# Mahmoud Abdelrahman

PhD. (Data Science in the Built Environment), Research Scientist, Product Manager, and Founder.

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## SUMMARY

I love data,

I'm driven by tech and data for creating better, sustainable cities. Currently, I'm a postdoc at NUS Urban Analytics Lab, delving into city digital twins and AI for the built environment. I'm co-founder at SpaceMatch, a startup using big data and AI for optimizing the work environemnt.

Prior to my current job, I worked as a product manager and research sceientist with over ten years of experience in Data Science and Machine Learning. I got my PhD. in the built environment from the National University of Singapore (NUS). I have developed a broad range of technical and interpersonal skills, including experience in Data Analytics, AI, Business development, and Leadership. I have also successfully commercialized my research outcome from ideation all the way to production and raising funds. My approach to product management utilizes design thinking, while my ability to communicate complex concepts and ideas to diverse groups has enabled me to consistently create positive impact in my field. I am motivated to continue growing my knowledge and making a lasting contribution to the industry.

## WORK EXPERIENCE

**Postdoc Research Fellow, NUS, Singapore**                    Nov 2023 - Present

– Worked on a City Digital Twin project.
– Identified key data and built AI/ML models for digital twin and Geospatial Artificial Intelligence projects.
– Developed Novel models on Street View Imaging to optimize resource allocation.
– Developed a Large Language Model to extract information from 10,000 research papers in the field of Digital Twins.
– Collaborated with multi-desciplinary teams to build a Digital Twin platform for NUS campus.

**Product Manager, Saltmine, Singapore.**                    Mar 2022 - Aug 2023

– Led ideation and development of a workspace utilization and recommendation engine and a corporate portfolio workspace strategy optimization system.
– Worked closely with the data science, ui/ux, QA, and Engineering teams.
– Led my team during scrum meetings and Sprints.
– Communicated with different stakeholders to build the features.
– Identified valuable data sources,
– Automated collection processes, and pre-process of structured and unstructured data.
– Built predictive models and machine-learning algorithms.
– Built data products that extract valuable business insights and drive optimal actions.
– Developed proof of concept software. Led teams of designers, data scientists, and engineers to develop a recommendation system and Automated TestFit.
– Built APIs using Python and FastAPI, and implemented optimization solutions using Reinforcement Learning, Single Objective Optimization, and Multi-Objective Optimization.

**CEO and CTO, SpaceMatch Pte. Ltd, Singapore.** Mar 2021 - present
– Led the development of a B2B2C SaaS platform for workspace recommendation and digital twin data analytics
– Raised funding for the project
– Defined the product vision and strategy
– Worked with the business team to align the product with market requirements
– Identified pain points and developed innovative solutions to address them

**Resarch Associate, NUS, Singapore** Jan 2019 - Feb 2021
Building and Urban Data Science (BUDS) Lab
– Contributed to defining research problems, scope, and experiment design for spatial-temporal indoor environmental satisfaction.
– Developed an indoor localization mobile app for spatial-temporal data analytics with digital twins.
– Conducted indoor satisfaction experiments and fused the subjective data with BIM spatial data using neural graph networks and digital twins.
– Assisted in teaching and preparing educational materials for online Edx MOOC (Data Science for Construction, Architecture, and Engineering).
– Assisted in evaluating and giving feedback on students' projects.
– Mentored final year project (FYP) students and helped them define research problems and project scope.
– Contributed to developing and debugging a smartwatch app for collecting user feedback on health, wellness, and privacy.
– Published and co-authored articles in top-tier journals and conferences.
– Built state-of-the-art Graph Neural Network Python library for BIM spatial-temporal data integration called (Build2Vec).

**Research Assistant, NUS, Singapore** Mar 2019 - Jan 2020
Integrated Data, Energy Analysis, and Simulation (IDEAS) Lab
– Defined and developed an end-to-end modular web-based visual programming app for building integrated energy simulation and data visualization (Vizpro).
– Developed a tool for creating and optimizing floor plans for foreign worker dormitories that meets regulatory requirements related to the COVID-19 pandemic.
– Published research papers in top tier journals and conference venues.

# PROJECTS

**Build2Vec V1.0**                                                    Link to Demo

Python library for Spatial-temporal BIM to Digital Twin integration using Graph Neural Network

**VizPro V.1.0.0**                                                    Link to Demo

React-JS modular library (JavaScript) for visual programming.

**SpaceBrain (Software Invention Disclosure)**

(ILO Ref: 2021-140)– Title: SpaceBrain: System and Methods for a Corporate Employees' Flexible Workspace Dynamic Allocation

**SpaceMatch**                                                          Website

Peer to Peer sharing economy platform for workspace matching using advanced AI.

# EDUCATION

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|---|---|---|
| 2018 - 2022 | PhD (Built Environment) at **NUS - Singapore** | (GPA: 4.83/5.0) |
| 2012 - 2017 | M.Sc. (Architectural Engineering) at **Mansoura University - Egypt** | (GPA: 4.8/5.0) |
| 2004-2009 | B.Sc. (Architectural Engineering) at **Mansoura University - Egypt** | |

# SKILLS

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|---|---|
| Agile Methodology | JIRA; Scrum and Kanban methods; and advanced roadmaps |
| AI and Data science | Machine Learning, Computer Vision, Natural Language Processing, and GANs; Spatial-temporal data analysis, Single and Multi-objective optimization, Graph Neural Networks, Embeddings, Data visualization, Statistical methods, web scrapping; and Business Intelligence |
| Graph data science | Graph embeddings, Graph NN, Graph Query using Neo4J and Cypher. Large graph data mining. |
| Coding | Python, JavaScript, MERN stack, Node.js, React-js, React-Native, .Net framework, and C++, React-three/fiber, three.js |
| Cloud computing | Google Cloud Platform, Cloud Run, Containers, Cloud functions, Compute Engine, Cloud Storage, AWS, Firebase |
| Building Science | Building Simulation, BMS data mining, Digital Twin integrations, Building information modelling with IFC.js. GIS data analysis using QGIS and geoPandas. |
| Game Engines and graphics | Unity, 3D Max, Rhinoceros, Blender, Figma, FigJam, Photoshop, Illustrator, AfterEffects, Adobe Premier |
| Design | Architecture, Interior Design, UI/UX, Logo design |
| Personal | Leadership, Teaching and mentoring, Team management, distributed workforce team management. |

# PUBLICATIONS

Abdelrahman, Mahmoud M et al. (2022). "Personal thermal comfort models using digital twins: Preference prediction with BIM-extracted spatial-temporal proximity data from Build2Vec". In: *Building and Environment*.

Abdelrahman, Mahmoud et al. (2021). "Longitudinal Personal Thermal Comfort Preference Data in the Wild". In: *Proceedings of the 19th ACM Conference on Embedded Networked Sensor Systems*. SenSys '21. Coimbra, Portugal: Association for Computing Machinery, pp. 556–559. ISBN: 9781450390972. DOI: 10.1145/3485730.3493693. URL: https://doi.org/10.1145/3485730.3493693.

Abdelrahman, Mahmoud M, Sicheng Zhan, et al. (July 2021). "Data science for building energy efficiency: A comprehensive text-mining driven review of scientific literature". en. In: *Energy Build.* 242.110885, p. 110885. DOI: 10.1016/j.enbuild.2021.110885.

Miller, Clayton et al. (2021). "The Internet-of-Buildings (IoB)–Digital twin convergence of wearable and IoT data with GIS/BIM". In: *Carbon Neutral Cities - Energy Efficiency Renewables in the Digital Era*. Lausanne, Switzerland.

Abdelrahman, Mahmoud M. et al. (2020). "Build2Vec: Building Representation in Vector Space". In: *Proceedings of the 11th Annual Symposium on Simulation for Architecture and Urban Design*. SimAUD '20. Virtual Event, Austria.

Abdelrahman, Mahmoud M. et al. (2020). "A Three-Tier Architecture Visual-Programming Platform for Building-Lifecycle Data Management". In: *Proceedings of the 11th Annual Symposium on Simulation for Architecture and Urban Design*. SimAUD '20. Virtual Event, Austria.

Jayathissa, Prageeth et al. (2020). "Humans-as-a-Sensor for Buildings—Intensive Longitudinal Indoor Comfort Models". In: *Buildings* 10.10. ISSN: 2075-5309. DOI: 10.3390/buildings10100174. URL: https://www.mdpi.com/2075-5309/10/10/174.

Sood, Tapeesh et al. (Nov. 2019). "The {SDE4} Learning Trail: Crowdsourcing occupant comfort feedback at a net-zero energy building". In: *J. Phys. Conf. Ser.* 1343.1, p. 12141.

Tarabieh, Khaled et al. (Sept. 2019). "Statics of space syntax: Analysis of daylighting". In: *Frontiers of Architectural Research* 8.3, pp. 311–318. ISSN: 20952635. DOI: 10.1016/j.foar.2019.05.004.

Abdelrahman, Mahmoud M. and Ahmed Mohamed Yousef Toutou (2019). "ANT: A Machine Learning Approach for Building Performance Simulation: Methods and Development". In: *The Academic Research Community publication* 3.1, p. 205. ISSN: 2537-0154. DOI: 10.21625/archive.v3i1.442.