ANURENDRA KUMAR

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RESEARCH INTEREST

Machine Learning; Explainable Artificial Intelligence

EDUCATION

University of Illinois at Urbana-Champaign — *Aug '19 - May'21*
M.S., *Computer Science, Concentration in Bioinformatics* — *GPA: 4/4*
Indian Institute of Technology, Kanpur — *Jul '12 - May '17*
M.Tech, *Electrical Engineering* — *GPA: 9.67/10*
B.Tech, *Electrical Engineering* — *GPA: 8.0/10*
Minors in *Artificial Intelligence, Linguistics*

WORK EXPERIENCE

Graduate Research Assistant — *Aug'19 - Present*
FORWARD Lab mentored by Prof. Kevin Chang, Funded by NSF and UIUC-IBM collaboration

Developed a large dataset and a novel scalable Deep learning architecture for web information extraction. Inspired by the recent advances in NLP, we propose a self attention based architecture for optimal contextual learning. The proposed model is promising because it is optimized to exploit semi-structured data such as a webpage.

Lead, Data & Artificial intelligence — *Jan'18 - Mar'19*
Start up Project (Confidential)

Developed and validated machine learning algorithms for futuristic finance services. My work included-i) Designing statistical framework for risk assessment and mitigation in our platform, ii) Modeling and prediction of time-series data when very less training data is available, iii)Explainability of Artificial intelligence techniques.

Research Intern [Presentation] — *Jun'17 - Aug'17*
IBM Research Bangalore, India (Cognitive Computing Platform & Infrastructure Division)

Hierarchical sparse representation of Knowledge base(KB) – Developed an algorithm to learn the vector representation of entity and relations in KB. The proposed model could exploit the existing tree structured hierarchy in latent dimensions.

Intern (Extreme Blue Internship Program) [Video] — *May'16 - Jul'16*
IBM Bangalore, India

Internet of Things (IOT) in Agriculture – Developed the prototype for precision agriculture in India. Our foundational work later developed into full fledged system and won the prestigious **AEGIS GRAHAM BELL AWARD** .

Research Associate [Presentation] — *Aug'17 - Dec'17*
Indian Institute of Technology Kanpur, India (Funding Agency: Indian Space and Research Organisation)

Image quality evaluation aimed to develop a no reference metric for quantifying the remote sensing image dynamics.

Research Intern — *May'15 - Jul'15*
Samsung Research Institute, Delhi, India

Latent variable models for object classification and annotation.

JOURNAL PUBLICATIONS

A.Kumar, T.Guha, P.Ghosh, 'Dirichlet Latent Variable Model: A Dynamic Model Based on Dirichlet Prior for Audio Processing', **IEEE Transaction** on speech and language processing (2019) . [Link]

CONFERENCE PUBLICATIONS

A. Kumar, T. Guha, P. Ghosh, 'A Dynamic Latent Variable Model for Source Separation', Int. Conf. on Acoustics, Speech and Signal Processing (**ICASSP**), Calgary, Apr 2018 . [Link]

L.Pandey^{+}, **A.Kumar**$^{+}$, V.Namboodiri, 'Monoaural audio source separation using variational autoencoders', **Interspeech**'18, Hyderabad, India . [Link] (+ denotes equal contribution)

RELEVANT COURSEWORK

Machine Learning and Algorithms: Bayesian Machine Learning; Natural Language Processing*; Machine Learning for Computational Biology*; Learning theory; Computer Vision; Machine Learning; Data Structures and Algorithm; Principles of Computing

Signal Processing and Bioinformatics: Advanced Bioinformatics*, Detection and Estimation Theory*; Mathematical Methods in Signal Processing*; Image Processing*; Information Theory and Communication Systems; Topics in Signal and Image Processing; Digital Signal Processing

Mathematics: Convex Optimization*; Probability and Statistics*; Linear Algebra* (* denotes A grade)

MASTER'S THESIS

Dynamic Probabilistic Non-negative Matrix Factorization (DPNMF) [Thesis] *Jun'16 - May'17*
Master's Thesis mentored by Prof. T. Guha, IIT Kanpur and Prof. P. Ghosh, IISc Bangalore

Developed a dynamic latent variable model to exploit temporal dependence. Proposed a novel distribution as a prior distribution which is particularly suitable for dynamic non-negative data and leads to elegant update equations.

TEACHING EXPERIENCE

- Teaching Assistant, Convex Optimization, IIT Kanpur
- Teaching Assistant, Electronic Circuit Lab, IIT Kanpur

TECHNICAL SKILLS

Python, C, C++, R, Matlab, Javascript, Tensorflow,Pytorch, Caffe, Latex

RELEVANT PROJECTS

Multiple Word Vector Embedding for polysemous words [Project Material] *Sep' 15 - Nov'15*
Natural Language Processing course project under Prof. A. Mukherjee, IIT Kanpur
Extended word vector model to have multiple representations for polysemous words. Our primary contribution was in developing a non-parametric approach to clustering for optimal number of senses.

Automatic wheat grain quality estimation [Report] *Aug'16 - Nov'16*
Best project *in Image Processing course under Prof. T. Guha, IIT Kanpur*

Developed a proof-of-concept for quality estimation of grain from the image of a grain sample. Created a labeled data-set with the help of traders and farmers. Proposed a novel segmentation algorithm followed by classification.

Visual Odometry in Self-Driving Car [Project Material] *Sep'15 - Nov'15*
Undergraduate project mentored by Prof. G. Pandey, IIT Kanpur

Developed and implemented visual odometry in self-driving car using opencv library in C++. SIFT and FAST features were extracted in each frames. KLT tracker with RANSAC for outlier rejection was employed for tracking features.

Unsupervised speaker diarization [Report] *Jan'16 - Apr'16*
Selected Methods in Signal Processing course project under Prof. T. Guha, IIT Kanpur

Designed an end-to-end pipeline for speaker diarization.

Video segmentation [Project Material] *Jan'16 - Apr'16*
Computer Vision course project under Prof. V. Namboodiri, IIT Kanpur

Improved graph-based hierarchical segmentation in videos for both the online and offline segmentation.

Multiple Kernel Learning (MKL) [Project Material] *Sep'15 - Nov'15*
Learning with Kernel course project under Prof. H. Karnick, IIT Kanpur

Implemented and performed experiments to show that MKL automatically learns the efficient weighted distribution of multiple kernels and have the potential to handle data coming from heterogeneous sources.

Diverse feature selection in Latent Variable models [Report] *Jan' 16 - Apr'16*
Probabilistic Machine Learning course project under Prof. P. Rai, IIT Kanpur

The objective was to develop latent variable models to capture diverse topics/latent features. Used *determinantal point processes* and *mutual angular regularizer* as priors to incorporate diverse selection of latent features.