

# Ramnath Kumar

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## Research Interests

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Robust, efficient and scalable large-scale deep learning algorithms, especially for representation learning, and their applications in domains like LLMs, meta-learning and dense retrieval.

## EDUCATION

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### **BITS Pilani, Hyderabad Campus**

*Masters of Science in Economics*

*Bachelor of Engineering in Computer Science*

Hyderabad, India

Aug 2016 – Aug 2021

- . CGPA in Computer Science major: **9.65/10.0** (Top 10 in class of 255)
- . Overall CGPA (B.E. Computer Science and Msc. Economics): 8.92/10.0
- . Thesis: Worked on malware detection in IoT devices using machine learning techniques [7].

## SELECTED RESEARCH/WORK EXPERIENCE

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### **Google DeepMind**

*Pre-Doctoral Researcher in Machine Learning and Optimization Group & Ads ML Team*

Bangalore, India

Jul 2022 – Present

- . Advisor: [Dr. Prateek Jain](#) and [Prof. Inderjit S. Dhillon](#)
- . Developed an optimization technique for reweighting gradient descent samples [1], alongside an end-to-end efficient retrieval architecture [2], both slated for integration into various Google products.

### **Google Research**

*Research Associate in Machine Learning and Optimization Group*

Bangalore, India

Apr 2022 – Jul 2022

- . Advisor: [Dr. Dheeraj Nagaraj](#)
- . Developed IER, a replay buffer sampler inspired by previous methods like RER, with the potential to enhance the convergence of RL algorithms like DQN, TD3, and more [5].

### **Mila - Quebec Artificial Intelligence Institute**

*Consultant*

Montreal, Canada

Jul 2021 – Mar 2022

- . Advisor: [Prof. Yoshua Bengio](#)
- . Explored the impact of diversity in meta-learning, resulting in an oral presentation at AAAI [3], and delved into the meta-RL, contributing to workshop publications and presentations at the EEML summer school [6].

### **Amazon ML**

*Applied Scientist Intern*

Bangalore, India

Jan 2021 – Jun 2021

- . Advisor: Dr. Gokul Swamy
- . Published as the first author at Amazon's internal conference (AMLC 2021) and investigated causal attributions and their significance within the Amazon sales model 📄.

### **Mila - Quebec Artificial Intelligence Institute**

*Research Intern*

Montreal, Canada

Nov 2020 – Apr 2021

- . Advisor: [Prof. Samira E. Kahou](#)
- . Worked on theoretical machine learning in the domain of graph neural networks 📄.

### **CoCo Lab, Université de Montréal**

*Research Intern*

Montreal, Canada

Jun 2020 – Nov 2020

- . Advisor: [Prof. Karim Jerbi](#)
- . Worked on Brain based subject identification using EEG data 📄.

### **Kno.e.sis, Wright State University**

*Research Intern*

Dayton, USA

May 2019 – Aug 2019

- . Advisor: [Prof. Amit P. Sheth](#) and [Prof. Krishnaprasad Thirunarayan](#)
- . Worked on sybil detection in the darknet markets using an unsupervised multi-view learning framework [4].

## PUBLICATIONS

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- [1] [Stochastic Re-weighted Gradient Descent via Distributionally Robust Optimization](#)  
**Ramnath Kumar**, Kushal Alpesh Majmundar, Dheeraj Mysore Nagaraj, and Arun Suggala  
*Under Review, ICML 2024.*  
*ICLR 2023 Workshop on Pitfalls of limited data and computation for Trustworthy ML.*  
[Google AI Blog Coverage](#).
- [2] [EHI: End-to-end Learning of Hierarchical Index for Efficient Dense Retrieval](#)  
**Ramnath Kumar\***, Anshul Mittal\*, Nilesh Gupta, Aditya Kusupati, Inderjit Dhillon, and Prateek Jain  
*Under Review, ICML 2024.*
- [3] [The Effect of diversity in Meta-Learning](#)   
**Ramnath Kumar**, Tristan Deleu, and Yoshua Bengio  
*AAAI 2023 (Oral; Acceptance Rate: 4.7%).*  
*NeurIPS Workshop on Meta-Learning, 2021.*  
[SyncedReview Blog Coverage](#).
- [4] [eDarkFind: Unsupervised Multi-view Learning for Sybil Account Detection](#)   
**Ramnath Kumar**, Shweta Yadav, Raminta Daniulaityte, Francois Lamy, Krishnaprasad Thirunarayan, Usha Lokala, and Amit Sheth  
*The Web Conference (WWW), 2020.*
- [5] [Introspective Experience Replay: Look Back When Surprised](#)   
**Ramnath Kumar** and Dheeraj Nagaraj  
*Transactions on Machine Learning Research, 2024*  
*NeurIPS Workshop on DeepRL, 2022.*  
[Google AI Blog Coverage](#).
- [6] [Rethinking Learning Dynamics in RL using Adversarial Networks](#)   
**Ramnath Kumar**, Tristan Deleu, and Yoshua Bengio  
*NeurIPS Workshop on DeepRL, 2022.*  
*Presented findings at EEML 2022.*
- [7] [Temporal Dynamics and Spatial Content in IoT Malware detection](#)   
**Ramnath Kumar** and G Geethakumari  
*TENCON 2019.*

## SELECTED AWARDS AND HIGHLIGHTS

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| <b>Google Blog</b> , RGD work [1] was highlighted, and well received by the community   . | 2023      |
| <b>Presentee</b> , AAAI Oral Presentation (Acceptance Rate: 4.7%).  | 2023      |
| <b>Awardee</b> , NTSE Scholar (Awarded to 775 students amongst 0.5 million candidates).   | 2014-2020 |

## ACADEMIC SERVICES

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- **Reviewer:** ICLR (2023) and NeurIPS (2022, '23), ICML (2022), AutoML (2022) and ICWSM (2020, '21, '22, '23).
- **Volunteer:** COLT (2023).

## RELEVANT COURSEWORK AND SKILLS

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- **Math, Stats and Machine Learning:** Calculus, Linear Algebra, Probability and Statistics, Differential Equations, Convex Optimization, Foundations of Data Science, Artificial Intelligence, Machine Learning, Information Retrieval.
- **Summer School:** Eastern European Machine Learning Summer School, Vilnius Lithuania (EEML 2022), *ML Foundations*; Research Week with Google, India (2022), Machine Learning Summer School, Taipei (2021), Google AI Summer School, India (2020).
- **Programming Languages and Libraries:** Python, C++, Pytorch, Tensorflow, Jax, OpenCV.