

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)

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
- *Institute Web Nominee*, Academic Council ○ Web Secretary, H7 Council
- 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)
- Improved the graph kNN algorithm to achieve **>98%** recall with **<10%** distance comparisons and require **90% lesser** memory
- Added low-memory (**<20MB**) support to DiskANN: handles live data with **>1M** points, **>100** dimensions, and constant edits
- 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

Co-Founder and CTO

Mumbai, India

May '20 - May '21

- Adapted leading face recognition algorithms to work on **Indian faces**. Built web-app to filter and send every guest's event pics
- 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 | Received Recommendation

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 | Received Recommendation

Vienna, Austria

May '18 - July '18

- Improved the *POMCP* algorithm to create an online MEMDP solver and established its superiority over POMDP solvers
- Exploited the sparse transitions in MEMDPs to have faster belief updates [**$O(n)$**] as opposed to [**$O(n^2)$**]
- Solver was **50x faster** & a **20x** better environment detector with higher success & **crash-less** navigation on Hallway benchmarks

Publication

- Krishnendu 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

- Received 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)
- Conferred the **Institute Academic Excellence Award** by the Dean for securing **Institute Rank 1** (2017)

Academic Research

Bachelor's Thesis [Link]

Undergraduate Research Award | Prof. Shivaram Kalyanakrishnan | Received Recommendation

IIT Bombay

Aug '19 - May '20

- Made policy iteration in POMDPs more controllable by regulating the update of Finite-State Controllers (FSCs)
- Designed algorithms to **combine multiple FSCs** & improve **arbitrary subsets** of FSC-nodes while ensuring Policy Improvement
- Solver found policies with **20%** higher rewards to show superiority over Value Iter & MCTS on complex 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 of people and deities in paintings from **Ajanta Caves, Mumbai**

Temporal Data Support for SQL

IIT Bombay | Aug '18 - Dec '18

- Extended open-source **PostgreSQL** codebase to add a new '*valid-time*' attribute: stores time frame for which data was valid
- Designed syntax for declaring **temporal relations**. Supported "*natural and theta joins*" among all types of relations

Software & Programming Skills

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