actions from several types of structured and unstructured log files
Key-words: Kibana, Elasticsearch, Java, Rest API, Talend ETL, Batch, Scrum

PROFESSIONAL PROJECTS

• Crowd Management and Danger Prediction with V3Trans-Crowd (KAUST, 2022)
I designed a transformer-based crowd monitoring framework, called V3Trans-Crowd, that captures information from video data and extracts meaningful output to categorize the behavior of the crowd. As our approach is hierarchical and based on a self-attention mechanism that learns the relationships between elements of the video's frames, it enables the modeling of long dependencies while supporting parallel processing and demonstrating excellent scalability to very large capacity networks and huge datasets.
Keywords: Vision Transformers, BERT, Attention Mechanism, Behaviour Analysis

• Low-complexity real-time video de-noising of corrupted video feed with rain and environmental effects for autonomous vehicles (KAUST, 2022)
Created a low-latency video processing pipeline where videos captured by a low-quality camera equipped to the navigation systems of a device (e.g., UAV, autonomous vehicle) is cleaned from rain droplets and rainstreaks and other environmental effects and then reconstructed and enhanced. The resultant de-noised feed becomes more plausible and artifact-free to the driver and also to object detection/recognition algorithms.
Keywords: Generative Adversarial Networks (GANs), Continual Learning, Computer Vision, Auto-Encoders (AE), Optical Flow for motion estimation

• Mobile Crowdsourcing Image-based Event Reporting System (MIT, 2021)
Designed two heuristic low-latency AI-powered redundancy filtering and quality check system for captured images in Mobile Crowdsourcing frameworks. After the IoT devices capture the needed photo of the event, wrong, inaccurate, and redundant images must be dismissed before being uploaded to

save resources such as energy and bandwidth. The first designed approach relied on an optimized and compressed Convolutional Neural Network (CNN) with a graph data-structure P-tree search while the second approach relied on a mixed and hierarchical multi-modal auto-encoder with meta-data embedding and clustering analysis.
Keywords: NLP, Transformers, BERT, Auto-Encoders, Feature analysis, Clustering, Graph theory, Django, Rest API, OpenCV

• Recruitment and Scheduling in Spatial Mobile Crowdsroucing (Meta AI, 2020)
Designed several deterministic algorithms to recruit and match/recommend suitable IoT devices to crowdsourcing task in dynamic and large-scale IoT networks. These systems include a highly convex formulation with an Integer Linear Program (ILP) constrained problem and a Mixed Integer Linear Program (MILP). Because this problem is NP-complete, several stochastic approaches were also created based on either, Genetic Algorithm (GA), Particle Swarm Optimization (PSO), Optimal Stopping Strategy, and tweaked bipartite graph matching.
Keywords: SIFT, Stochastic optimization, Integer Linear Programs, Bipartite graph matching, Stable marriage, Genetic Algorithm, Gurobi

• Team formation in Collaborative Mobile Crowdsroucing for Social (Stevens Inst., 2020) IoT
Formulated and solved optimal team formation problems to create groups of IoT devices that match specific required tasks. The formulated approach serves also as community detection and resource allocation for different components in the IoT network. As the problem is NP-hard, heuristic Fuzzy-logic approaches, inspired from Graph Neural Networks and graph embedding, were also proposed.
Keywords: Social IoT, Community detection, Graph Neural Network, Node embedding, Clustering analysis, Fuzzy-logic

ACADEMIC PROJECTS

• IoT Agro Environnemental
Was part of a team that designed a smart IoT application relying on wireless sensor network for data acquisition and control for agriculture irrigation.
Keywords: Zolertia, Contiki, Node-RED, 6loWPAN, Raspberry Pi 2, MySQL, C, 6LBR, RPL

• Smart Home Security*
Designed a Smart Home hybrid mobile application that enables distant control over the house' facilities (e.g., Windows) and monitor the security status.
Keywords: Node.JS, Ionic, SSL/TLS, Corodova, Socket.io, MongoDB, REST, JWT, MQTT

• Smart-Phone Indoor/Outdoor Localization System
Designed a localization system which uses the images captured by the mobile of the user and gives the latter the ability to determine his/her position and to navigate even in GPS's coverage dead zones using image feature matching.
Keywords: Machine Learning, SIG, Django, AngularJs, Cordova, Xamarin, XML, JavaScript

• Student Guide
Worked on an android application called "Student Guide" that facilitates student's life by giving them access to several features such as filling administrative forms, creating their private online club chat and accessing their grades.
Keywords: Web Scrapping, HTTPs, MySQL, Android Studio, Hashing, Google APIs

SIDE STRENGTHS

Programming Languages	Python, C, C++, Java, Matlab
Protocols & APIs	SOAP, REST
Databases	MySQL, Elasticsearch, MongoDB
Python Libraries	TensorFlow, Pytorch, Keras, Pandas, OpenCV, Numpy
Languages	Arabic (Native), English (C1), French (B1)
Academic Certificates (Highlights)	CCNA 1, 2 and 3, TOEFL(101/120)*, GRE(312/3)*
Professional Certificates (Highlights)	Discrete Optimization, Deep Learning, CNN & and NNs, Computer Vision Speciality, Improving Deep Neural Networks: Hyper-parameter Tuning, Regularization and Optimization.

PUBLICATIONS

1. **A. Hamrouni**, H. Ghazzai, and Y. Massoud, "V3Trans-Crowd: A Video-based Visual Transformer for Crowd Management Monitoring," [**Pending peer-review**].
2. **A. Hamrouni**, H. Ghazzai, and Y. Massoud, " Multi-modal Asymmetric Autoencoders for Massive Photo Collection Applications," [**Pending peer-review**].
3. **A. Hamrouni**, H. Ghazzai, and Y. Massoud, "Generative Adversarial Networks for de-noising Images Corrupted with Environmental Effects," [**Pending peer-review**].
4. **A. Hamrouni**, H. Ghazzai, and Y. Massoud, "Resource Allocation in Social IoT using Graph Neural Networks," [**Pending peer-review**].
5. **A. Hamrouni**, H. Ghazzai, and Y. Massoud, "Graph Neural Networks for Service Discovery and Navigability in Social Internet-of-Things: Opportunities and Challenges," [**Pending peer-review**].
6. **A. Hamrouni**, A. Khanfor, H. Ghazzai, and Y. Massoud, "A Graph Neural Network Approach for Large-scale Service Discovery using Social Internet-of-Things," [**Pending peer-review**].
7. **A. Hamrouni**, H. Ghazzai, Y. Massoud, H. Menouar, and F. Salim, "Unmanned Aerial Vehicles in Crowd Management Systems: Opportunities and Challenges" [**Pending peer-review**].
8. H. Ganame, L. Yingzhuang, **A. Hamrouni**, H. Ghazzai, "Evolutionary Algorithms for 5G Multi-Tier Radio Access Network Planning," in IEEE Access, 2021.
9. **A. Hamrouni**, H. Ghazzai, T. Alelyani, and Y. Massoud, "Towards Collaborative Mobile Crowdsourcing," in IEEE Internet-of-Things Magazine (IoT- M), 2021.
10. **A. Hamrouni**, H. Ghazzai, T. Alelyani, and Y. Massoud, "Low-Complexity Recruitment for Collaborative Mobile Crowdsourcing Using Graph Neural Networks," in IEEE Internet-of-Things (IoT), 2021.
11. **A. Hamrouni**, H. Ghazzai, T. Alelyani, and Y. Massoud, "An Evolutionary Algorithm for Collaborative Mobile Crowdsourcing Recruitment in Socially Connected IoT Systems," 2020 IEEE Global Conference on Artificial Intelligence and Internet of Things (GCAIoT), Dubai, UAE, 2020.
12. **A. Hamrouni**, H. Ghazzai, T. Alelyani, and Y. Massoud, "Optimal Team Recruitment Strategies for Collaborative Mobile Crowdsourcing Systems," 2020 IEEE Technology Engineering Management Conference (TEMSCON), Novi, MI, USA, 2020.
13. A. Khanfor, **A. Hamrouni**, H. Ghazzai, Y. Yang, and Y. Massoud, "A Trustworthy Recruitment Process for Spatial Mobile Crowdsourcing in Large-scale Social IoT," 2020 IEEE Technology Engineering Management Conference (TEMSCON), Novi, MI, USA, 2020.
14. **A. Hamrouni**, H. Ghazzai, and Y. Massoud, "Many-to-Many Recruitment and Scheduling in Spatial Mobile Crowdsourcing," in IEEE Access, 2020.

15. **A. Hamrouni**, H. Ghazzai, M. Frikha, and Y. Massoud, "A Spatial Mobile Crowdsourcing Framework for Event Reporting," in IEEE Transactions on Computational Social Systems, April 2020
16. **A. Hamrouni**, H. Ghazzai, T. Alelyani, and Y. Massoud, "A Stochastic Team Formation Approach for Collaborative Mobile Crowdsourcing," 2019 31st International Conference on Microelectronics (ICM), Cairo, Egypt, 2019.
17. **A. Hamrouni**, H. Ghazzai, M. Frikha, and Y. Massoud, "A Photo-Based Mobile Crowdsourcing Framework for Event Reporting," 2019 IEEE 62nd International Midwest Symposium on Circuits and Systems (MWSCAS), Dallas, TX, USA, 2019.

HONORS AND AWARDS

- M.S. Fellowship, King Abdullah University of Science and Technology (KAUST), September, 2021
- Provost Fellowship, Stevens Institute of Technology, August, 2021
- Best Dissertation Award, Higher School of Communication of Tunis (SUP'COM), January, 2020
- Best Dissertation Award, Higher School of Communication of Tunis (SUP'COM), January, 2020
- Excellence Scholarship, Higher School of Communication of Tunis (SUP'COM), August, 2016

SERVICES

- Active reviewer in IEEE IoT Journal, IEEE Transactions on Computational Social Systems, IEEE Access, and IEEE Communication Letters.