# Shashank Kirtania

Research Fellow, PROSE Team
Microsoft

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## Education

**Thapar Institute of Engineering and Technology** 2019 - 2023
*Bachelors of Engineering in Computer Engineering*

## Experience

**Microsoft Research, India** Sep. 2023 – Present
*Research Fellow (Predoctoral) with the PROSE group* *Remote / Bengaluru*
Projects: StackFeed, MetaReflection, Logic-LM++

**Wadhwani AI** Jan. 2023 - July 2023
*Machine Learning Research Intern* *Remote / Bengaluru*
Project: Oral Reading Fluency for Indic languages

**Google Summer of Code, PyMC** May 2022 - Sep 2022
*Open Source Contributor* *Remote*
Project: APIs for probabilistic models.

**Indian Institute of Information Technology** June 2021 - May 2022
*Research Intern* *Remote*
Project: Classification of images using DWT coefficients

## Publications And Preprints

C = Conference, W = Workshop, J = Journal

C.1 ***MetaReflection: Learning Instructions for Language Agents using Past Self-Reflections***
**Shashank Kirtania***, Priyanshu Gupta*, Ananya Singha*, Sumit Gulwani, Arjun Radhakrishna, Sherry Shi, Gustavo Soares.
***The 2024 Conference on Empirical Methods in Natural Language Processing*** **[EMNLP'24]**

W.1 ***Activation Steering in Neural Theorem Provers***
**Shashank Kirtania**
***Foundational Models in Wild Workshop at ICLR*** **[FMWild @ ICLR'25]**

W.2 ***Logic-LM++: Multi-Step Refinement for Symbolic Formulations***
**Shashank Kirtania**, Priyanshu Gupta, Arjun Radhakrishna.
**NL Reasoning and Structured Reasoning Workshop at ACL** **[NLRSE@ACL'24]**

P.1 ***STACKFEED: Structured Textual Actor-Critic Knowledge Base Editing with Feedback***
**Shashank Kirtania***, Naman Gupta*, Priyanshu Gupta, Krishna Kariya, Sumit Gulwani, Arun Iyer, Suresh Parthasarathy, Arjun Radhakrishna, Sriram K. Rajamani, Gustavo Soares
***Under review*** **[preprint]**

J.1 ***DWT-CompCNN: Deep Image Classification Network for High-Throughput JPEG2000 Compressed Documents***.
Tejasvee Bisen, M Javed, **Shashank Kirtania**, P Nagabhushan.
**Pattern Analysis and Applications Journal** **[Springer 2023]**

## Selected Projects And Collaborations

**Automated Code Repair** Jan. 2024 – June 2024
*Advisor: Dr. Gustavo Soares, Dr. Arjun Radhakrishna* *Microsoft PROSE*

- Developed **MetaReflection**, an offline reinforcement learning technique enhancing language agents by leveraging past reflections, improving performance in code vulnerability detection. Published @ EMNLP Main.
- This technique showed significant improvements in low resource programming languages and in distilling capabilities of LLMs into SLMs, It is currenlty used by GitHub for secret key detection. Blog

- Worked on fixing component governance issues from alerts for C# using tool-aided LLM system. Developed Roslyn APIs as tools to improve code understanding for LLMs.
- Worked on automatic bug reproduction for GitHub issues in repositories to improve bug localization in Python repositories.

**Knowledge Learning from LLM Interactions** Aug. 2024 – Present

*Advisor: Dr. Arun Iyer, Dr. Gustavo Soares* *MSR India*

- Developed **STACKFEED**, a multi-agent actor-critic framework for iterative knowledge base refinement using expert feedback, enhancing Retrieval-Augmented Generation (RAG) systems by up to 8% over baselines.
- Built pipeline to use compiler feedback to generate edits in knowledge bases for code migration and generation.
- Working on learning knowledge bases from interactions of LLM agents on benchmarks like SWEBench, OSWorld.

**Language Models for Automated Reasoning** Apr. 2024 – Present

*Advisor: Dr. Arun Iyer, Dr. Arjun Radhakrishna*

- Introduced **Logic-LM++**, a multi-step refinement framework leveraging LLMs for symbolic reasoning, achieving significant improvements over existing methods. Published at NLRSE Workshop @ ACL
- Built pipeleine to capture activation vectors representing natural language reasoning for LLMs. Used this technique to beat SOTA on *miniF2Ftest*. Published at FM in Wild Workshop @ ICLR.

**Automated Repository Code Migration** Sep. 2023 – May 2024

*Advisor: Dr. Gustavo Soares, Dr. Sumit Gulwani* *Microsoft PROSE*

- Built pipeline for using LLMs as pseudo-domain experts that learn from failures to detect code vulnerability.
- Employed novel strategy of automatic instruction learning to optimize performance of LLM agent trajectories.

**Autofill for data manipulation** Aug 2023

*Advisor: Prof. Shalini Batra* *github*

- Implemented PBE based approach same as FlashFill, to generate programs from input-output examples in Julia.
- Developed directed acyclic graphs with iterative intersection and unification functions for data process optimization.

**Phonetically Aware Word Recommendation** Jan. 2023 - Mar. 2023

*Advisor: Dr. Soma Dhavala* *Wadhwani AI, blog*

- Curated dataset for English and Gujarati for students from grade 2 to grade 10 for phonetic assessment.
- Created RICE translation Scheme for Gujarati to break down words phonetically at the unicode level.
- Trained encoder to cluster words using unicodes for English & Gujarati for phonetic similarity across languages.

**Contactless Biometric Verification** Jan. 2022 - Dec. 2022

*Advisors: Prof. Shalini Batra, Prof. Prashant Rana* *Undergraduate Capstone*

- Created custom filters in image processing pipeline for image refinement for fingerprints maintaining quality.
- Worked on remote fingerprint verification systems that uses specialised encoder model to breakdown fingerprint photos and fingerprint scans to a shared embedding space for biometric verification.
- Trained U-net styled architecture to create dense embedding, achieved an EER of 4.7% competitive to other deep learning methods for fingerprint verification.

**Classification of Images in Semi-compressed domain** June 2021 - May 2022

*Advisors: Dr. Mohammad Javed* *IIIT*

- Implemented Hight-Throughput JPEG2000 compression algorithm in MATLAB to compress document images.
- Used DWT coefficients with different bands for classifying semi-compressed images with getting 94.3% accuracy.
- Implemented and benchmarked state of the art CNNs for semi-compressed image classification on curated dataset.

## Technical Skills

**Languages**: Python, C++, Shell, MATLAB, Julia, C#, Rust* * = Elementary Proficiency
**Software and Tools**: PyTorch, AutoGen, Langchain, TreeSitter, Fairseq*, Flask, Git, Docker, Postman

## Achievements and Position of Responsibilities

- Volunteer at PLDI 2024, ICLR 2025.
- Positioned **6th nationally among 5000 + teams** in Amazon Machine Learning challenge 2023.
- **Bronze Medal** in American Express Time Series Forecasting Challenge 2022.
- PyData Delhi talk on "Introduction to Probabilistic Programming".
- **Top 5 percentile** in Facebook Hackercup 2020 Qualifiers