

Mohamed Fakhry Eldin Ghalwash, Ph.D.

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 Citations

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About

Mohamed Ghalwash is interested in developing novel machine learning and AI models for discovery of interpretable spatio-temporal patterns from complex events and exploiting their utilities in practical high impact real-world applications, focusing on analytics for healthcare, health behavior, and decision support to support the generation of real world evidence from medical data, wearable devices and instrumented environments. He also has more than ten years of expertise in the software engineering industry, developing software that are currently being deployed. He engaged in all phases of the project life cycle for the development of large business applications. He has held positions as a technical team leader for professional service department in Asset Technology Group, a Java Architect (senior expert) for the Java department in Raya Software, a team leader, leading a team of 5 members responsible for producing UML design class diagrams and detailed sequence diagrams for an Automated Web Based Integration System (ERP) of a Credit Guarantee Company, and an instructor, teaching Java, and J2EE as part of the Ministry of Communication and Information Technology (MCIT)'s Basic Training Program at IBM partner NileSoft, and Orascom partner Allied Consultant.

In IBM, I was responsible for driving an innovative and strategic research agenda that introduces differentiating novel and innovating technologies in IBM offering in healthcare and life sciences. I applied my experience to a wide set of problems ranging from disease progression modeling to novel approaches for chronic diseases. In the disease progression modeling space, I investigated the development of state-of-the-art machine learning techniques such as temporal sequence mining techniques like newly emerging multitask learning techniques, in novel ways to help the customers better understand how complex chronic disease progress in an objective, data driven way. I have developed such models to bring unprecedented new possibilities for the understanding of complex chronic disease that are heavily impacting the overall healthcare development of drugs that may reduce or even halt the progression of these disease. I was also involved in the development of new machine learning schemes that learn not just from data but also in the presence of external knowledge.

In Proteinea, I lead a team of AI researchers, data scientists, and engineers. I developed a framework for learning and development aimed at enhancing the skills of the research team and establishing performance goals for individual team members. This framework was successfully implemented, leading to significant skill improvements within the team.

Prior to working for IBM, I worked on various projects at Temple University that involved developing machine learning models to tackle challenging problems. I developed novel ideas for early detection and accurate detection of change in the state of sepsis. In addition, I have mentored students and participated in developing predictive models for temporal social network and BIG temporal graphs using probabilistic exponential graphical model.

My long-term goal is to put my footprints in the field of machine learning and pattern recognition through contribution of original ideas and translating those ideas to end applications and products.

Employment History

Academia

2025/9 – Present

◆ **Associate Professor**, Data Science and AI Program, School of Computational Sciences and Artificial Intelligence, Zewail City, Giza, Egypt.

Employment History (continued)

2023/1 – Present	◆ Associate Professor , Computer Science, Mathematics Department, Faculty of Science, Ain Shams University, Cairo, Egypt.
2014/9 – 2016/8	◆ Research Assistant Professor , Center for Data Analytics and Biomedical Informatics, Temple University, Philadelphia, USA.
2014/6 – 2022/12	◆ Assistant Professor , Faculty of Science, Ain Shams University, Cairo, Egypt.
2013/9 – 2014/8	◆ Postdoctoral Associate , Center for Data Analytics and Biomedical Informatics, Temple University, Philadelphia, USA.
2011/9 – 2013/8	◆ Research Assistant , Center for Data Analytics and Biomedical Informatics, Temple University, Philadelphia, USA.
1998/10 – 2009/8	◆ Teaching Assistant , Faculty of Science, Ain Shams University, Cairo, Egypt.

Industry

2023/8 – 2024/8	◆ Director of AI and R&D , Proteinea, Egypt.
2016/10 – 2023/7	◆ Research Scientist , IBM T.J. Watson Research Center, NY, USA.
2008/2 – 2009/8	◆ Technical Team Leader , Asset Technology Group, Cairo, Egypt.
2005/7 – 2008/1	◆ Java Team Leader , Raya Software, Cairo, Egypt.
2002/1 – 2005/6	◆ Software Developer and Instructor , Nile Soft, Cairo, Egypt.
2001/1 – 2001/8	◆ Java Instructor , Allied Soft, Cairo, Egypt.

Education

2009/9 – 2013/8	◆ Ph.D. in Computer Science (Machine Learning and Pattern Recognition) . Temple University, Philadelphia, USA. Thesis title: <i>Interpretable Early Classification of Multivariate Time Series</i> .
2001/2 – 2006/6	◆ M.Sc. in Computer Science (Randomized Algorithms) . Faculty of Science, Ain Shams University, Egypt. Thesis title: <i>Randomized Algorithms and Its Applications</i> .
1994/9 – 1998/6	◆ B.Sc. in Pure Mathematics and Computer Science . Faculty of Science, Ain Shams University, Egypt. <i>Excellent with Honours, Ranked 1st</i> .

Projects

IBM

- ◆ **Patient Representation.**
Develop and test patient and disease representations for clinical models. Jointly learning embedding for different domains and further fine tuning or enhancing embeddings for some domains when limited amounts of data is available present significant AI challenges that will force us to produce methodological innovations. We build a comprehensive library for representation learning methods and develop novel methods to address these presented issues. These representation algorithms will be assessed based on their sensitivity to data characteristics including fairness.

Projects (continued)

◆ **Computational Models for Type 1 Diabetes (T1D).**

Develop novel computational disease models that could be used to identify factors that impact the rapid/slow progression of Type 1 Diabetes (“T1D”) in infants and young children who are genetically pre-disposed and may be pre-symptomatic clinically. Such methodologies and models may

- incorporate heterogeneous features coming from multiple sites and assessments covering multiple aspects of T1D.
- leverage diverse data sets to accommodate noise and uncertainty in study data.
- provide comprehensive view of risk factors that impact the onset of T1D in different time horizons.

◆ **Objective Pain Metric.**

This work is focused on identifying correlates of individual pain, defining objective pain metrics, and determining changes to the device parameters that provide the user with the greatest impression of relief. A number of data streams will be studied to identify pain correlates from physiological signals, environmental stresses, and individual behavioral responses. These correlates will be used to identify pain metrics, understand the individual patient’s pain experience and how the device parameters can be changed to optimize the sense of change in a manner that is adaptive to the varying needs of the patient.

Temple University

◆ **Structured Regression in Complex Networks by Fusion of Qualitative Knowledge and Big Data.**

Integrating context, domain knowledge, and data-driven modeling of complex phenomena based on observations that are highly structured and interdependent is a very challenging task. In this project we address this problem by using the structured predictive modeling framework based on a probabilistic exponential graphical model instead of relying on traditional statistical approaches that assume independent and identically distributed random variables. Current state-of-the-art predictive modeling techniques usually cannot deal with such large and complex networks; thus we provide knowledge-based compression techniques for complexity reduction. We use multiple kinds of domain knowledge and context to capture additional information that might be missing from the observed data. We also directly constrain the model optimization based on domain constraints and embed other problem-specific qualitative knowledge directly into the framework. The main innovation of this project is extending our structured learning models to explore in detail the hypothesis that a unified approach of integrating big data with sources of high-level knowledge (ontologies, domain-based constraints etc.) is beneficial for predictive modeling of complex phenomena.

◆ **Prospective Analysis of Large and Complex Partially Observed Temporal Social Networks.**

The analysis of social networks often assumes a time invariant scenario, while in practice actor attributes and links in such networks evolve over time and are inextricably dependent on each other. In addition, the temporal graph is just partially observed, multiple kinds of links exist among actors, various actors have different temporal dynamics and environmental influence can be both positive and negative. This project is closely examining the hypothesis that a unified approach of jointly modeling these and related problems is beneficial for prospective analysis of large-scale partially observed temporal hypergraphs. Novel methods for analyzing large and evolving graphs developed on the project are evaluated on high impact applications related to predictive modeling of information networks, climate and human health.

Projects (continued)

◆ **Predictive Modeling of Patient State and Therapy Optimization.**

This project develops and validates effective predictive modeling technology to achieve the following sepsis treatment related aims on high dimensional and noisy data at a clinically relevant scale

- **AIM 1:** Personalized sepsis therapy optimization for an individual patient's state improvement.
- **AIM 2:** Early diagnosis of sepsis and accurate detection of change in the state of sepsis., and
- **AIM 3:** Gene expression analysis for sepsis biomarkers identification.

Asset Technology Group

◆ **Vodafone DCA (Distribution Channels Automation).**

Vodafone Egypt (VFE) has established agreements with indirect sales business partners (Agents) and 3rd party (Exclusive Dealers, Trade Key Accounts and Dealers) all over Egypt to address all country markets to ensure Vodafone projects and services availability nationwide. Vodafone Egypt sells its products to agents; agents in turn sell Vodafone products to exclusive dealers and dealers who eventually sell to end customers. The current number of agents is 7 with around 50 branches; the number of exclusive dealers is around 150 shops and the number of main normal dealers is around 7000. Vodafone Distribution Department would like to track VFE products' sales movement performed by distribution channels in order to produce accurate incentive calculations and to be able to generate and view analytical reports on dealers' sales patterns in order to study the market behavior versus various parameters (e.g. time, cities, zones, etc...). This project affects VFE, Agents, Trade Key Accounts, dealers and end customers and it is an online web-based application be accessed by VFE Sales staff and Agents for stock management, transactions recording and serialized products tracking. The application also enables VFE sales staff to view agents and dealers information and to evaluate their performance in order to manage their incentives. There are as well integrations with other 3rd party systems like Billing System, TIBCO, etc.

◆ **Vodafone HandHeld.**

Vodafone sales representatives use a handheld device to make their sales out transactions at the dealer branch. This project is responsible for providing the extranet functionality to the handheld application through HTTP. The handheld application sends an HTTP request to the extranet application to perform some task and the extranet application responds back the results but compressed using HTTP compression. Using the handheld application, the sales agent may conduct sales out transactions and check their stock.

◆ **Vodafone Website.**

Implementing pilots with Oracle UCM and making certain adjustments to the workflow, security, fragmentation, etc. to meet our demands. The website can be published to an external web server using the publishing tool.

Raya Software

◆ **Al Watany Bank (AWB).**

Implementing multi threading technology on the AWB (Al Watany Bank) middleware and apply some needed modifications.

◆ **Ministry of Civil Aviation (MOCA) Portal.**

Designing the framework for one of the biggest project in the company Ministry of Civil Aviation MOCA.

Projects (continued)

◆ National Societe Generale Bank Middleware (NSGB).

The construction of a new middleware for NSGB, an intermediary tier that shields legacy systems from being transparent to retail and customer-serving delivery channels, was part of this project. The main responsibility of the middleware is to receive requests from the frontend, parse the information from these requests, send inquiries to the backend, receive replies back, process the replies and apply some logic, and finally return the results to the requester. Along with managing the project (resource management, mission planning, logistics, status reports, financial control, etc.), participating in the feasibility study to design the project, and participating in the technical design of the required software changes (specifications and programming support), I was also implementing the middleware's core functionality.

◆ NSGB Admin Web Tool.

Designing and implementing with a team of 4 members the NSGB admin web tool. The tool consists of 4 modules.

- Subscription module is responsible for the subscriptions of a customer to some products or services.
- Administration module is responsible for maintaining the user profile that uses the system.
- Reporting module is responsible for generating reports for all channels and these reports could be exported to excel sheets and PDF.
- Security module assigns the roles and the privileges for the users.

Nile Soft

◆ Arabization of Invoicing System – Duravit Company.

As a Technical Consultant, I was in charge of training a team of four members on Java, Jasper Report, and J2EE, and directing the group responsible for developing the Duravit Company's invoicing system and arabization of the inventory items.

◆ Automated Web Based Integration System (ERP) of the Credit Guarantee Company (CGC)

Working as a Team Leader, leading a team of 4 members responsible for producing UML class diagrams and detailed sequence diagrams for an automated web-based integration system (ERP) of the Credit Guarantee Company (CGC). CGC was mainly established to provide small businesses with loan guarantees. The system is composed of 8 subsystems (Finance/Accounting, Payroll, Fixed Assets, Credit Guarantees, Micro Credit Unit, Access Rights, Deposits, and Investment) and was created in accordance with UML standards. The system's architecture is multi-tiered, built on J2EE standard and the MVC paradigm, and uses Oracle Database Server for the persistent layer with EJB, Struts for the control layer, and JSP for the presentation layer.

Invited Talks

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| 2022/11 | ◆ Optimal Ages to Screen , The 5th Childhood Diabetes Prevention Symposium - General Population Screening for T1D, Barbara Davis Center for Diabetes - School of Medicine - University of Colorado, CO, USA. |
| 2020/11 | ◆ T1D1 Screening Toolbox , The 3rd Childhood Diabetes Prevention Symposium - General Population Screening for T1D Current Issues in time of COVID-19, Barbara Davis Center for Diabetes - School of Medicine - University of Colorado, CO, USA. |

Invited Talks (continued)

- 2012/10 ♦ **Characterization of Intrinsic Disorder in a Large Database of Protein Sequences**, 1st Annual Computational Research on Owl's Nest (CROO) Symposium, Temple University, Philadelphia, USA.
- 2011/7 ♦ **Towards Analysis of Uncertainty in Protein Disorder Prediction**, Institute of Computational Molecular Science, Temple University, Philadelphia, USA.

Synergetic Activities to the Research Community

Editorial Board Member

- 2020 – Present ♦ Big Data (2020 - Present).
- 2016 – Present ♦ SM Bioinformatics, Genomics and Proteomics (2016 - Present).
- 2015 – Present ♦ International Journal of Data Mining and Bioinformatics (2015 - Present).
- 2016 – 2019 ♦ Journal of Biomedical Engineering and Informatics.

Session Chair

- 2013 ♦ International Conference of Data Mining (ICDM).

PC Member

- 2022 ♦ AMIA, ICML, IEEE Big Data, NeurIPs.
- 2021 ♦ AMIA, IEEE Big Data, International Journal of Medical Informatics.
- 2020 ♦ AAAI, AMIA, IEEE Big Data, ICLR, IJCAI, SDM, International Journal of Medical Informatics.
- 2019 ♦ AMIA, IEEE Big Data, ICLR, IJCAI, SDM, NeurIPs.
- 2018 ♦ AMIA, IEEE Big Data, ICLR, IJCAI, SDM, NeurIPs.
- 2017 ♦ IEEE Big Data, SDM, NeurIPs.
- 2015 ♦ International Conference on Decision Support System Technology, Conference of Artificial Intelligence in Medicine (AIME), 1st Workshop on Matrix Computations for Biomedical Informatics, International Conference on Bioinformatics and BioEngineering (BIBE).

Reviewer

- ♦ BioMed Research International Journal
- ♦ Machine Learning Journal (special Issue for Health and Medicine)

Ad-hoc Reviewer

- 2015 ♦ KDD, ICDM, BigData
- 2014 ♦ SDM, KDD
- 2013 ♦ SDM, KDD, BigData
- 2012 ♦ SDM, ICDM

Awards

- 2023 ♦ **Publication Awards**, Ain Shams University, Cairo, Egypt.
- 2022 ♦ **Publication Awards**, Ain Shams University, Cairo, Egypt.
- 2021 ♦ **Patent Plateau Award**, IBM Research, NY, USA.
- 2019 ♦ **Patent Plateau Award**, IBM Research, NY, USA.

Awards (continued)

- 2013 ♦ **Best Graduate Paper**, ACM Future of Computing - Temple University, Philadelphia, USA.
- 2012 ♦ **Student Travel Award**, IEEE International Conference on Bioinformatics and Biomedicine.
- ♦ **Best Graduate Paper**, ACM Future of Computing - Temple University, Philadelphia, USA.
- 2009 ♦ **Graduate Scholarship**, Ministry of Higher Education, Egypt.

Graduate Students

- 2022/6 – Present ♦ **Mohamed Saleh**, Co-supervisor with Dr. Wael Zakaria.
M.Sc. thesis title: *Feature Extraction for Electroencephalogram Signals Classification*. Ain Shams University, Cairo, Egypt.
- 2023/1 – Present ♦ **Mostafa Hanafy**, Co-supervisor with Prof. Hatem Bahig.
M.Sc. thesis title: *Cryptanalysis using Machine Learning*. Ain Shams University, Cairo, Egypt.
- 2025/1 – Present ♦ **Tarek Ahmed**, Co-supervisor with Prof. Nahed Mokhlis.
M.Sc. thesis title: *Development of a Circular-Linear-Circular Distribution for Structure Learning in Bayesian Networks*. Ain Shams University, Cairo, Egypt.
- 2025/2 – Present ♦ **Taha Mohamed**, Co-supervisor with Associate Prof. Dieaa Nasr, and Prof. Sohier Khamis.
Ph.D. thesis title: *Intelligent Learning Models for Steganography*. Ain Shams University, Cairo, Egypt.
- 2026 – Present ♦ **Nesreen Ahmed**,
M.SC. thesis title: *Machine Learning for Side-Channel Attacks* Ain Shams University, Cairo, Egypt.
- ♦ **Mohamed Essam**,
M.SC. thesis title: *Quantum Machine Learning* Ain Shams University, Cairo, Egypt.
- ♦ **Israa Elsayed**,
M.SC. thesis title: *Distributed Concept Localization in Images* Ain Shams University, Cairo, Egypt.

Teaching

- 2025 – 2026 ♦ DSAI 402: Reinforcement Learning
DSAI 456: Speech Recognition
DSAI 406: MLOps
CSAI 101: Logic Design
- 2024 – 2025 ♦ COMP 304: Compiler Design
COMP 402: Bioinformatics
COMP 403: Parallel Computing
COMP 603: Mathematics for Machine Learning

Teaching (continued)

2023 – 2024	◆	COMP 104: Programming Language (C++) COMP 402: Bioinformatics COMP 403: Parallel Computing COMP 603: Mathematics for Machine Learning CS 702: Advanced Artificial Intelligence
2022 – 2023	◆	COMP 104: Programming Language (C++) COMP 303: Formal Syntax and Semantics COMP 402: Bioinformatics COMP 603: Mathematics for Machine Learning COMP 612: Deep Learning
2021 – 2022	◆	COMP 104: Programming Language (C++) COMP 303: Formal Syntax and Semantics COMP 304: Compiler Design COMP 402: Bioinformatics