DEEPAK BADARINATH

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Research Experience

Statistical Machine Learning at the University of Oxford   Oct. 2022 – Oct. 2026
Doctoral Student   *Oxford, United Kingdom*
- PhD thesis title: Reinforcement Learning algorithms for airline revenue management and healthcare
- Design of interpretable offline reinforcement learning approaches for dynamic treatment regimes in healthcare, work done in collaboration with Prof. Sourush Saghafian from the Harvard Kennedy School

Fraunhofer Institute for Algorithms and Scientific Computing   Sep. 2021 – Sep. 2022
Student Research Assistant   *Sankt Augustin, Germany*
- *Master's thesis* student in the **Computational Finance** group. The goal of my thesis was to build an agent that optimizes portfolios in the energy and commodity markets. Built an agent that yields a profit when we have a battery that stores energy, a market to buy/sell energy from, and a grid to supply energy to.

Institute for Applied Mathematics   Aug. 2021 – Jan. 2022
Graduate Research Assistant   *Bonn, Germany*
- Obtained theoretical performance bounds for (un)adjusted Hamiltonian Monte Carlo (algorithms obtained after discretization of a stochastic differential equation) under special cases. Ran computational experiments to verify the performance of the algorithm with dimension and other parameters.

Education

PhD. in Machine Learning [PhD. StatML]   Oct. 2022 – Oct. 2026
University of Oxford   *Oxford, United Kingdom*

Master of Science [M.Sc. Mathematics]   Oct. 2019 – Aug. 2022
University of Bonn   *Bonn, Germany*
- Final grade: 1,8

Bachelor of Mathematics (Honours) [B.Math(Hons.)]   Jul. 2016 – May 2019
Indian Statistical Institute   *Bangalore, India*
- Aggregate percentage: 94.4%

Teaching Experience

Statistics Department   Jan. 2024 – March 2024, Oct. 2024 - Jan. 2025
University of Oxford   *Oxford, United Kingdom*
- Master's tutor: Advanced topics in statistical machine learning, Stochastic Processes

Honours

- **DAAD Stibet Partial Scholarship**, awarded from Aug. 2021 to Jan. 2022 to fund Master's thesis.
- **S.H.Aravind Gold Medal, first rank** holder in *B.Math(Hons.)* batch of 2016-2019.
- **Teacher's Prize**, *6/6* times in *B.Math(Hons.)*, awarded for top-3 students each semester.

Publications

- **Cost of interpretablity: Blocked Value Iteration** - Presented at the Interpretable Policies Workshop at the Reinforcement Learning conference at RLC 2024.
- **Value Interpretable Dynamic Treatment Regimes** - We design a greedy model-based interpretable approach to design optimal interpretable policies given by lists. We employ this to derive decision tree policies for treatment of patients with diabetes.[in progress]
- **Tight Value Interpretable Dynamic Treatment Regimes** - We optimize the above algorithm by computing a tight version of the same where the transitions and rewards are assumed to be close in time. We delve into the theory of convex approximations to find conditions when the conditions are close given the error functionals are close.[in progress]

- **Game theoretical RL** We come up with game theoretic reinforcement learning algorithms which is employed to the airline pricing problem. Using a diverse range of pricing data we employ this algorithm to derive the optimal pricing policy. [future work]

Software Skills

Python - Numpy, Scipy, Pandas, Matplotlib, LaTeX, Multithreading, High performance computing