

Deep Karkhanis

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Education

Carnegie Mellon University

MS in Machine Learning

Pittsburgh, PA

Aug '21 - Dec '22

- Current Courses: Advanced **Natural Language Processing**, Statistics, Machine Learning (ML) PhD

Indian Institute of Technology, Bombay (IIT Bombay)

B.Tech. with Honors in Computer Science and Engineering

Mumbai, India

July '16 - May '20

- Core GPA : **9.58**/10.0 ○ Honors GPA : **10.0**/10.0
- Minor in **Applied Statistics** and Informatics
- **Teaching Assistant** in Computer Networks, Linear Algebra, Differential Equations
- Key Courses: **Advanced Machine Learning**, Advanced Statistics, Derivative Pricing, Image Processing, Remote Sensing

Experience

Microsoft Research Lab

Microsoft Research Fellow

Bangalore, India

Aug '20 - Aug '21

- Upgraded Microsoft's DiskANN indexing algorithm to add semantic search in **MS Exchange (pending Patent Application)**
- The algorithm can host all Outlook/Exchange emails and is planned to be **shipped worldwide**. Currently deployed internally
- Improved the graph kNN algorithm to require **90% lesser** memory and achieve **>95%** recall with **half** the computational costs
- Added low-RAM (<20MB) support while supporting constantly changing datasets with **>1M** points, **>100** dimensions
- Developed prototype (kNN based) for a new **Bing Ad system** serving **all European Markets** in **all supported languages**
- Designed the **first graph ANN algorithm** which supports and optimizes for filter-based search directly in the index build phase

Kwikpic.in (StartUp)

Co-Founder and CTO

Mumbai, India

May '20 - May '21

- Adapted leading face recognition algorithms to work on **Indian faces** and built system to deliver to guests their event photos
- Optimized algorithm to handle varied lighting conditions to achieve accuracy of **>98%** for indoor & **>95%** for night events

RWTH Aachen University [Link]

Scientific Research Intern | Prof. Joost-Pieter Katoen

Aachen, Germany

May '19 - July '19

- Combined concepts of Stochastic Model Checking & **Counting-SAT** to compute Bounded Reachability Probabilities in MDPs
- Designed a **10x faster** solver by formulating a succinct CNF encoding for Markov Chains using the transition probabilities *BDD*

Institute of Science and Technology (IST) Austria

Scientific Research Intern | Published in ICAPS 2020 ¹

Vienna, Austria

May '18 - July '18

- Improved the *POMCP* algorithm to create an online UCT based MEMDP solver and proved its superiority over POMDP solvers
- Exploited the sparse transitions in Multiple Environment MDPs to get faster belief updates (**O(n)** as opposed to **O(n²)**)
- Created solver which was **50x** faster, **20x** better environment detector and achieved **crash-less** navigation on Hallway benchmarks

Publication

- ¹Krishnendu Chatterjee, Martin Chmelík, **Deep Karkhanis**, Petr Novotný and Amélie Royer, "Multiple-Environment Markov Decision Processes: Efficient Analysis and Applications", **ICAPS 2020**, Nancy, France [AAAI Link]

Awards and Scholastic Achievements

- Secured the **Undergraduate Research Award**, IIT Bombay for distinguished research in POMDP solvers (2019)
- Awarded the **DAAD scholarship** by the *German Federal Ministry* for pursuing advanced research in Germany (2019)
- Received the **Institute Academic Excellence Award** from the Dean for securing **Institute Rank 1** (2017)

Academic Research

Bachelor's Thesis [Link]

Undergraduate Research Award | Prof. Shivaram Kalyanakrishnan

IIT Bombay

Aug '19 - May '20

- Improved policy iteration in Partially Observable Markov Decision Processes by regulating Finite-State Controller (FSC) updates
- Designed algorithms to **combine multiple FSCs** & improve **arbitrary subsets** of FSC-nodes while ensuring Policy Improvement
- Created a solver which got **20%** higher rewards than Value Iteration & Monte Carlo Tree Search on infinite-horizon problems

Restoring degraded Cave-Paintings using Deep-Image Priors

IIT Bombay | Sept '18 - Jan '19

- Optimized image **inpainting** methods using deep-image priors & **denoising** to identify and restore damaged parts of paintings
- Successfully restored the depicted ornaments & facial features in some **1500 year old paintings** from Ajanta Caves, Mumbai

Temporal Data Support for SQL

IIT Bombay | Aug '18 - Dec '18

- Extended open-source **PostgreSQL** codebase to store time-range of data validity by adding new '*valid-time*' attributes
- Designed syntax and added support for **temporal relations** and implemented "*natural and theta joins*" among all relation types

Software & Programming Skills

C++/C, Python, MATLAB, Web Development, Java, Scheme, Android Studio, VHDL, Prolog, Clingo, Solidworks, L^AT_EX