

AYMEN HAMROUNI

Artificial Intelligence Researcher, Deep Learning and Algorithm Design, M.Sc. @ KAUST
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Aymen Hamrouni* (01/1996) is currently a M.Sc. student in Electrical and Computer Engineering at King Abdullah University of Science and Technology (KAUST) under the supervision of Prof. Yehia Massoud*. Aymen 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 received 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 researcher 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 algorithm design, deep generative models, graph theory, and computer vision. Aymen is currently serving as an active reviewer in IEEE IoT Journal, IEEE Transactions on Computational Social Systems, IEEE Access, and IEEE Communication Letters. During the span from 2019 to 2021, he was affiliated as a research assistant and then promoted to be a junior research scientist with the School of Systems and Enterprises at Stevens Institute of Technology, New Jersey, USA. He has managed, till now, to be part of more than 6 industry-oriented projects and produce more than 15 state-of-the-art scientific papers including journals, conferences, and magazines in various top IEEE venues.

EDUCATION

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|---|---|
| King Abdullah University of Science and Technology (KAUST)
Ivy League University
Currently pursuing M.Sc. in Electrical and Computer Engineering
Minor in Computer Science
Affiliated (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
Advisor: Prof. Yehia Massoud and Dr. Hakim Ghazzai | <i>Aug. 2021 - Dec 2022</i>
Thuwal, Saudi Arabia |
| Higher School of Communication of Tunis (SUP'COM)
Bachelor of Engineering (Diplome D'ingénieur) in Telecommunication
Minor in Computer Science
Graduated with Honors (<i>summa cum laude</i>) with the best graduation project in 2020
GPA: 3.81 | <i>Sep. 2016 - Jan 2020</i>
Ariana, Tunisia |
| Sfax Preparatory Engineering School (IPEIS)
French CPGE Degree
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 | <i>Sep. 2014 - May 2016</i>
Sfax, Tunisia |

EXPERIENCE

- | | |
|--|---|
| Stevens Institute of Technology
<i>Junior Research Scientist</i> | October 2020 - Present
<i>Hoboken, NJ, USA</i> |
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- Joint research work with KAUST.
- Designing low-complexity meta-heuristic algorithms for team formation and recruitment in collaborative mobile crowdsourcing using social Internet-of-Things networks.
- Working on enabling innovative Graph Neural Network techniques for service discovery in social IoT.
- Affiliated with the "Smart Cities" lab.

Key-words: Particle Swarm Optimization, Genetic algorithm, Graph embedding, Graph Neural Network, Approximation algorithms

Stevens Institute of Technology

Research Intern/Scholar

January 2019 - September 2020

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, Local search, Meta-heuristic, Bipartite Graph, Dynamic Programming, Greedy Algorithms, Constrained Programming

Aprico Consulting

*Big Data Intern**

June 2018 - September 2018

Sfax, Tunisia

- Designed I-Monitor, a data analytic tool that provides actionable insights from several types of structured and unstructured log files

Key-words: Kibana, Elasticsearch, Java, Rest API, Talend, Batch, Scrum

PROFESSIONAL AND ACADEMIC PROJECTS

- Low-complexity real-time video de-noising of corrupted feed with rain and environmental effects for autonomous vehicles

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

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: Convolutional Neural Network, Multi model Auto-Encoders, Feature analysis, Clustering, Graph theory, Django, Rest API, OpenCV

- Recruitment and Scheduling in Spatial Mobile Crowdsourcing

Designed several deterministic algorithms to recruit and match suitable IoT devices to crowdsourcing task in dynamic and large 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: Integer Linear Programs, Convex optimization, Bipartite graph matching, Stable marriage, Genetic Algorithm, Gurobi

- Team formation in Collaborative Mobile Crowdsourcing for Social 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

- 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, Cordova, 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 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	XML, JSON, SOAP, REST
Databases	MySQL, Elasticsearch, MongoDB
Vanilla Python ML Libraries	TensorFlow, Pytorch, Keras, Pandas, OpenCV, Numpy
Languages	Arabic (Native), English (C1), French (B1)
Academic Certificates	CCNA 1, 2 and 3, TOEFL(101/120)*, GRE(312/3)*
Professional Certificates	Discrete Optimization, Deep Learning, CNN & NNs

RESEARCH 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
- Excellence Scholarship, Higher School of Communication of Tunis (SUP'COM), August, 2016