Nihal V. Nayak

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RESEARCH SUMMARY

My research focuses on building zero-shot systems, a class of intelligent systems that generalize to new classes, tasks, and environments without human annotations. Applications of my work include domain adaptation and architecture probing of foundation models such as LLMs and VLMs. (*Flexible graduation date.)

EDUCATION

Brown University   Providence, USA
Doctor of Philosophy in Computer Science (GPA: 4.0)   *Aug. 2019 – May 2025**
- Thesis: Zero-Shot Learning with Structured Knowledge, Composition, and Synthetic Datasets
- Committee: Stephen H. Bach (Advisor), Ellie Pavlick, Chen Sun

Brown University   Providence, USA
Master of Science in Computer Science (GPA: 4.0)   *Aug. 2019 – May 2021*

M. S. Ramaiah Institute of Technology   Bangalore, India
Bachelor of Engineering, Information Science and Engineering (GPA: 8.96)   *Aug. 2013 – May 2017*

EXPERIENCE (RECENT)

Brown University   Providence, USA
Graduate Research Assistant   *June 2019 – Present*
- **Bonito**: Created an open-source LLM that converts unannotated text from specialized domains into synthetic instruction-tuning datasets. Trained three LLMs (Llama and Mistral variants) on the synthetic datasets and improved their zero-shot performance across seven datasets by **22.1 F1 points**. Achieved 700+ GitHub stars, 10,000+ model downloads, and featured in numerous well-known blogs [1] [2] (ACL Findings, 24).
- **Compositional Soft Prompting (CSP)**: Proposed a novel parameter-efficient, prompt-tuning method that decomposes soft prompts into modular concepts for composable zero-shot inference. Improved CLIP (VLM) on compositional zero-shot learning benchmarks by **10.9 AUC points** (ICLR, 23).
- **ZSL-KG**: Developed a general-purpose zero-shot learning framework that trains a novel transformer-based graph convolutional network to use common sense knowledge graphs. Improved zero-shot performance over WordNet-based approaches on **5 out of 6 datasets** in language and vision (TMLR, 22).

ASAPP   New York, USA
ML Research Intern   *May 2022 – Sep. 2022*
- Developed a few-sample clustering evaluation framework that **reduces evaluation metric estimation error by 57%** compared to the best-performing method (arXiv, 22).

Stride.AI   Bangalore, India
NLP Engineer   *Nov. 2017 – May 2019*
- Designed a new LSTM-based architecture for financial NER. Improved state-of-the-art performance by **4.8 F1 points** (AAAI-MAKE 2019).

PAPERS (SELECTED)

- **Nihal V. Nayak**, Yiyang Nan, Avi Trost, and Stephen H. Bach. **Learning to Generate Instruction Tuning Datasets for Zero-Shot Task Adaptation**, *ACL Findings*, 2024 [PDF] [Model] [Code].

- Martha Lewis*, **Nihal V. Nayak***, Peilin Yu, Qinan Yu, Jack Merullo, Stephen H. Bach, and Ellie Pavlick. **Does CLIP Bind Concepts? Probing Compositionality in Large Image Models**, *EACL Findings*, 2024 [PDF] [Code].

- **Nihal V. Nayak***, Peilin Yu*, and Stephen H. Bach. **Learning to Compose Soft Prompts for Compositional Zero-Shot Learning**, *International Conference on Learning Representations (ICLR)*, 2023 [PDF] [Code].

- **Nihal V. Nayak** and Stephen H. Bach. **Zero-Shot Learning with Common Sense Knowledge Graphs.** *Transactions on Machine Learning Research*, 2022 [PDF] [Code] [Project].

- Victor Sanh et. al. **Multitask Prompted Training Enables Zero-Shot Task Generalization.** *International Conference on Learning Representations (ICLR)*, 2022 [PDF] [Model] [Code]. **(Spotlight)**