

Ibrahim Sabek

University of Southern California - Assistant Professor

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Research Interests

I build the **next generation** of **data management, processing, and analysis systems**. My research focuses on deeply understanding fundamental techniques in **machine learning, quantum computing, and systems design**, resulting in entirely new designs, algorithms, and data structures for data-intensive systems and applications. My research areas broadly include **instance-optimized database systems, probabilistic databases, scalable knowledge base construction, video analytics, and big spatial data management and analysis**.

Education

University of Minnesota, Twin Cities

Minnesota, USA

Ph.D. in Computer Science

Aug 2014 - Jan 2020

- Dissertation: Adopting Markov Logic Networks for Big Spatial Data and Applications
- Award: **University of Minnesota's Best Doctoral Dissertation Award 2021, Honorable Mention**

University of Minnesota, Twin Cities

Minnesota, USA

M.Sc. in Computer Science

Aug 2014 - Jan 2018

Alexandria University

Alexandria, Egypt

M.Sc. in Computer and Systems Engineering

Mar 2012 - Aug 2014

- Dissertation: Intelligent Hybrid Man-Machine Translation Evaluation

Alexandria University

Alexandria, Egypt

B.Sc. in Computer and Systems Engineering

Sep 2005 - Jun 2010

- Award: Alexandria University's Best CS Bachelor's Thesis

Employment

University of Southern California (USC)

California, USA

Assistant Professor, Thomas Lord Department of Computer Science

Aug 2023 - Present

Assistant Professor, Dornsife Spatial Sciences Institute (SSI)

Sep 2024 - Present

Massachusetts Institute of Technology (MIT)

Massachusetts, USA

Postdoctoral Associate, Computer Science and Artificial Intelligence Laboratory (CSAIL)

Feb 2020 - Aug 2023

University of Minnesota, Twin Cities

Minnesota, USA

Graduate Research Assistant, Department of Computer Science and Engineering

Aug 2014 - Jan 2020

Microsoft Research

Washington, USA

Research Intern, Database Group

Jun 2017 - Aug 2017 & May 2016 - Aug 2016

NEC Research Labs

California, USA

Research Intern, Data Management Group

May 2015 - Aug 2015

Umm Al-Qura University

Mecca, Saudi Arabia

Research Associate, KACST GIS Technology Innovation Center

Jan 2014 - Jul 2014

Egypt-Japan University of Science and Technology (E-JUST)

Alexandria, Egypt

Research Associate, Wireless Research Group

Sep 2011 - Dec 2013

Microsoft Research

Cairo, Egypt

Research Associate, Advanced Technology Lab

Jun 2011 - Jun 2012 & Oct 2010 - Feb 2011

Vimov LLC

Alexandria, Egypt

Research and Software Engineer

Jan 2013 - Jun 2013

Awards, Honors, Fellowships and Certificates

2024 **Data Analytics and Insights (DANI) Award**

Google

2024 **Best Demo**

ACM SIGSPATIAL 2024

2024 **Best Workshop Paper**

GUIDE-AI@SIGMOD 2024

2023 **Outstanding Reviewer**

ACM SIGSPATIAL 2023

2020 - 2023 **Computing Innovation Fellowship** by National Science Foundation and Computing Research Association

NSF/CRA

2022 **MIT Kaufman Teaching Certificate**

MIT

2021	University of Minnesota's Best Doctoral Dissertation Award, Honorable Mention	<i>University of Minnesota</i>
2019 - 2020	University of Minnesota's Doctoral Dissertation Fellowship	<i>University of Minnesota</i>
2019	First place in ACM SIGSPATIAL Graduate Student Research Competition (SRC)	<i>ACM SIGSPATIAL 2019</i>
2018	ACM SIGSPATIAL Best Paper Runner-up and was invited to ACM TSAS special issue on best papers	<i>ACM SIGSPATIAL 2018</i>
2017	ACM SIGMOD Graduate Student Research Competition (SRC) Finalist	<i>ACM SIGMOD 2017</i>
2016	University of Minnesota's CS Academic Excellence Fellowship	<i>University of Minnesota</i>
2010	Alexandria University's Best CS Bachelor's Thesis	<i>Alexandria University</i>
2010 - 2019	Travel Grant Awards to attend VLDB (2019), ACM SIGSPATIAL (2019, 2018, 2017, 2015), ACM SIGMOD (2017), IEEE WCNC (2013) and ISDA (2010)	<i>NSF/ACM/IEEE</i>
2006 - 2010	Alexandria University's Undergraduate Excellence Certificates of Honor	<i>Alexandria University</i>
2009	Undergraduate Research Fellowship Award for being the top of my class, was offered as a part of the Exchange of Students program between IAESTE Germany and Alexandria University	<i>IAESTE Germany</i>

Publications

Conference Papers

- [14] "From Logs to Causal Inference: Diagnosing Large Systems"
M. Markakis, B. Youngmann, T. Gao, Z. Zhang, R. Shahout, P. B. Chen, C. Liu, **I. Sabek**, and M. Cafarella
International Conference on Very Large Data Bases (VLDB), 2025 **VLDB 2025**
- [13] "Optimizing Video Selection LIMIT Queries With Commonsense Knowledge"
Wenjia He, **Ibrahim Sabek**, Yuze Lou, and Michael Cafarella
International Conference on Very Large Data Bases (VLDB), 2024 **VLDB 2024**
- [12] "The Case for Learned In-memory Joins"
Ibrahim Sabek and Tim Kraska
International Conference on Very Large Data Bases (VLDB), 2023 **VLDB 2023**
- [11] "Can Learned Models Replace Hash Functions?"
Ibrahim Sabek, Kapil Vaidya, Dominik Horn, Andreas Kipf, Michael Mitzenmacher, and Tim Kraska
International Conference on Very Large Data Bases (VLDB), 2023 **VLDB 2023**
- [10] "LSched: A Workload-Aware Learned Query Scheduler for Analytical Database Systems"
Ibrahim Sabek, Tenzin Samten Ukyab, and Tim Kraska
ACM International Conference on Management of Data (SIGMOD), 2022 **ACM SIGMOD 2022**
- [9] "The Case for Distance-Bounded Spatial Approximations"
Eleni Tzirita Zacharitou, Andreas Kipf, **Ibrahim Sabek**, Varun Pandey, Harish Doraiswamy, and Volker Markl
Conference on Innovative Data Systems Research (CIDR), 2021 **CIDR 2021**
- [8] "Sya: Enabling Spatial Awareness inside Probabilistic Knowledge Base Construction"
Ibrahim Sabek and Mohamed F. Mokbel
IEEE International Conference on Data Engineering (ICDE), 2020 **IEEE ICDE 2020**
- [7] "CRA: Enabling Data-Intensive Applications in Containerized Environments"
Ibrahim Sabek, Badrish Chandramouli, and Umar Farooq Minhas
IEEE International Conference on Data Engineering (ICDE), 2019 **IEEE ICDE 2019**
Being used to build Microsoft analytics platforms
- [6] "TurboReg: A Framework for Scaling Up Spatial Logistic Regression Models"
Ibrahim Sabek, Mashaal Musleh, and Mohamed F. Mokbel
ACM International Conference on Advances in Geographic Information Systems (SIGSPATIAL), 2018 **ACM SIGSPATIAL 2018**
Best paper runner-up award
- [5] "On Spatial Joins in MapReduce"
Ibrahim Sabek, and Mohamed F. Mokbel
ACM International Conference on Advances in Geographic Information Systems (SIGSPATIAL), 2017 **ACM SIGSPATIAL 2017**

- [4] “Sphinx: Empowering Impala for Efficient Execution of SQL Queries on Big Spatial Data” *SSTD 2017*
Ahmed Eldawy, **Ibrahim Sabek**, Mostafa Elganainy, Ammar Bakeer, Ahmed Abdelmotaleb, and Mohamed F. Mokbel
International Symposium on Spatial and Temporal Databases (SSTD), 2017
- [3] “MonoPHY: Mono-Stream-based Device-free WLAN Localization via Physical Layer Information” *IEEE WCNC 2013*
Heba Abdel-Nasser, Reham Samir, **Ibrahim Sabek**, and Moustafa Youssef
IEEE Wireless Communications and Networking Conference (WCNC), 2013
Cited more than 100 times
- [2] “Multi-entity Device-Free WLAN Localization” *IEEE GlobeCom 2012*
Ibrahim Sabek and Moustafa Youssef
IEEE Global Communications Conference (GlobeCom), 2012
- [1] “Wiki-Rec: A Semantic-based Recommender System using Wikipedia as an Ontology” *ISDA 2010*
Ahmed Elgohary, Hussien Nomier, **Ibrahim Sabek**, Mohamed Samir, Moustafa Badwi, and Noha A. Youstri
International Conference on Intelligent Systems Design and Applications (ISDA), 2010

Journal Papers

- [3] “Scalable Multinomial Autologistic Regression with Unordered Categorical Variables Using Markov Logic Networks” *ACM TSAS 2019*
Ibrahim Sabek, Mashaal Musleh, and Mohamed F. Mokbel
ACM Transactions on Spatial Algorithms and Systems (TSAS), 2019
Special issue on the best papers in ACM SIGSPATIAL 2018
- [2] “Flash: Scalable Spatial Probabilistic Graphical Modeling” *ACM SIGSPATIAL Special 2019*
Ibrahim Sabek
ACM SIGSPATIAL Special, 2019
- [1] “ACE: An Accurate and Efficient Multi-Entity Device-Free WLAN Localization System” *IEEE TMC 2015*
Ibrahim Sabek, Moustafa Youssef, and Athanasios V. Vasilakos
IEEE Transactions on Mobile Computing (TMC), 2015
Cited more than 100 times

Demonstrations and Student Research Competitions

- [8] “Pyneapple-L: Scalable Expressive Learning-based Spatial Analysis” *ACM SIGSPATIAL 2024*
Y Liu, N Lee, Y Kang, M Shahneh, A Mahmood, V Chinnam, A Sarawadekar, S Oymak, **I Sabek**, and A Magdy
ACM International Conference on Advances in Geographic Information Systems (SIGSPATIAL), 2024 (Demo)
Best demo award
- [7] “Sawmill: From Logs to Causal Diagnosis of Large Systems” *ACM SIGMOD 2024*
M Markakis, A B Chen, B Youngmann, T Gao, Z Zhang, R Shahout, P B Chen, C Liu, **I Sabek**, and M Cafarella
ACM International Conference on Management of Data (SIGMOD), 2024 (Demo)
Demo
- [6] “PAINE Demo: Optimizing Video Selection Queries With Commonsense Knowledge” *VLDB 2023*
Wenjia He, **Ibrahim Sabek**, Yuze Lou, and Michael Cafarella
International Conference on Very Large Data Bases (VLDB), 2023 (Demo)
Demo
- [5] “Flash in Action: Scalable Spatial Data Analysis Using Markov Logic Networks” *VLDB 2019*
Ibrahim Sabek, Mashaal Musleh, and Mohamed F. Mokbel
International Conference on Very Large Data Bases (VLDB), 2019 (Demo)
Demo
- [4] “Towards Scalable Spatial Probabilistic Graphical Modeling” *ACM SIGSPATIAL 2019*
Ibrahim Sabek
ACM International Conference on Advances in Geographic Information Systems (SIGSPATIAL), 2019 (SRC)
Winning gold medal (first place in the competition)
SRC Competition
- [3] “A Demonstration of Sya: A Spatial Probabilistic Knowledge Base Construction System” *ACM SIGMOD 2018*
Ibrahim Sabek, Mashaal Musleh, and Mohamed F. Mokbel
ACM International Conference on Management of Data (SIGMOD), 2018 (Demo)
Demo

[2] “Optimizing Spatial Queries in MapReduce” **ACM SIGMOD 2017**
Ibrahim Sabek *SRC Competition*
ACM International Conference on Management of Data (SIGMOD), 2017 (SRC)
Selected among top 10 finalists

[1] “SPOT Demo: Multi-entity Device-Free WLAN Localization” **WINTECH@MobiCom 2012**
Ibrahim Sabek and Moustafa Youssef *Demo*
WINTECH Workshop at ACM International Conference on Mobile Computing and Networking (MobiCom), 2012 (Demo)

Tutorials

[3] “Machine Learning Meets Big Spatial Data (Revised)” **IEEE MDM 2021**
Ibrahim Sabek and Mohamed F. Mokbel
IEEE International Conference on Mobile Data Management (MDM), 2021 (Tutorial)

[2] “Machine Learning Meets Big Spatial Data” **IEEE ICDE 2020**
Ibrahim Sabek and Mohamed F. Mokbel
IEEE International Conference on Data Engineering (ICDE), 2020 (Tutorial)

[1] “Machine Learning Meets Big Spatial Data” **VLDB 2019**
Ibrahim Sabek and Mohamed F. Mokbel
International Conference on Very Large Data Bases (VLDB), 2019 (Tutorial)

Workshops

[6] “Press ECCS to Doubt (Your Causal Graph)” **GUIDE-AI@SIGMOD 2024**
M. Markakis, Z. Zhang, R. Shahout, T. Gao, C. Liu, **I. Sabek**, and M. Cafarella
GUIDE-AI Workshop @ ACM International Conference on Management of Data (SIGMOD), 2024
Best workshop paper award

[5] “Constrained Quadratic Model for Optimizing Join Orders” **Q-Data@SIGMOD 2024**
Pranshi Saxena, **Ibrahim Sabek**, and Federico Spedalieri
Q-Data Workshop @ ACM International Conference on Management of Data (SIGMOD), 2024

[4] “Learning-Augmented Frequency Estimation in Sliding Windows” **ICNT@ICNP 2024**
Rana Shahout, **Ibrahim Sabek**, and Michael Mitzenmacher
ICNT Workshop @ IEEE International Conference on Network Protocols (ICNP), 2024

[3] “When Are Learned Models Better Than Hash Functions?” **AIDB@VLDB 2021**
Ibrahim Sabek, Kapil Vaidya, Dominik Horn, Andreas Kipf, and Tim Kraska
AIDB Workshop at International Conference on Very Large Data Bases (VLDB), 2021

[2] “The Case for Learned Spatial Indexes” **AIDB@VLDB 2020**
Varun Pandey, Alexander van Renen, Andreas Kipf, **Ibrahim Sabek**, Jialin Ding, and Alfons Kemper
AIDB Workshop at International Conference on Very Large Data Bases (VLDB), 2020

[1] “Adopting Markov Logic Networks for Big Spatial Data and Applications” **PhD Workshop@VLDB 2019**
Ibrahim Sabek
PhD Workshop at International Conference on Very Large Data Bases (VLDB), 2019

Teaching Experience

University of Southern California, Thomas Lord Department of Computer Science *California, USA*
Instructor *2024*
CSCI-550: Advanced Data Stores Fall 2024, Spring 2024

University of Minnesota, Twin Cities, Computer Science and Engineering Department *Minnesota, USA*
Teaching Assistant *2014 - 2018*
CSCI-4707: Practice of Database Systems Fall 2014, Spring 2015, Fall 2015, Spring 2018

Lecturer/Teaching Assistant

2010 - 2013

CS-121: Programming using Java and C/C++	Fall 2010, Fall 2012, Fall 2013
CS-223: Advanced Data Structures	Spring 2010, Spring 2012, Spring 2013
CS-221: Object-Oriented Programming	Fall 2010
CS-322: Database Systems	Spring 2012, Spring 2013
CS-E41: Special Topics on Information Systems	Fall 2010, Fall 2012, Fall 2013
CS-E42: Pattern Recognition and Applications	Fall 2010
CS-E43: Introduction to Computer Vision	Fall 2012

Service, Leadership and Other Professional Activities

Conference Program Committee (PC) Member

ACM SIGMOD	2025, 2024, 2023, 2022
VLDB	2025, 2024, 2023
IEEE ICDE	2025, 2023
EDBT	2026, 2024, 2022
ACM SIGSPATIAL	2023, 2022, 2021, 2020
AutoML-Conf	2022
GEOProcessing	2021, 2020

Workshop Program Committee (PC) Member

DBML @ IEEE ICDE	2024
GeoPrivacy @ ACM SIGSPATIAL	2023
AutoML Workshop @ ICML	2021, 2020
SpatialAPI Workshop @ ACM SIGSPATIAL	2021, 2020

Invited Journal and Transactions Reviewer

The International Journal on Very Large Data Bases (VLDBJ)	2024, 2022
IEEE Transactions on Knowledge and Data Engineering (TKDE)	2024, 2020
ACM Transactions on Spatial Algorithms and Systems (TSAS)	2024, 2023, 2021, 2020, 2019
IEEE Transactions on Multimedia	2024
IEEE Internet of Things Journal (IoT-J)	2021
Distributed and Parallel Databases (DAPD)	2020
International Journal on Advances of Computer Science for GIS (GeoInformatica)	2020, 2019, 2018
IEEE Transactions on Mobile Computing (TMC)	2014, 2013
IEEE Transactions on Vehicular Technology (TVT)	2014, 2013, 2012
IEEE Signal Processing Magazine	2013

External Reviewer

SRC @ ACM SIGSPATIAL	2024, 2023
MLSys	2022
ACM SIGMOD	2020, 2019, 2018, 2017, 2016, 2015
VLDB	2020, 2019, 2018, 2017, 2016, 2015, 2014
IEEE ICDE	2019, 2018, 2017, 2016, 2015, 2014
ACM SIGSPATIAL	2018, 2017, 2016, 2015, 2014
EDBT	2017
SSTD	2018, 2017, 2016, 2015, 2014
IEEE MDM	2017, 2016
SSDBM	2017

Conference/Workshop Organization

Workshop Chair	Q-Data Workshop in SIGMOD 2024, PhD Workshop in VLDB 2024
Session Chair	ACM SIGMOD 2024, VLDB 2023, EDBT 2022
Web Chair	ACM SIGSPATIAL 2014, 2015, 2016, and 2017
Student Service	VLDB 2019, ACM SIGMOD 2017, ACM SIGSPATIAL 2018, ACM SIGSPATIAL 2017, and ACM SIGSPATIAL 2015

Leadership and Other Professional Activities

2022-Now	Mentor/Counselor , I am currently a part of the Egypt Scholars initiative, helping Egyptian students to continue their graduate studies in renowned universities worldwide.	<i>Egypt Scholars Initiative</i>
2024	Academic Host , I was a part of the USC Viterbi's Summer High School Intensive in Next-Generation Engineering (SHINE) program, mentoring highly-motivated high-school students.	<i>University of Southern California</i>
2024	Volunteer/Speaker , I was a part of the USC Viterbi's K-12 STEM outreach program for the American Indian Science and Engineering Society (AISES).	<i>University of Southern California</i>
2024	Panelist , I was a panelist in the "Getting a Faculty Job" panel in the "Academic Job Search" seminar	<i>MIT</i>
2022	Mentor , I was a mentor in the VLDB 2022 Diversity and Inclusion program.	<i>VLDB 2022</i>
2020-2021	Mentor , I mentored students in the MIT Undergraduate Research Opportunities Program (UROP).	<i>MIT</i>
2021	Organizer , I organized the annual MIT Data Systems and AI Lab (DSAIL) retreat.	<i>MIT</i>
2019	Member , I was a member of the UMN Grants Committee in the Council of Graduate Students (COGS).	<i>University of Minnesota</i>
2017	Representative , I represented the Data Management Lab in the UMN Research Showcase Exhibit.	<i>University of Minnesota</i>
2013	Trainer , I led the efforts of Alexandria ACM Chapter in the summer training of Machine Learning.	<i>Alexandria University</i>
2013	Organizer , I organized the Start Menu Day at Alexandria University with 500+ attendees.	<i>Alexandria University</i>
2012-2013	Club Leader , I led the Oracle CS club at Alexandria University.	<i>Alexandria University</i>

Selected Invited Talks

Oct 2024	Towards Robust and Verifiable Learned Database Systems: Query Optimization Case Study	<i>Univ of California, Riverside</i>
Jun 2024	Turning Spatial Data into Spatial Knowledge	<i>Anawakalmekak High School</i>
Feb 2024	The Role of AI/ML in Advancing Database Systems	<i>Singularity Syndicate Podcast</i>
Nov 2023	Towards Robust Learned Query Scheduling: Be Aware of Your Constraints	<i>Univ of Pennsylvania</i>
Apr 2023	Building Better Data-Intensive Systems Using Machine Learning	<i>Univ of Southern California</i>
Jan 2023	Machine Learning Enhanced Query Scheduling and Execution Operations in Database Systems	<i>Northeastern University</i>
Mar 2022	Instance-Optimized Data Structures and Algorithms	<i>Facebook's Velox Team</i>
Mar 2022	LSched: A Workload-Aware Learned Query Scheduler for Analytical Database Systems	<i>Cornell Database Group</i>
Mar 2021	Machine Learning Meets Big Spatial Data: The Landscape	<i>University of Maryland</i>
Sep 2019	Adopting Markov Logic Networks for Big Spatial Data and Applications	<i>MIT Data Systems Group</i>
Aug 2017	Containerization of Data Intensive Computations with CRA	<i>Microsoft Research Redmond</i>
Aug 2016	Coral: Common Run-time for Analytics	<i>Microsoft Research Redmond</i>
Aug 2015	Cost-based Multi-query Optimization inside the Odyssey System	<i>NEC Labs America, California</i>
May 2013	Introduction to Machine Learning - The Brilliance of Science	<i>ACM Alexandria Chapter</i>
Jan 2013	Collaborative Machine Translation Evaluation	<i>Alexandria University</i>