

# Rasika Muralidharan

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## EDUCATION

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- **Indiana University Bloomington** Bloomington, USA  
*PhD Informatics, minor in Computer Science* Aug 2024 - May 2028
- **Indiana University Bloomington** Bloomington, USA  
*Masters' of Science - Data Science; GPA: 3.8/4.0* Aug 2022 - May 2024  
*Courses:* Statistics, Applied Algorithms, Machine Learning, Computer Vision, Network Science,  
Graph Analysis, Advanced Database Concepts, Data Visualization, Social Media Mining
- **Manipal Institute of Technology** Manipal, India  
*B.Tech - Electrical and Electronics; GPA: 8.2/10.0* Jul 2018 - Jul 2022  
*Courses:* Data Structures and Algorithms, Statistical Inference with R, Data Visualization

## EXPERIENCE

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- **Indiana University Bloomington** Bloomington, USA  
*Independent Study, advised by Prof Yong-Yeol Ahn* Oct 2023 - May 2025
  - Studied how moderation practices scale on decentralized platforms by analyzing whether instance size predicts the topical and lexical properties of community rules on Mastodon.
  - Collected data from 6,660 Mastodon instances and extracted 28,000 server rules and descriptions via the platform's API.
  - Used a few-shot prompting strategy with GPT-4o-mini and GPT-3.5-turbo for multi-label classification of rules into governance categories, achieving 76% accuracy against human-labeled ground truth.
  - Computed lexical metrics—word count, rule count, type-token ratio (TTR), and Flesch-Kincaid readability—to evaluate rule complexity and language.
  - Regression analysis revealed that instance size is the strongest predictor of lexical features compared to federation degree and instance age.
  - Found that smaller instances emphasize user-centric moderation with few focused rules, while larger instances adopt broader policies covering hate speech, harassment, and illegal content, with more numerous, longer, and less readable rules.
- *Research Assistant, advised by Prof. Jisun An* August 2024 – May 2025
  - Investigated how team structure (flat vs. hierarchical) and demographic diversity affect reasoning performance and collaboration in multi-agent LLM systems.
  - Developed a framework to simulate LLM agent teams, integrating role-based hierarchies and persona-based diversity (e.g., gender, age, ethnicity, occupation).
  - Ran over 70 controlled experiments using four open-source models—LLaMA-8B, Qwen-2.5 7B, Mistral, and DeepSeek—across four benchmarks: CommonsenseQA, Social IQa, StrategyQA, and Latent Implicit Hate.
  - Found that flat teams consistently outperformed hierarchical teams by an average of 2.5% across models and tasks.
  - Used pre- and post-task team agent interviews and GPT-4o evaluations to assess communication, collaboration, and team integration.
  - Results suggest that while demographic diversity does not boost accuracy, it improves team comprehension and dialogue quality.
- *Faculty Research Assistant, advised by Prof Maria Parker* May 2023 - March 2024
  - Spearheaded a team of 3 students to build topic modeling using SentenceBERT embeddings and KNN on datasets of 200k tweets each. Hypertuned a UMAP function to increase processing time by 25%.

- Upgraded coherence score for brand tweets at 0.68 for optimal topics of 5 and 0.62 for street tweets at 40 topics.
  - Implemented a regression model to predict sentiment based on features like topic ID and engagement metric to observe relationship between the target and the features with accuracy of 85%. Conducted model evaluation by identifying coefficients and statistical tests
- *Graduate Research Assistant, advised by Prof Selma Sabanovic* *Jul 2023 - June 2024*
    - Designed and tested 50+ prompts for social interaction of older adults with robot using OpenAI GPT-3.5
    - Built a Name Entity Recognition model to create a user profile. Operationalized the user profiles through prompt engineering with GPT 3.5.
  - *Graduate Research Assistant, advised by Prof Matthew Francisco* *Jan 2023 - May 2024*
    - Designed 8 human-collaborative interaction experiments to study the capabilities of LLMs in education with respect to problem discovery, scientific inquiry, and output creation.
    - Created a co-design interface as a collaborative tool for school students using Flask and OpenAI GPT-4 API.
    - Collected data through interviews with 20+ students from 3+ education levels and analyzed data through t-tests and qualitative tests.
    - Created our own code book for the human-chatbot interactions and the final research statement produced. Conducted inter-reliability test for the scoring and also operationalized the scoring using GPT-3 and GPT-4.
    - Currently building automated process with the inclusive of fine-tuned BERT model trained with novel lexicon for a more customized experience.
  - **Avtaar** Bangalore, India  
*Machine Learning Engineer* *Jan 2022 - Apr 2022*
    - Built an automated evaluation system deployed with Flask and AWS (S3 buckets and EC2) for integration into the existing application which increased user engagement by 10% and reduced content team efforts by 50%.
    - Modeled Natural Language Generation using GPT-3 through OpenAI API. Evaluated semantic similarity and word embedding for comparison using HuggingFace transformers. Reported 0.6 as a threshold score as optimal.
  - *Business Analyst Intern* *Jul 2021 - Oct 2021*
    - Designed and presented 4+ core dashboards to the executives of the company. Collaborated with the design team to enhance the signup system and increase customer acquisition by 25%.
    - Optimized SQL script to retrieve data through PostgreSQL to get user data according to team requirements.
    - Programmed Natural Language Processing techniques like Name Entity Recognition and POS Tagging to identify skills, tools and technologies and domain areas in 1000+ job descriptions scrapped from the web.
    - Built a predictive model using Random Forest to suggest top 3 jobs to a user based on their skills and interests. Features were created through LDA and PCA topic modeling of job descriptions.

## ACADEMIC PROJECTS

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- **Social Media Mining**  
*Computational Methods*
  - Semantic differences between during-war and post-war (Israel Palestine) comments on Reddit
  - Collected 10k+ comments from Reddit from subreddits dedicated to conversation about Israel Palestine war and by using search queries.

- Implemented EMPATH sentiment analysis, DistilBERT and BERTopic for topic modeling, t-test and p-test to observe other differences in semantic measures like sentence length, word count, readability, lexical density.
- Found that the top 10 emotions for the datasets were centered around war, terrorism, death, fear and serious emotions with increased variability in scores for the Hamas dataset. Topic modeling revealed datasets had overlapping clusters. While statistical tests showed statistical significant in post-war comments.

## Data Visualization

Fall 2023

### • Professor: Yong-Yeol Ahn

- Led a team of 3 to build a interactive dashboard using dash and plotly called STEM Vision for comprehensive understanding of job roles related to computer science and data science.
- Created network visualization to showcase associated skills with a job roles. Also created a weighted skillmap for each job role. Created a skill-association map for all job roles within a domain.
- Created comprehensive bar plots and choropleth maps for analysis on salary, location and top companies for each role.

## Network Science

Spring 2023

### • Professor: Yong-Yeol Ahn

- Led project on network analysis of Mastodon.
- Collected and analyzed 10k+ data points from Mastodon via API.
- Constructed comprehensive networks and examined follower-following patterns, and post-repost trends, assessed attributes like degree distribution, power-law tendencies, clustering, and degree centrality with Gephi visualizations.
- Observed that large instances (like Mastodon.social) have behaviors similar to a centralized platform like Twitter with power law in follower-following degree graphs and strong hubs in clustering visualization.
- Sample 1000 random toots to observe patterns with trending topics and number of followers. Observed that 33% of trending topics traced back to users with highest follower counts.

## PUBLICATIONS

- **Can Lessons From Human Teams Be Applied to Multi-Agent Systems? The Role of Structure, Diversity, and Interaction Dynamics**  
*Rasika Muralidharan, Haewoon Kwak, Jisun An*[Under Review at Empirical Methods in Natural Language Processing (EMNLP)]
- **Federating Governance: How Community Rules Scale with Mastodon Servers**  
*Rasika Muralidharan, Yong-Yeol Ahn, Bao Tran, Truong*[Under Review at Computer-Supported Cooperative Work(CSCW)]
- **Comparative Analysis of the Breast Cancer Information Landscape on Facebook: Neural Network Topic Modeling and Metadata Analysis of English and Spanish Content**  
*Rasika Muralidharan, Arthur D. Soto-Vasquez, Maria Montengero, Danny Valdez*[Under Review at Health Communication Journal]
- **Digital Epidemiology of Prescription Drug References: Mapping the Twitter Narrative with Deep Learning**  
Varun Rao, Danny Valez, *Rasika Muralidharan*, Aravind Dendukuri, Vandana Panth, Jon Agle, Kate Edens, Maria A. Parker Journal of Medical Internet Research (JMIR), 2024
- **Let's Talk About You: Development and Evaluation of an Autonomous Robot to Support Ikigai Reflection in Older Adults**  
Long-Jing Hsu, Weslie Khoo, Manasi Swaminathan, Kyrie Jig Amon, *Rasika Muralidharan*, Hiroki Sato, Min Min Thant, Anna S. Kim, Katherine M Tsui, David J Crandall, and Selma Šabanovic IEEE International Conference on Robot and Human Interactive Communication (RO-MAN), 2024

- **Profiled with Purpose: LLMs’ Role in User Profiles for Personalized Conversations**  
Manasi Swaminathan, Long-Jing Hsu, Kyrie Amon, *Rasika Muralidharan* IEEE/ACM International Conference on Human-Robot Interaction (HRI), 2024
- **Modeling Future Careers: A Large Language Collaborative Tool for Scaffolding Problem Discovery and Research Planning for Transitioning Students**  
Matthew Francisco, *Rasika Muralidharan*, Ece Gumsel [IN PREPARATION]

## PRESENTATIONS

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- **Scaling of Community Rules Across Mastodon Servers**  
*Rasika Muralidharan*, Bao Tran Truong, Yong-Yeol Ahn  
Upcoming Parallel Talk at International Conference of Computational Social Science (IC2S2) 2025, Norrkoping, Sweden
- **Can Lessons From Human Teams Be Applied to Multi-Agent Systems? The Role of Structure, Diversity, and Interaction Dynamics**  
*Rasika Muralidharan*, Haewoon Kwak, Jisun An  
Midwest Speech and Language Days (MSLD) 2025, University of Notre Dame
- **Modeling Future Careers: A Large Language Collaborative Tool for Scaffolding Problem Discovery and Research Planning for Transitioning Students**  
Matthew Francisco, *Rasika Muralidharan*, Ece Gumsel  
Faculty Academy on Excellent Teaching (FACET), Indiana University
- **Building Scientific Inquiry and Problem Discovery Using Large Language Models**  
*Rasika Muralidharan*, Matthew Francisco  
Research Poster Competition, Center of Women in Excellence and Technology, Indiana University

## SKILLS SUMMARY

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- Languages      Python, C++, JavaScript, SQL, R, JAVA
- Frameworks    Scikit, NLTK, SpaCy, TensorFlow, Keras, Django, Flask, NodeJS, NetworkX, PyTorch
- Tools            Kubernetes, Docker, GIT, PostgreSQL, MySQL, Gephi
- Platforms      Linux, Windows, Arduino, Raspberry, AWS, GCP