

ABHINAV KUMAR

Contact Information	<i>Email:</i> abhinavkumar.wk@gmail.com <i>Links:</i> Webpage , Google Scholar , Github	
Education	<i>Birla Institute Of Technology and Science, Pilani</i>	2015-2020
	M.Sc.(Hons.) Physics	GPA: 9.54/10
	Thesis: Disentangling Mixtures of Unknown Causal Intervention	
	Advisor: Dr. Gaurav Sinha , Adobe Research, Bangalore	
	<i>Birla Institute Of Technology and Science, Pilani</i>	2015-2020
	B.E.(Hons.) Computer Science	GPA: 9.54/10
Work Experience	Thesis: Fine-Tuning Word Embedding for Domain Adaptation	
	Advisor: Dr. Partha Talukdar , Indian Institute of Science, Bangalore	
	<i>Microsoft Research</i> , Bangalore	07/21 - Present
	Research Fellow	
	Generalization and Explainability of ML model with Causal Perspective	
	Advisor: Dr. Amit Sharma , Dr. Chenhao Tan and Dr. Amit Deshpande	
	<i>Paypal</i> , Hyderabad	08/20 - 06/21
	Software Engineer 1	
	Backend Service Development for Fraud Detection Platform	
	<i>Adobe Research</i> , Bangalore	01/20 - 07/20
Publications	Research Intern	
	Root Cause Analysis with Causal Perspective	
	Advisor: Dr. Gaurav Sinha	
	<i>Indian Institute of Science (IISc)</i> , Bangalore	05/19 - 12/19
	Research Intern	
	Fine-Tuning Word Embedding for Domain Adaptation	
	Advisor: Dr. Partha Talukdar	
	<i>Google Summer of Code</i>	05/18 - 08/18
	Research Intern, CERN-High Energy Software Foundation	
	Deep Learning for Particle Detection and Energy Prediction for particle detectors at CERN	
	Advisor: Dr. Grasseau Gilles and Dr. Florian Beaudett	
	<i>Center for Astronomy and Astrophysics (IUCAA)</i> , Pune	05/17 - 07/17
	Research Intern	
	Efficient Computation of Gravitational Potential in N-body simulation	
	Advisor: Dr. Kanak Saha	
	1. Abhinav Kumar , Chenhao Tan, Amit Sharma. “ Probing Classifiers are Unreliable for Concept Removal and Detection ”. To appear in 36th Conference on Neural Information Processing Systems (Paper ↗ , NeurIPS 2022).	
	2. Abhinav Kumar , Gaurav Sinha. “ Disentangling mixtures of unknown causal interventions ”. Proceedings of the Thirty-Seventh Conference on Uncertainty in Artificial Intelligence (Paper ↗ , UAI 2021) [Oral , 6% acceptance rate].	

3. Gilles Grasseau, [Abhinav Kumar](#), Andrea Sartirana, Artur Lobanov and Florian Beaudette. “**A deep neural network method for analyzing the CMS High Granularity Calorimeter (HGCAL) events**”. 24th International Conference on Computing in High Energy and Nuclear Physics ([Paper](#) , [CHEP 2019](#)).

Selected Research Projects

Unreliability of Probing Classifier

07/21 - 05/22

Advisors: [Dr. Amit Sharma](#) and [Dr. Chenhao Tan](#)

1. Neural network models trained on text data have been found to encode undesired linguistic or sensitive concepts in their latent representation.
2. Latent Space based concept detection and removal methods like Null-Space removal (INLP) and Adversarial Removal, which internally uses probing classifiers, have become indispensable tool for debugging and debiasing ML models.
3. Through an extensive theoretical and empirical analysis, we show that these methods can be counter-productive: they are unable to remove the attributes entirely, and in the worst case may end up corrupting or destroying all task-relevant features.
4. This work was accepted at [NeurIPS 2022](#).

Disentangling Mixture of Unknown Causal Intervention

01/20 - 04/21

Advisor: [Dr. Gaurav Sinha](#), Adobe Research, Bangalore

1. In many real-world scenarios, such as gene knockout experiments, targeted interventions are often accompanied by unknown interventions at off-target sites. Moreover, different units can get randomly exposed to different unknown interventions, thereby creating a mixture of interventions.
2. Identifying different components of this mixture can be very valuable in some applications. We study the problem of identifying all components present in a mixture of interventions on a given causal Bayesian Network.
3. We show that this problem is not identifiable in general and give sufficient condition under which we could provably identify all the unknown intervention targets. Our proof gives an efficient algorithm to recover these targets from the exponentially large search space of possible targets.
4. This work was published at [UAI 2021](#) as an *Oral paper* with acceptance rate of 6%.

Fine-Tuning Word Embedding for Domain Adaptation

05/19 - 12/20

Advisor: [Dr. Partha Talukdar](#), Indian Institute of Science, Bangalore

1. Traditional word embeddings like Word2Vec and GloVe are often trained on very large corpus such that several different senses of a word are compressed in one single vector. There are lots of words whose meanings are domain-dependent and these pre-trained vectors instead capture the most dominant sense.
2. The downstream tasks (target domain) in which these embeddings will be used as input could have domain bias on the meaning hence these pretrained word embedding are prone to under-perform. To solve this problem of domain shift in word embeddings, the general strategy involves fine-tuning, projection-based methods and data augmentation on the downstream domain.
3. We propose new regularization scheme based on drift in sense distribution of words between the source and target domain.

Relevant Coursework

Computer Science: Discrete Mathematics, Data Structure and Algorithms, Machine Learning, Data Mining, Information Retrieval, Theory of Computing

Mathematics: Probability and Statistics, Linear Algebra, Complex Numbers, Differential Equations

Physics: Statistical Mechanics, Math Methods of Physics, Quantum Mechanics, Non-Linear Dynamics and Chaos, Quantum Information and Computing, Electromagnetic Theory

Online: [Probabilistic Graphical Models](#), [Deep Learning Specialization](#)

Skills

Programming Languages: Python, C, C++, Java, Matlab, Fortran
Tools and Systems: Tensorflow/Pytorch, Linux, Git

Academic Service

Peer Review: [CODS-COMAD'23](#)

Volunteering Roles

CausalML Reading Group, *Co-organiser* 10/21 - Present
Microsoft Research, Bangalore

- Co-organise weekly meetups to discuss recent trends and paper broadly in Domain Generalization and Interpretability with causal perspective.

Honors and Awards

BITS Merit Scholarship 2015 - 2020

- Recipient of university's merit scholarship awarded to top 2% students based on their academic performance.