Robert Joseph George

Email: rjoseph1@ualberta.ca
Portfolio: robertj1.com
Twitter: @Robertljg
Github: github.com/Robertboy18
Linkedin: linkedin.com/robert-joseph-2001

Education

University of Alberta Edmonton, AB
BSc Honors Applied Mathematics and Computer Science *Sep 2019 - Present*

- **Honors Thesis 1**: Numerical Analysis for Real-time Nonlinear Model Predictive Control of Ethanol Steam Reformers
- **Honors Thesis 2**: Hybrid Dealiasing Convolutions
- **Academic Profile**: GPA: (4.0/4.0) and Dean's Honor Roll (4 Semesters).

Work Experience

California Institute of Technology (Caltech) Pasadena, CA
Research Intern, Theoretical Machine Learning Group *Jul 2022 - Present*

- **Deep Learning**: Foundations of Deep Learning; understanding Rank and Spectral Bias in Neural Networks plus applications to solving PDEs using Fourier Neural Operators. In charge of developing models and producing the experimental results. We propose Incremental Fourier Neural Operator (IFNO), which augments both the frequency modes and data resolution incrementally during training. We show that IFNO achieves better generalization (around 15% reduction on testing L2 loss) while reducing the computational cost by 35% compared to standard FNO. Work still in progress to understand the various theoretical properties of these models and generalize to Physics-informed Neural Operator.
- **Academic advisor**: Anima Anandkumar

Alberta Machine Intelligence Institute (Amii) Edmonton, AB
Research Intern, Reinforcement Learning and Artificial Intelligence Lab *Jan 2022 - Present*

- **Reinforcement Learning**: Optimization of RL environments - Decreased training time by around 50% on all environments and proposed a new hyperparameter approach. Released the code as open source on Github. The codebase is used by RL researchers to test their RL and AI agents. Optimized it further by including Just in Time compilation.
- **Theoretical Machine Learning**: Comparing the theoretical properties of Implicit vs Explicit Kernel Features using functional analysis. Analyzing Gaussian Processes vs Bayesian Linear Regression using Kernel Features; In charge of writing up the paper and conducting experiments.
- **Academic advisors**: Martha White and Adam White

Pacific Institute for the Mathematical Sciences (PIMS) Toronto, ON
Research Assistant, Department of Mathematics and Statistics *Jan 2022 - Dec 2022*

- **Research Projects**: Numerical Analysis for NMPC of Ethanol Steam Reformers and Finding the solution space of a homogeneous linear ODE. The work is was part of my Honors Thesis and Honors ODE course - Github
- **Impact**: Performed simulations, numerical and a rigorous theoretical analysis of first-order quasi-linear PDEs.
- **Academic advisor**: Xinwei Yu

Google Edmonton, AB
Developer Student Founder and Leader *Jul 2020 - Apr 2022*

- **Google Developer Technologies**: Developer Student Lead/Founder for The University of Alberta DSC Chapter
- **Impact**: Helped organized events and promoted the usage of Google developer technologies. Collaborated with startups, Google Developer Experts etc. Grew the club to around 1,000 members. Got promoted to lead the whole of Alberta province and have been advising various GDSC clubs in North America for 2 years.

Microsoft Redmond, WA
Data Science Intern, Azure Compute *Jun 2021 - Aug 2021*

- **Azure Dedicated Hosts**: Improved the efficiency of Azure, 0.05% increase in accuracy.
- **Machine Learning and AI**: Worked in Azure alongside Microsoft Research to create Interpretable and Explainable Classifiers (Explainable Boosting, LIME and SHAP Kernel Explainer) and did feature importance using Mutual Information and other statistics. Used AI tools in Power BI to verify the results and create reports.
- **Impact**: Helped lay the foundation for more research and increase in efficiency led to a $200 Million save for Microsoft.

Teaching Experience

Department of Mathematics and Department of Computer Science Edmonton, AB
Honors Mathematics/ Machine Learning/ Algorithms *Apr 2021 - Present*

- **Duties**: Graded assignments and exams (MATH 117/118/127/227, CMPUT 204/267/304/474, Decima Robinson Center).
- **Impact**: Helping students understand concepts in Real Analysis, Linear Algebra, ML and Theoretical CS/Algorithms.

Skills Summary

- **Languages**: Python, C++, Asymptote, Mathematica, LaTeX, SQL, MySQL, Git, Bash
- **Frameworks**: Scikit, OpenGym, TensorFlow, Pytorch, Panadas, Numpy, GCP, Azure, Compute Canada
- **Technical**: Machine Learning, Deep Learning, Algorithms, Mathematics, Data Engineering/Visualization/Analysis
- **Soft Skills**: Leadership, Public Speaking, Time Management, Teamwork, Communication, Problem Solving, Research
- **Courses**: Artificial Intelligence, Theoretical CS, Theoretical Machine Learning, Real/Complex Analysis, Numerical Methods

Honors and Awards

- Google Computer Science Research Program Scholar 2022
- The Harry E. Balfour Scholarship in Mathematics - $1,650 2022
- Dr Clement W Bowman Scholarship in Honors Applied Mathematics (Year 3) -$3,500 2022
- Mathematical and Statistical Sciences Undergraduate Student Research Award - $8,800 2022
- Code For Good Hackathon - $500 (Acquired by **Morgan Stanley**) 2022