Deep Karkhanis

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Indian Institute of Technology, Bombay — *Graduating 2020*

- B.Tech with Honors in **Computer Science** and Engineering
- GPA : **9.59**/10.0 (after 7 semesters)
- Minor in **Applied Statistics** and Informatics

Accepted 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

Awards and Scholastic Achievements

- Conferred the **Institute Academic Excellence Award** by the Dean for securing **Institute Rank 1** at the end of 1st year
- Received the **Undergraduate Research Award**, IIT Bombay for distinguished research in POMDP solvers
- Secured a Perfect **10/10 GPA** in *3 out of 7 semesters*. Only student (1 of 950) with 10.0 GPA in both Freshman semesters
- Awarded **3 AP grades** (Advanced Performer) for having the best performance in Linear Algebra, Biology and Env. Engineering
- Awarded the **DAAD scholarship** by the *German Federal Ministry* for pursuing advanced research in Germany

International Internships

Bounded Model Checking in MDPs — **RWTH Aachen, Germany**
Prof. Dr. Ir. Joost-Pieter Katoen | Received Letters of Recommendation — *May '19 - July '19*

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

Multiple Environment MDPs (MEMDPs) — **IST Austria**
Prof. Krishnendu Chatterjee | Publication accepted at ICAPS 2020 | Received Recommendations — *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

Bachelor's Thesis

Tractable Policy Iteration for POMDPs — **IIT Bombay**
Prof. Shivaram Kalyanakrishnan | Undergraduate Research Award | Received Recommendation — *Ongoing*

- 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

Entrepreneurship Experience

Kwikpic.in [http://kwikpic.in/] — *Co-Founder*

- Employed **PCA** based face recognition to create a **web-app** for instant and secure procurement of a user's event photos
- Developed a **proof of concept** and worked with wedding and corporate event planners to further refine the idea
- Optimized algorithm to handle varied lighting conditions to achieve accuracy of >**85%** for indoor & >**80%** for night events

Academic and Research Projects

Temporal Data Support for SQL — *Prof. S. Sudarshan*

- 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**, which are relations having a valid time attribute
- Supported *"natural and theta joins"* among relations, irrespective of them being temporal or non-temporal

Language Processor for a subset of C — *Prof. Uday Khedkar*

- Designed a **compiler and interpreter** from scratch for processing a C style language
- Built support for **multiple variable scopes** and datatypes, along with control-flow, conditional and arithmetic statements
- Implemented support for *"recursion"* and user-defined functions with multiple return-types

Restoring degraded Cave-Paintings using Deep-Image Priors — *Prof. Masaaki Nagahara*

- 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**

Leadership and Mentorship Experience

Teaching Assistant
- CS252, CS224: Computer Networks, MA106: Linear Algebra, MA108: Differential Equations
- Mentored **200+** UG's, conducted weekly tutorials, created assignments and code testers

Institute Web Nominee, *Academic Council*
- **Search optimized** UGAC website for Google Search
- Managed portals used by **3000+**students, **100+**professors

Web Secretary
- Received **Organizational Color Award** for exceptional work
- Developed website & app, conducted **digitization** of hostel

Relevant Coursework

Artificial Intelligence and ML, Advanced Machine Learning*, Probability Theory, Statistical Inference, Regression Analysis*, Derivative Pricing, Digital Image Processing, Understanding Design (UI-UX), Advanced Remote Sensing*, System Dynamics*

* (To be completed by May '20)

Software & Programming Skills

C/C++, Python, Matlab, Advanced Web Development, Scheme, LaTeX, QGIS, Java, VHDL, Prolog, Clingo, Android Studio, SolidWorks

Other Key Academic Projects

- *Natural Language Processing* : QnA website using **Bayesian Taggers** for tagging/grouping questions
- *Simulating Bokeh Effect in Videos* : Grab-Cut for getting foreground, emulating Lens Blur for **simulating Bokeh**
- ***Intel SGX** Programming* : Coded **Accountable Decryption**, used Merkel-Trees for decryption-requests log
- *Diagonal Parity* : Designed an algorithm for "*2-bit error correction*" using parity along 3 directions
- *FPGA Railway Signal* : Used VHDL based **FPGA**-boards for 8-way junctions, **USB and UART** connections with server
- ***GO** Playing **Bot*** : Developed a DFS-based **territory counting** algorithm, used MCTS with UCT for move selection