Amin Bigdeli

Personal Data

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Publications: Google Scholar

Skills

Programming	Python, Java, C/C++
Tools and Libraries	Transformers, SentenceTransformers, PyTorch, TensorFlow, LangChain NLTK, SpaCy, Pandas, Lucene, Anserini, Pyserini, Scikit-learn, MLflow, automl, DVC, SHAP, ONNX, Bokeh, Git, NewRelic
Data & Cloud Platforms	MySQL, PostgreSQL, Snowflake, AWS, GCP, Azure

Research Interests

Information retrieval	Semantic Search	Retrieval-Augmented Generation
Large Language Models	Adversarial Machine Learning	Responsible AI

Industry and Research Experience

July 2021 - Present

Head of Data Science - **Warranty Life**, Vancouver, Canada

- Designed and implemented **state-of-the-art machine learning models**, leveraging **Convolutional Neural Networks (CNNs)** and **Vision Transformers (ViTs)** for image analysis tasks like **device protective case detection**, achieving **over 90% accuracy**. Incorporated various language models such as **BERT** for various Natural Language Processing tasks, including **product matching** and sequence classification, improving accuracy in business processes.
- Leveraged **gradient boosting algorithms (XGBoost, LightGBM)** and **deep learning architectures** for predictive analytics. Trained and evaluated models on **large-scale datasets** from **over 100k+ users**, turning diverse user data into actionable insights.
- Engineered and deployed **end-to-end scalable production ML pipelines** using tools like **MLflow**, enabling seamless execution of models across **10,000+ devices annually**. Designed these pipelines to optimize **computational efficiency**, ensuring **low-latency predictions (sub-50ms)** while maintaining acceptable resource consumption on devices.

May 2023 - Present

Research Assistant - **University of Waterloo**, Waterloo, Canada

- Conducting research on **adversarial attacks** against **information retrieval** models, **Large Language Models**, and Retrieval-Augmented Generation (**RAG**) systems with a focus on identifying vulnerabilities and enhancing system robustness.
- Preparing publications for top-tier conferences and journals, focusing on improving the reliability and trustworthiness of neural-based retrieval systems.

Fall 2020 - Fall 2021

Research Assistant - **Toronto Metropolitan University**, Toronto, Canada

- Conducted research on exploring and mitigating biases in information retrieval systems, contributing to advancements in fairness and effectiveness in the field.
- Published findings in prestigious venues such as **SIGIR, ECIR, CIKM, and EDBT**, with this work culminating in a high-impact thesis that earned the **Best Master's Thesis Award** from **Canadian AI Association**.

Education

Present

PhD Student in Computer Science
University of Waterloo, Waterloo, Canada
Supervisor: Dr. Charles L. A. Clarke and Dr. Ebrahim Bagheri
Thesis: Safety and Trustworthiness of Information Retrieval Systems Against Adversarial Attacks

Spring 2023

Related courses: Advanced Topics in HCI: 4/4, Advanced Topics in Databases: 4/4

Fall 2021

Master of Science in Information Technology Management
Toronto Metropolitan University, Toronto, Canada
Supervisors: Dr. Ebrahim Bagheri and Dr. Morteza Zihayat
Thesis: "Exploration and Mitigation of Stereotypical Gender Biases in Information Retrieval Systems"

Fall 2020

Related courses: Deep Learning for NLP: 4/4, Graph Neural Networks: 4/4, Graph Mining: 4/4

Fall 2019

Bachelor of Science in Computer Engineering
Ferdowsi University of Mashhad, Mashhad, Iran

Fall 2015

Related courses: Information Retrieval: 4/4, Data Mining: 4/4, Artificial Intelligence and Expert Systems: 4/4

Awards and Honors

2024 Invited to Author a Book for Foundations and Trends in Information Retrieval (FNTIR 2024) on Gender bias in Information Retrieval Systems
2024 Nominated by University of Waterloo CS (one of four) to apply for Google PhD Fellowship
2024 Lijian Fang Graduate Scholarship in Computer Science ($5,000) – Awarded for academic excellence
2024 SIGIR 2024 Student Travel Award
2024 Alberta Machine Intelligence Institute (Amii) AI Week Talent Bursary
2023 University of Waterloo Graduate Scholarship ($5,000)
2023 Alberta Machine Intelligence Institute (Amii) AI Week Talent Bursary
2022 **Best Paper Award** at 44th European Conference on Information Retrieval (ECIR 2022)
2022 **Best Master's Thesis Award** at 35th Canadian Artificial Intelligence Association (CAIAC 2022)
2022 Alberta Machine Intelligence Institute (Amii) AI Week Talent Bursary
2020 Toronto Metropolitan University Graduate Fellowship ($3,000)

Journal Articles and Book Manuscripts

1. **Understanding and Mitigating Gender Bias in Information Retrieval Systems.** Seyedsalehi, S., **Bigdeli, A.**, Arabzadeh, N., AlMousawi, B., Marshall, Z., Zihayat, M., and Bagheri, E. In Foundations and Trends© in Information Retrieval (**FnTIR 2024**).

2. **A Contrastive Neural Disentanglement Approach for Query Performance Prediction.** Salamat, S., Arabzadeh, N., Seyedsalehi, S., **Bigdeli, A.**, Zihayat, M., and Bagheri, E. In Machine Learning Journal (**MLJ 2024**) (Impact Factor: **4.3**).

3. **Feature-based Question Routing in Community Question Answering Platforms.** Soorosh, S., Roohollah, E., **Bigdeli, A.**, Zihayat, M., and Bagheri, E. In Information Sciences Journal (**INS 2022**) (Impact Factor: **8.1**).

4. **EMPRA: Embedding Perturbation Rank Attack against Neural Ranking Models. Bigdeli, A.**, Arabzadeh, N., Bagheri, E., and Clarke, C. *(To Be Submitted to TOIS)*.

5. **Estimating Query Performance based on Nearest Neighbor Sampling. Bigdeli, A.**, Ebrahimi, S., Arabzadeh, N., Khodabakhsh, M., Salamat, S., Seyedsalehi, S., Zarrinkalam, F., and Bagheri, E. *(To Be Submitted to TOIS)*.

Conference Papers

1. **Leveraging Large Language Models for Adversarial Attacks on Information Retrieval Systems. Bigdeli, A.**, Arabzadeh, N., Bagheri, E., and Clarke, C. Under Review for a Suitable Conference.

2. **Evaluating Relative Retrieval Effectiveness with Normalized Residual Gain. Bigdeli, A.**, Arabzadeh, N., Bagheri, E., and Clarke, C. In **SIGIR-AP 2024** *(Acceptance Rate:* **38.6%***)*.

3. **Learning to Jointly Transform and Rank Difficult Queries. Bigdeli, A.**, Arabzadeh, N., and Bagheri, E. In **ECIR 2024** *(Acceptance Rate:* **24.3%***)*.

4. **Adapting Standard Retrieval Benchmarks to Evaluate Generated Answers.** Arabzadeh, N., **Bigdeli, A.**, and Clarke, C. In **ECIR 2024** *(Acceptance Rate:* **23%***)*.

5. **LaQuE: Enabling Entity Search at Scale.** Arabzadeh, N., **Bigdeli, A.**, and Bagheri, E. In **ECIR 2024** *(Acceptance Rate:* **23%***)*.

6. **De-biasing Relevance Judgements for Fair Ranking. Bigdeli, A.**, Arabzadeh, N., Seyedsalehi, S., Zihayat, M., and Bagheri, E. In **ECIR 2023** *(Acceptance Rate:* **27%***)*.

7. **Quantifying Ranker Coverage of Different Query Subspaces.** Arabzadeh, N., **Bigdeli, A.**, and Clarke, C. In **SIGIR 2023** *(Acceptance Rate:* **25.12%***)*.

8. **Neural Disentanglement of Query Difficulty and Semantics.** Salamat, S., Arabzadeh, N., Seyedsalehi, S., **Bigdeli, A.**, Zihayat, M., and Bagheri, E. In **CIKM 2023** *(Acceptance Rate:* **27.4%***)*.

9. **Don't Raise Your Voice, Improve Your Argument: Learning to Retrieve Convincing Arguments.** Salamat, S., Arabzadeh, N., **Bigdeli, A.**, Seyedsalehi, S., Zihayat, M., and Bagheri, E. In **ECIR 2023** *(Acceptance Rate:* **27%***)*.

10. **Addressing Gender-related Performance Disparities in Neural Rankers.** Seyedsalehi, S., **Bigdeli, A.**, Arabzadeh, N., Zihayat, M., and Bagheri, E. In **SIGIR 2022** *(Acceptance Rate:* **24.7%***)*.

11. **Exploration and Mitigation of Stereotypical Gender Biases in Information Retrieval Systems. Bigdeli, A.** In 35th Canadian Artificial Intelligence Association (**CAIAC 2022**). **[Best Master's Thesis Award]**

12. **A Light-weight Strategy for Restraining Gender Biases in Neural Rankers. Bigdeli, A.**, Arabzadeh, N., Seyedsalehi, S., Zihayat, M., and Bagheri, E. In **ECIR 2022**. **[Best Paper Award]**

13. **Bias-aware Fair Neural Ranking for Addressing Stereotypical Gender Biases.** Seyedsalehi, S., **Bigdeli, A.**, Arabzadeh, N., Mitra, B., Zihayat, M., and Bagheri, E. In **EDBT 2022**.

14. **On the Orthogonality of Bias and Effectiveness in Ad hoc Retrieval.** **Bigdeli, A.**, Arabzadeh, N., Seyedsalehi, S., Zihayat, M., and Bagheri, E. In **SIGIR 2021** *(Acceptance Rate:* **27.6%***)*.

15. **Matches Made in Heaven: Toolkit and Large-Scale Datasets for Supervised Query Reformulation.** Arabzadeh, N., **Bigdeli, A.**, Seyedsalehi, S., Zihayat, M., and Bagheri, E. In **CIKM 2021** *(Acceptance Rate:* **32.5%***)*.

16. **Exploring Gender Biases in Information Retrieval Relevance Judgement Datasets.** **Bigdeli, A.**, Arabzadeh, N., Zihayat, M., and Bagheri, E. In **ECIR 2021** *(Acceptance Rate:* **25%***)*.

17. **Query Performance Prediction through Retrieval Coherency.** Arabzadeh, N., **Bigdeli, A.**, Zihayat, M., and Bagheri, E. In **ECIR 2021** *(Acceptance Rate:* **25%***)*.

18. **Analyzing Co-authorship Patterns Using Frequent Patterns Extraction: Case Study: Ferdowsi University of Mashhad.** Bashari, B., Ameli, A., **Bigdeli, A.**, and Behkamal, B. In **ICWR 2019**.

Tutorials

1. **Understanding and Mitigating Gender Bias in Information Retrieval Systems.** **Bigdeli, A.**, Arabzadeh, N., Seyedsalehi, S., Zihayat, M., and Bagheri, E. In **ECIR 2023**.

2. **Gender Fairness in Information Retrieval Systems.** **Bigdeli, A.**, Arabzadeh, N., Seyedsalehi, S., Zihayat, M., and Bagheri, E. In **SIGIR 2022**.

Invited Talks

October 2021. Stereotypical Biases in Information Retrieval Systems. Invited talk at Microsoft Research.
December 2021. De-biasing Methods for Mitigating Gender Biases in Information Retrieval Systems. Invited talk at Information Retrieval group of Radboud University.

Peer Reviewing Experience

- International World Wide Web Conference, WWW
- International ACM SIGIR Conference on Research and Development in Information Retrieval, SIGIR
- ACM International Conference on Information and Knowledge Management, CIKM
- European Conference on Information Retrieval, ECIR
- Centre for Advanced Studies Conference, CASCON
- Canadian Conference on Electrical and Computer Engineering, CCECE

Teaching Assistant

2022 Systems Analysis and Design (ITM305), Ryerson University
2021 Big Data Analytics (ITM760), Ryerson University
2021 Artificial Intelligence in Business (ITM703), Ryerson University
2020 Object Oriented Design Patterns, Ferdowsi University of Mashhad
2019 Software Engineering, Ferdowsi University of Mashhad
2019 Microprocessor and Assembly Language, Ferdowsi University of Mashhad
2019 Design and Implementation of Programming Languages, Ferdowsi University of Mashhad
2019 ARM Microcontroller Programming, Ferdowsi University of Mashhad
2018 Database Design, Ferdowsi University of Mashhad

References

Dr. Charles Clarke
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Dr. Ebrahim Bagheri
Full Professor at Toronto Metropolitan University
Email: bagheri@torontomu.ca

Dr. Morteza Zihayat
Associate Professor at Toronto Metropolitan University
Email: mzihayat@torontomu.ca