Ayush Kaushal

The University of Texas at Austin

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Education

Masters of Science in Computer Science *August 2021 - May 2023*
The University of Texas at Austin, TX, USA ***4.00***/*4.00*

Bachelors of Technology in Computer Science and Engineering *July 2017 - May 2021*
Indian Institute of Technology Kharagpur, West Bengal, India ***9.54***/*10.0*

Publications and Talks

- Efficient Encoders for Streaming Sequence Tagging. **EACL 2023, Under Review** [pdf]
- What do tokens know about their characters and how do they know it? **NAACL 2022, Oral** [pdf | code]
- Causal Direction of Data Collection Matters: Implications of Causal & Anticausal Learning in NLP, **EMNLP 2021 Oral** [pdf | code]
- *t-WT*^{2}: A Dataset to Assert the Role of Target Entities for Detecting Stance of Tweets, **NAACL-HLT**-2021. [pdf | code]
- Multi-Staged Language Models for Extracting Measurements, their Attributes and Relations, **ACL-SemEval** 2021. [pdf | code]
- Leveraging Event Specific and Chunk Span features to Extract Twitter COVID Events, **EMNLP-2020 Oral** Workshops [pdf | code]
- Domain Specific BERT for Named Entity Recognition on Lab Protocols, **EMNLP-2020 Workshops** [pdf | code]
- WordTokenizers.jl: Basic Tools for Tokenizing Natural Language in Julia, Journal of Open Source Software (*JOSS*) 2020 [pdf | code]
- Natural Language Processing in Julia, JuliaCon 2020 Conference Talk and Software Demo - 30 minutes [video]

Work Experience

Google Search | Advisor: Aditya Gupta, Dr. Shyam Upadhyay, Dr. Manaal Faruqui Mountain View, California
Query Understanding, NLP, Semantic Parsing | Graduate Research Intern May 2022 - Aug 2022
- Engineered novel techniques for adaptive neural modelling for understanding a streaming input query.
- Proposed techniques reduced FLOP count by over 71.1%, while improving performance by more than 10%.
- One publication under review at EACL 2023 for the work done during internship.

University of Texas at Austin | Advisor: Prof. Kyle Mahowald Austin, Texas
NLP, GPT, Bertology | Graduate Researcher Sept 2021 - Jan 2022
- Probed Large Language Models (LLM) like GPTJ, GPT3 to quantify extent of character information in sub-word level models.
- Traced the source of character information in LLMs to linguistic phenomena of Part of Speech, NER and variability in statistical tokenization.
- Research was acclaimed as an **Oral** Presentation at the prestigious **NAACL 2022** conference.

ETH Zürich, Institute for ML | Advisor: Prof. Mrinmaya Sachan, Prof. Bernhard Schölkopf Zürich, Switzerland
NLP, Machine Translation, Causality | Research Intern May 2021 - July 2021
- Investigated and exhaustively experimented for the implications of **causal direction in NLP** data focusing on the popular tasks of Neural Machine Translation, Syntax Discovery, Domain Adaptation and Semi-Supervised Learning.
- Formulated **Minimum Description Length** for transformers and experimented for Neural Machine Translation with over 38 language-pairs.
- Conduct extensive analysis of Minimum Description Length Principle with 5 different methods for Text Generation Models.
- Research was acclaimed as an **Oral** Presentation at the prestigious **EMNLP 2021** conference.

University of Oregon, SHI Labs | Advisor: Prof. Humphrey Shi Eugene, USA
Multimodal Learning, Computer Vision | Intern July 2020 - Dec 2020
- Devised show-attend-tell inspired grounded captioning model delivering **1.29 CIDEr**, despite being **7x smaller** than state of the art models.
- Improved visual grounding models to **85.02% accuracy** via adversarial training with inverse task of referring expression generation.
- Conceptualized novel task of Spatio-temporal video dense captioning; Curated its 1.2M+ Captions dataset and benchmarked on its baselines.
- Explored **convolutional-free transformer** models for Video-Captioning using ViT, Temporal Attention and Language Modelling.

IBM Research Labs | Advisor: Vitobha Munigala Bangalore, India
Bias and Explainability, Deep Learning | GRM Programme Intern May 2020 - June 2020
- Improved fine-grained bias detection by up to **4.1% F1 gains** using auxiliary objectives of sentiment and VAD lexical-attribute scoring.
- Developed novel task of bias removal from news while preserving the information-content and document level coherence of the news article.
- Proposed and experimented with the modular neural architectures for the novel de-biasing task, handling over 14 categories of biases.

IIT Kharagpur, Computer Science Department | Advisor: Prof. Niloy Ganguly Kharagpur, India
NLP, Explainability in NLP, Deep Learning Jan 2020 - April 2021
- Integrated semantics for stance detection using graph attention to improve up to **+10.7% accuracy** gains on the WT-WT dataset.
- Diagnosed spurious cues across 6 stance detection datasets and built using novel augmentations, 100k+ size de-biased target-aware benchmark.
- Published the research at **NAACL 2021** conference while also being lauded among the **Best Bachelor Thesis** at the Institute.

Google Summer of Code, Julia Language | Advisor: Dr. Lyndon White, Avik Sengupta India

NLP, Open Source Software — May 2019 - August 2019

- Formulated novel regex-free approach for custom **multilingual tokenization** up to 4 times faster than SpaCy, NLTK.
- Proposed end-to-end CRF-LSTM model for general-purpose NER, POS tagging APIs with 93.1, 91.2 F1 on CoNLL'03.
- Lead the development of JuliaText packages – TextAnalysis, WordTokenizers with **500+ GitHub stars and 5000+ downloads**
- Delivered a 30-minute **talk+demo at JuliaCon** 2020 on these ML/NLP packages. Also published at the Journal of Open Source Software.

Competitions

Cogito's 2021 AI for Intelligence Augmentation Challenge — Global
Winner | Low-Latency speech emotion recognition — Aug 2021 - Sept 2021

- Proposed and built novel state-of-the-art **phono-linguistic transformer** for speech emotion recognition achieving 61.38% fine-grained accuracy.
- Designed rich multimodal representation with Bert & HuBert. Evaded catastrophic forgetting via auxiliary task of the pre-training objective.
- Won the competition for our novel approach receiving **100,000 INR cash** reward. Built a user-friendly web application for emotion classification.

AllenNLP Hacks 2021 — Global
Best Design Award | Improving GPT-3 for Text Simplification — Sept 2021

- Leveraged **GPT-3 for text-simplification** via prompt-engineering and improved via ranking multiple generated outputs in post-processing.
- Devised a ranking model over GPT-3's outputs as Bert Regression model trained for sorted simple text first on scrapped ELI5 subreddit data.

ACL - SemEval 2021 Task 8 — Global
Second runners-up | Understanding Counts and Measurements in Scientific Text — Jan 2021

- Implemented a 3 staged pipeline, with sequence labeling Bert and regex to extract measurement spans in text, units and attributes.
- Achieved more than 100% gains over the baselines and **ranked 3rd** on the subtask-2. Published at ACL-SemEval 2021.

EMNLP 2020 — Global
Winner | Extracting Entities from Twitter COVID Events — July 2020

- Composed a pair of multi-task learned systems for the disparate slot-filling and classification entity of the 16 possible entities.
- Improvised using domain-specific Bert with attention pool and auxiliary task of event prediction to achieve SoTA with 65.98 F1.
- Secured **1st position** in the challenge and published at EMNLP 2020 as an Oral presentation at the Noisy-Text workshop.

OpenSoft 2018 — Intra-University
Winner | Parsing Handwritten Medical Documents — March 2018

- Augmented the general-purpose Azure-OCR to Medical Documents using Image Processing and NLP techniques to intelligently parse and auto-correct document metadata and prescribed medicines while preserving diagrammatic information.

Open-Source and Miscellaneous Projects

- Devised a cryptocurrency based incentive mechanism and developed its smart contract for a crowd-sourced Google Earth alternative.
- Leading contributor for TextAnalysis and WordTokenizer packages with various NLP models and off-the-shelf APIs.
- Added numerous fixes and paper-data for the EACL 2021's virtual conference website with over 1000 participants.

Coursework

Graduate: Blockchain & Smart Contract, Machine Learning, Natural Language Processing, Advanced Algorithms, Cyber Security Law & Policy
Undergraduate: Operating Systems, Computer Networks, Computer Architecture, Linear Algebra, Probability and Statistics, Multivariate Calculus, Operations Research, Image Processing, Social Computing, Artificial Intelligence, Theory of Computation, Discrete Mathematics

Technical Skills

Python, C/C++, Solidity, Javascript, Git, Bash, Linux, Numpy, PyTorch, JAX, Matplotlib, Regex, LaTeX, Flask, Huggingface

Teaching, Volunteering and Extracurricular

- Served as Graduate Teaching Assistant at UT Austin for Graduate Algorithms and Information Retrieval in Spring and Fall 2022 respectively.
- Mentored in Google Summer of Code 2020 and Google Code-In 2019 for NLP-ML projects for freshmen and high-schoolers.
- Among 50 students selected for and attended the Google's AI Research Summer School 2020 in the Natural Language Understanding Track.
- Conference Volunteer: EACL 2021, ICLR 2021, NAACL 2021 || Reviewer: EMNLP 2020 Workshop, ACL-SemEval 2021
- Attended the Eastern European Machine Learning Summer School July 2021 organized by DeepMind & EEML focusing on DL Research.
- Organized, curated the contents and led the open-to-all workshops on Python and Git in IIT Kharagpur with over 500 attendees.
- Served as Executive Head of Kharagpur Open Source Society in 2019, promoting open-source through workshops, mentoring, hackdays.

Awards and Achievements

- Ranked 488 and 249 with 99.96 and 99.87 percentile in 2017 IIT-JEE Main & IIT-JEE Advanced Exams respectively of over 200k candidates.
- Selected as member of National Sports Organization (2017-2019) for being among the best Tennis players of the institute at IIT Kharagpur.
- Received the Mitacs Globalink 2020 Summer Research Scholarship funding of 6000+ CAD for summer research intern at UBC, Canada.
- Awarded with the Student Par Excellence Award by IIT Kharagpur for outstanding academic performance record.
- Recipient of the KVPY 2017 scholarship by the Government of India for excellency and interests in science.