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Ayush Kaushal

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Academics

Year	Education	Grade
2017-2021	*B.Tech* in **Computer Science and Engineering, IIT Kharagpur**	**9.45**/10.0 (Ongoing)
2017	*Higher Secondary School Certificate Examination*, **CBSE**	**93.6%**
2015	*Secondary School Certificate Examination*, **CBSE**	**10**/10

Research Interests

Machine Learning | Deep Learning | Natural Language Processing | Computer Vision

Research Experience

May 19 - Aug 19

Google Summer Of Code, 2019: **FluxML, The Julia Language**
Guide: Dr Lyndon White and Mr Avik Sengupta
- Added support for Linear Chain Conditional Random Fields in the Flux Machine Learning Library and implemented Viterbi Decode algorithm.
- Explored state of the art end-to-end deep learning models for practical sequence labelling APIs using CNNs for Character Embeddings, Word Embeddings, Bi-LSTMs and Conditional Random Fields. (link)
- Built well tested usable APIs for Named Entity Recognition and Part of Speech Tagging with Neural sequence labelling models as backend.

Key Projects

- **JuliaText: Open-source package ecosystem for Natural Language Processing in Julia**
  (Nov 2018 - Present)
  - **WordTokenizer.jl, Tokenizers for Natural Languages:**
    - Wrote variety of lexers for the TokenBuffer API leading to novel feature of creating high-speed custom tokenizers.
    - Added a casual tweet tokenizer, improved the multilingual tokenizer among numerous fixes and features addition.
  - **TextAnalysis.jl, A Julia Package for Text Analysis:**
    - Fixed the statistical summarizer, part of speech tagger, naive bayes classifier and sped up ROUGE score.
    - Ported BM-25, Latent Semantic Analysis and wrote APIs for conversion between tag schemes for sequence labelling.
    - Added docstrings, revamped documentation amongst other fixes to its codebase with over 250 stars on GitHub.
  - **CorpusLoaders.jl, Variety of NLP Loaders:**
    - Added lazy loaders for Senseval, CoNLL and WikiGold corpora using Coroutines, DataDeps and string interning.
    - Made numerous significant fixes to the codebase in form of documenting, CI Tests and codebase.
  - Made numerous fixes on the dependency packages ecosystems of FluxML, JuliaIO, DataDeps.jl and Embeddings.jl in the form of bug-fixes, feature additions, documentation, docstrings and tests.

- **Social Computing for managing disasters and crisis**
  (Guide: Prof Niloy Ganguly) [Ongoing Bachelor Thesis]
  - Working on Verified-Summarization of disaster-specific tweets. Using word embeddings, language models and attention-based recursive neural networks to propagate the set of reply tweets, combined the previous user tweets for user representation and static user data to verify the legitimacy of tweets as part of the pipeline.

Publications

- **WordTokenizers.jl: Basic tools for tokenizing natural language in Julia:** **A. Kaushal**, L. White, M. Innes, R. Kumar *Journal of Open Source Software, 5(46), 1956.*

Coursework

Complete	Algorithms , Discrete Structures , Software Engineering , Probability and Statistics , Formal Languages , Algorithms-II , Linear Algebra , Compilers , Knowledge Modelling Semantic Web , Computer Organization Architecture
OnGoing	Operating Systems , Computer Networks , Machine Learning , Principles of Programming Languages
Online	Deep Learning Specialization , CS224n:NLP with Deep Learning , CS231n: Convolutional Neural Networks

Technical Skills

Programming Languages	*Proficient:* Python | Julia | C/C++
	Competent: JavaScript | Octave | Java | Verilog | Haskell | Lisp
Libraries / Frameworks	OpenCV | Numpy | Pandas | Scikit-Learn | Tensorflow | Keras | PyTorch | Flux.jl
Systems / Platforms	Git | Linux | Bash | Heroku | Azure | LaTeX

Miscellaneous Side Projects

Speeding up Weak Adversarial Networks for PDEs using Neural ODEs -

• Implemented a Weak Adversarial approach for solving Partial Differential Equations (PDEs) using the autodiff software Tracker.jl
• Sped up the approach using the adjoint method of backpropagation through neural-ODEs using DiffEqFlux.jl.

DigiCon - The project intelligently parses a doctor's hand-written prescription using OpenCV, Flask, CoreNLP, bash and Docker.
• Worked majorly on the backend, using Natural Language Processing and Image Processing techniques for extracting and parsing the medical prescription.
• The project entry bagged gold in the intra-university opensoft competition.

Connect All - Developed in 36 hours during Hack-A-BIT 2019, ConnectAll is a platform that enables specially-abled to use technology with equal ease as everyone else and offers Zulip integration for corporate usage.
• Worked on the Zulip chatbot integration of the webapp services and implemented notes and book narrations features.

Kronos - Built a WebApp for the various courses offered at IIT Kharagpur using Flask, Javascript, Python, CSS/Bootstrap.

Tethering Wiki to ERP - Wrote a WikiBot, linking the metakgp wiki with the institute's ERP for automatically updating the wiki.

Relevant Coursework Projects

Rental Store Software: *(Guide: Dr Sudip Misra)*

Built a Rental store software by applying software engineering principles as a part of coursework. The project was written in Java using Swing and MySQL.

TinyC Compiler: *(Guide: Dr Partha Pratim Das)*

A compiler for Tiny C, a self-defined subset of the C language, built using Compiler principles and techniques in C++ with Flex for Lexical Analysis and Bison for Semantic parsing.

Single Cycle CPU: *(Guide: Dr Bhargab Bikram Bhattacharya)*

Designed a Single Cycle 32-bit CPU with limited instruction set on Verilog, an assembler and tested the hardware design on FPGA.

Semantic Web based E-Tourguide: *(Guide: Dr Plaban Kumar Bhowmick)*

Used semantic web technologies and linked databases of DBpedia, Wikidata and MealDB to create a tour guide app.

Activities and Leaderships

Kharagpur Open Source Society, Executive Head *May'18-Feb'20*

- Worked towards promoting Open Source culture. Curated the contents of and taught in the Git Workshop and GoLang & Concurrency Workshop in the Open Source Summit 2019. Mentored in the workshops on Python, Git, Ubuntu.
- Successfully organized and conducted Kharagpur Winter of Code 2018 with over 2000 registrations. Responsible for development, deployment and maintenance of the website as well as the smooth going of the program.

Metakgp, Maintainer *Feb'19-Present*

- Active Contributor and maintainer for the Metakgp wiki, documenting the knowledge of the institute, IIT Kharagpur. Successfully conducted various activities like Demo Days and Hack Days to foster collaboration within the institute campus.

Achievements and Extra Curricular

- **Scholarship:** Selected by Mitacs and Shastry-Indo Canadian Institute for Globalink Research Scholarship
- **Mentor:** Guided freshers towards open source, in Google Code-In, 2019 and Kharagpur Winter of Code.
- Part of the contingent to win the General Championship Technology 2018 in the intra campus event.
- Student Par Excellence Award for Academic Performance by Dept. of Computer Science and Engineering, IIT Kharagpur.
- Attended a weeklong winter workshop on Image Processing and Path Planning by IEEE.
- Ranked 249, among the top 0.12 percentile in IIT Joint Entrance Exam Advanced-2017(IIT-JEE).
- Ranked 488, among the top 0.05 percentile in Joint Entrance Exam Mains-2017(IIT-JEE Mains).
- Kishore Vaigyanic Protsahan Yojana(KVPY) Scholar, program by Department of Science & Technology India.
- First rank in Regional Mathematics Olympiad held in Zone Uttarakhand.
- Member of the National Sports Organization (NSO) Tennis under the Government of India.