

RUOYUAN GAO

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RESEARCH INTEREST

My broad research interests include applying statistical analysis, natural language processing, and machine learning in search and recommender systems.

My recent studies focus on bringing fairness and transparency to the information retrieval (IR) in future artificial intelligent systems. In particular, I try to understand the bias associated with search and recommender systems. I develop fundamental frameworks and efficient algorithms to strike a balance between fairness and different utility factors of IR systems.

EDUCATION

Ph.D., Computer Science 2021
Rutgers University, New Jersey, USA.

Dissertation: Toward a Fairer Information Retrieval System

Committee: Chirag Shah, Yongfeng Zhang, Gerard de Melo, Fernando Diaz

B.E., Computer Science 2010
Zhejiang University, Zhejiang, China.

Honors degree, Double-Major Class in Chu Kochen Honors College.

PUBLICATION

- Feng, Y.; Saelid, D.; Li, K., **Gao, R.**; Shah, C. 2021. Towards Fairness-Aware Ranking by Defining Latent Groups Using Inferred Features. In Second International Workshop on Algorithmic Bias in Search and Recommendation.
- Ge, Y.; Liu, S.; **Gao, R.**; Xian, Y.; Li, Y.; Zhao, X.; Pei, C.; Sun, F.; Ge, J.; Ou, W.; Zhang, Y. 2021. Towards Long-term Fairness in Recommendation. In Proceedings of the 14th International Conference on Web Search and Data Mining.
- **Gao, R.**; Shah, C. 2020. Counteracting Bias and Increasing Fairness in Search and Recommender Systems. In Proceedings of the 14th ACM Conference on Recommender Systems (Tutorial).
- Fu, Z.; Xian, Y.; **Gao, R.**; Huang, Q.; Geng, S.; Ge, Y.; Xu, S.; Shah, C.; Zhang, Y.; De Melo, G. 2020. Fairness-Aware Explainable Recommendation over Knowledge Graphs. In Proceedings of the 43rd International ACM SIGIR Conference on Research and Development in Information Retrieval.
- Verma, S.; **Gao, R.**; Shah, C. 2020. Facets of Fairness in Search and Recommendation. In proceedings of ECIR-2020 International Workshop on Algorithmic Bias in Search and Recommendation.
- **Gao, R.**; Shah, C. 2020. Toward Creating a Fairer Ranking in Search Engine Results. *Information Processing & Management*, 57(1):102-138.
- **Gao, R.**; Shah, C. 2019. How Fair Can We Go: Detecting the Boundaries of Fairness Optimization in Information Retrieval. In Proceedings of the 2019 ACM SIGIR International Conference on the Theory of Information Retrieval.
- MacGlashan, J.; Babes-Vroman, M.; Winner, K.; **Gao, R.**; desJardins, M.; Littman, M.; and Muresan, S. 2012. Learning to Interpret Natural Language Instructions. In Proceedings of AAAI-2012 Workshop on Grounding Language for Physical Systems.
- Babes-Vroman, M.; MacGlashan, J.; **Gao, R.**; Winner, K.; desJardins, M.; Littman, M.; and Muresan, S. 2012. Learning to Interpret Natural Language Instructions. In Proceedings of NAACL-HTL Workshop on Semantic Interpretation in an Actionable Context.

- Qu, Y.H.; Tao, T.J.; Sharoff, S.; Jin, N.; **Gao, R.**; Zhang, N.; Yang, Y.T.; and Xu, C.Z. 2010. Using an integrated feature set to generalize and justify the Chinese-to-English transferring rule of the “ZHE” aspect. In Journal of Zhejiang University SCIENCE C (Computer & Electronics), 11(9):663-676.

TALK / POSTER

- **Gao, R.**; Mitsui, M.; Ghosh, S; Shah, C. Multi-facet Information Seeking. 6th Annual NJBDA Symposium 2019.
- **Gao, R.**; Babes-Vroman, M.; MacGlashan, J.; Winner, K.; Adjogah, R. Understanding and Following Natural Language Instructions. Mid-Atlantic Student Colloquium on Speech, Language and Learning (MASC-SLL). Maryland. 2012.
- Babes-Vroman, M.; MacGlashan, J.; **Gao, R.**; Winner, K.; Adjogah, R. Understanding and Following Natural Language Instructions. 7th Annual Machine Learning Symposium. NJ. 2012.

SELECTED RESEARCH PROJECTS

Fairness Accountability Transparency Ethics (FATE) project

7/2019 - Present

Advisor: Prof. Chirag Shah

- Investigate user awareness of fairness in search engine results.
- Mentor undergraduate students to develop an online platform for user data collection.
<http://tinyurl.com/googleornot>
- Mentor undergraduate students to perform statistical data analysis.
- Mentor undergraduate students to participate in TREC 2020 Fair Ranking Track.

Fairness-aware evaluation metrics in information retrieval

7/2019 - 6/2020

Advisor: Prof. Chirag Shah

- Propose a novel evaluation metric that unifies user utility and fairness.
- Propose effective and efficient fairness ranking algorithms to achieve optimal search utility.

Theoretical framework for fairness optimization in information retrieval

1/2019 - 6/2019

Advisor: Prof. Chirag Shah

- Characterize the trade-offs between fairness and system utilities as a data-dependent multi-objective optimization problem.
- Develop theoretical bounds on the optimal solutions that can be achieved on a dataset via sampling.

Content diversity fairness in search engine results

6/2018 - 12/2018

Advisor: Prof. Chirag Shah

- Investigate topical diversity bias in web search results.
- Propose fairness ranking algorithms to effectively achieve diverse and fairer content.
- Study the correlation and trade-offs between diversity fairness and the retrieval relevance.

Teaching computers to follow verbal instructions

9/2011 - 6/2013

Advisor: Dr. Smaranda Muresan (NSF IIS-00006577 and IIS-1065195)

- Develop probabilistic semantic parser to understand natural language instructions.
- Incorporate language models with inverse reinforcement learning to accomplish the task of situated learning.

WORKING EXPERIENCE

Amazon

Applied Scientist

*3/2021 – present
Palo Alto, CA*

Rutgers

Teaching Assistant

- CS 112: Data Structures and Algorithms
- CS 214: Systems Programming

- CS 314: Principles of Programming Languages
- CS 530: Principles of AI
- MI 562: Problem Solving with Data
- MI 564: Machine Learning for Data Science

Yahoo!

5/2015 – 8/2015

Technical Intern III

Sunnyvale, CA

Mentor: Elizabeth Zwicky and Prof. Richard Clayton

- Extract structural, contextual and content features in fraud emails.
- Define influence factors for evaluating the significance of fraud activities.

Yahoo!

5/2013 – 8/2013

Technical Intern III

Sunnyvale, CA

Mentor: Elizabeth Zwicky and Prof. Richard Clayton

- Develop content-based approach including topic modeling for phishing email detection.
- Build an effective spam filter with natural language processing techniques and classification models.

SERVICE & OTHER ACTIVITY

Program Committee Member

- **EARS** International Workshop on Explainable Recommendation and Search **2019**

Conference Volunteer

- **ACM FAT*** Conference on Fairness, Accountability, and Transparency **2019**

AWARD

- ACM SIGIR Travel Award 20'
- ACM SIGIR Travel Award 19'

TECHNICAL STRENGTH

Computer Languages

Python (preferred), Java, C/C++ and SQL.

Web development

PHP, HTML, Ajax, JavaScript, Flash/ActionScript

Tools

Hadoop, Pig, PyTorch, MatLab, Weka, NLTK, Gensim, Sciki-learn, GNUPlot and \LaTeX .