

Education

- Jul 2019- Jun 2023 **Birla Institute of Technology and Science (BITS), Pilani, Pilani campus, India.**
Bachelor of Engineering in Computer Science, CGPA: 9.68/10
Relevant Coursework - Deep Learning, Probability and Statistics, Data Structures & Algorithms, Linear Algebra, Information Retrieval, Object Oriented Programming, Programming Languages, Compiler Construction
- Ranked in the **top 1%** among 1100 students in the academic batch of 2023.

Research Interests

AI4Code, Natural Language Processing, Neurosymbolic AI, Software Engineering, Computer Vision

Research Experience

- Sep 2023- Present **LLM Fine-tuning for Excel Copilot Agent.**
PROSE, **Microsoft Research**, Bengaluru – Advisor: [Dr José Cambrero](#), [Dr Aditya Kanade](#)
- Developed **natural language validation** strategies to obtain high-quality synthetic data for fine-tuning.
 - Managed end-to-end pipeline for fine-tuning open-source and GPT LLMs on **NL to spreadsheet formula** task.
 - Conducted research on optimal data representations for code generation in structured data environments.
 - Designing a low-latency system for formula completion in Excel based on a **neuro-symbolic approach** to extract relevant context from spreadsheets.
- Jan 2023 - Jul 2023 **Comparative Analysis of Transformers for Modeling Tabular Data.**
AI Labs, **American Express**, India – Advisor: [Dr Piyush Arora](#)
- Trained 4 **Transformer** architectures on credit fraud prediction problem, achieving a best F1 score of **0.89**.
 - Adapted these techniques to **industry** data, enhancing performance by **3%** over the base LightGBM approach.
 - Conducted detailed experiments to study the impact of Upsampling and dimensionality on model performance.
- Aug 2022- Dec 2022 **Text and Multimodal Relation Extraction.**
ADAPT Lab, BITS Pilani – Advisor: [Prof Poonam Goyal](#)
- Designed a **sequence-to-sequence** model to perform relation extraction in out-of-domain textual content.
 - Adapted a **hybrid transformer** architecture for extracting relations from correlated image and text sources.
 - Devised an approach to efficiently extract relations when multiple images are interconnected with textual data.
- Jun 2022- Aug 2022 **Retrieval Augmented Long Document Question Answering.**
UKP Lab, **TU Darmstadt**, Germany – Advisor: [Prof Iryna Gurevych](#)
- Devised a **novel retriever-reader** approach for long document question-answering task on **QASPER dataset**.
 - Improved the SoTA baseline by **5 F1** points, integrating a Cross Encoder as the Retriever and T5 as the Reader.
 - Conducted a comprehensive analysis of language model behaviour, focusing on the impact of relevant information presence in input data.
- Jan 2022- Jun 2022 **Efficient Image Super-Resolution for Mobile Devices.**
Visual Computing Lab, BITS Pilani – Advisor: [Prof Pratik Narang](#)
- Devised four-stage super-resolution network incorporating **multiception** convolution layers in distillation block.
 - Implemented a **pixel attention** layer post-upsampling, and employed **smooth L1** loss for training.
 - Refined the RFDN model, achieving a **28%** reduction in parameters while preserving accuracy on **DIV-2K**.
- Aug 2021- Dec 2021 **Multilingual Chatbot for Indian Languages.**
Web Intelligence and Social Computing Lab, BITS Pilani – Advisor: [Prof Yashvardhan Sharma](#)
- Developed a multilingual chatbot leveraging **MuRIL BERT** for fixed response Q/A in 17 Indian languages.
 - Enhanced the chatbot to include context-based question-answering by fine-tuning it with the **SQuAD** dataset.
 - Conducted benchmarking of multilingual language models for fixed response accuracy, utilizing top-k evaluation.
- Jun 2021- Dec 2021 **Digital restoration of ancient Indian murals through image Inpainting.**
Council of Industrial and Scientific Research (**CSIR-CEERI**), India – Advisor: [Dr Dhiraj Sangwan](#)
- Developed an automatic damage detection method for images, using a **U-net** with optimized training time.
 - Innovated a **novel data augmentation** strategy, effectively addressing dataset scarcity in mural restoration.
 - Implemented an **inpainting** technique with **partial convolution** for selective restoration of damaged regions.

Publications

- 2024 **Asking language models how to represent data for fine-tuning.**
U. Singh, A. Singha, A. Awasthi, S. Gulwani, A. Kanade, V. Le, M. Singh, G. Verbruggen
ACL Rolling Review (submitted)
- 2024 **An Empirical Study of Validating Synthetic Data for Formula Generation.**
U. Singh, J. Cambronero, S. Gulwani, A. Kanade, A. Khatry, V. Le, M. Singh, G. Verbruggen
ACL Rolling Review (submitted)
- 2024 **Comparative Analysis of Transformers for Modeling Tabular Data: A Casestudy using Industry Scale Dataset.**
U. Singh, P. Arora, S. Ganesan, M. Kumar, S. Kulkarni, and S. R. Joshi
7th Joint International Conference on Data Science and Management of Data (CODS-COMAD)
- 2023 **Multilingual Chatbot for Indian Languages.**
U. Singh, N. Vora, P. Lohia, Y. Sharma, A. Bhatia, and K. Tiwari
14th International Conference on Computing, Communication and Network Technologies (ICCCNT)
- 2023 **Ancient Indian Murals Digital Restoration through Image InPainting.**
U. Singh, S. Maiti, A. Saini, and Dhiraj
10th International Conference on Signal Processing & Integrated Networks (IEEE SPIN)
- 2022 **MFDN: Multiception Feature Distillation Network.**
S. Sameen, **U. Singh**, and P. Narang
50th IEEE TENCON Conference

Awards

- 2023 **ACM Student Grant**, *Received a travel grant worth Rs. 30,000 from ACM to attend the CODS-COMAD conference in Bengaluru, India.*
- 2022 **DAAD-WISE Scholarship**, *Received a scholarship worth Rs. 3,00,000 from DAAD, Bonn for a research internship in Germany. This prestigious award is granted to the top 100 students across India..*
- 2017 **NTSE Scholarship**, *Selected among the top 750 students out of 2 lakh applicants in India in the national science examination. Awarded a scholarship worth Rs. 2,00,000 by the Govt. of India..*

Teaching Experience

- Aug 2022- Dec 2022 **Computer Programming**, *Teaching and Lab Assistant.*
Instructed 100 students in weekly 2-hour labs, focusing on fundamental concepts in C programming.
- Jan 2022- May 2022 **Data Structures & Algorithms**, *Teaching and Lab Assistant.*
Facilitated weekly 3-hour programming labs for 80 students. Developed lab exercises with contemporary topics and industry-relevant questions to aid in placement preparation.

Leadership and Volunteer Work

- Aug 2019- Jun 2022 **Nirmaan Organisation**, *Project Leader.*
Led a team of 20 teaching volunteers in Baas village, India. Devised a comprehensive plan to enhance spoken and written English skills, benefiting over 100 Nirmaan beneficiaries.
- Aug 2020- Dec 2020 **Student Faculty Council, BITS Pilani**, *Student Representative.*
Served as a student representative in the Department of Computer Science faculty meetings, playing a key role in incorporating student feedback into course design and curriculum development.

Academic Projects

- Feb 2022- May 2022 **Creation of custom compiler.**
Course Project: **Compiler Construction**, Advisor: [Prof Vandana Aggarwal](#)
 - Collaboratively designed and developed a custom language compiler in C within a team of five members.
 - Implemented all phases of the compiler, from parsing to assembly code generation from scratch.
- Mar 2022- May 2022 **Sentiment Analysis of Blogger's Opinion.**
Course Project: **Information Retrieval**, Advisor: [Prof Poonam Goyal](#)
 - Developed a sentiment analysis model using a BiLSTM, augmented with attention layers for improved accuracy.
 - Crafted an embedding strategy that integrates Glove embedding, TF-IDF scores, & WordNet sentiment scores.
- Sep 2021- Nov 2021 **Person Identification using Forehead images.**
Course Project: **Deep Learning**, Advisor: [Prof Kamlesh Tiwari](#)
 - Curated a dedicated forehead image dataset by extracting cropped images from 100 individuals.
 - Compared performance on baseline models- SIFT, SURF, FaceNet and ResNet50. **Best accuracy - 89%.**