AYUSH AGARWAL

SENIOR UNDERGRADUATE, IIT KANPUR

+91 9815139259 • ayuag@iitk.ac.in • ayushmclaren.github.io

EDUCATION

- **Bachelor of Science** — **Indian Institute of Technology, Kanpur**
  *Major: Mathematics and Scientific Computing, GPA: **8.8/10*** — *(expected) May 2021*
  *Top **ten** department rank in a class of 54 students*
- **CBSE AISSCE (standardized 12th grade)** — **Sanskar World School, Jaipur**
  *Science and Mathematics, **91.40** %* — *May 2017*

OPEN SOURCE SOFTWARE PUBLICATIONS

qbld: Quantile Regression for Binary Longitudinal Data **[CRAN][GitHub]**
Ayush Agarwal, Dootika Vats, Adam Maidman (Microsoft, Seattle) *September 2020*
Supported by: *Google Summer of Code, 2020* for *R project for Statistical Computing*

- Built a novel R package for estimating hierarchical Bayesian quantile regression model for longitudinal data and panel data with binary outcome developed in *Rahman and Vossmeyer* (2019).
- Implemented novel random number generators for Asymmetric Laplace, Generalized Inverse Gaussian and Truncated multivariate Normal distributions using Rcpp and RcppArmadillo.
- Cite: Agarwal A.,Vats D. (2020), Quantile Regression for Binary Longitudinal Data. R package v1.0 IIT-Kanpur.

WORK EXPERIENCE

IdeasHub, Macro Structuring and Research **April 2020 - June 2020**
Global Markets Analyst Intern, Nomura Structured Finance, Mumbai

- Designed a custom systematic trading algorithm for index trading in Python using Options Open Interest, PCR and MACD data; reduced average execution run-time by upto 60%.
- Back-tested on historical data for several global indices such as Nifty50, Nikkei225 and Nasdaq100 to generate cumulative annualised returns of up to 16% over a 2 year high volatility period.
- Realized 8% returns, 4.20 Sharpe's in 6 weeks of paper trading using technical and fundamental analysis.
- Built a Python implementation of portfolio allocator and optimiser across asset classes using Markowitz efficient frontier; Allocations across different constraints were compared to generate maximum risk-reward.

RESEARCH PROJECTS

- **Change-point algorithms and Kolmogorov tests for Markov chains** **[details]**
  -Prof. Dootika Vats (Dept. of Maths & Statistics, IIT Kanpur) *September 2020 - Present*
  - Proposed a novel non-parametric change-point algorithm using CUSUM statistic for Markov chains, and extended it to identify burn-in periods in generalised α-mixing processes. [Research paper in works]
  - Extended the method to a parametric case when the sample distribution or log-posterior values are known.
  - Currently developing tools to extend the 2-sample Kolmogorov-Smirnov test to the MCMC setting.
- **SARIMA Time-Series Analysis and Forecasting** **[details]**
  -Prof. Amit Mitra (Dept. of Maths & Statistics, IIT Kanpur) *August 2019 - December 2019*
  - Modelled the Indian monthly rainfall data of the last 114 years using Box-Jenkins algorithm, augmented Dickey-Fuller stationarity test and PACF interpolation techniques for missing data.
  - Performed residual analysis to find the best fit model and achieved predictive forecasting for the next month.
- **Quantitative Methods** **[details]**
  -Prof. Michael Parzen, Department of Statistics, Harvard University *June 2019 - August 2019*
  - Employed exploratory analysis, visualisation techniques, hypothesis testing, statistical inference and various regression/classifier models to database models in real world datasets eg: Glassdoor's job vs salary data
  - Secured 'A' grade for exceptional overall performance.
- **Is Happiness a choice?** **[details]**
  -Prof. Devpriya Kumar (Dept. of Psychology, IIT Kanpur) *Jan 2019 - May 2019*

- Explored and duplicated research on the "Effect of over-choice on customer satisfaction" by Barry Schwartz, concluded on an optimal number of choices for maximum satisfaction in a shopping experience.
- Conducted experiments on 50+ participants on a custom built software in OpenSesame (python).

TEACHING ASSISTANT AND MENTORSHIP

Teaching Assistant, Statistical Simulation & Data Analysis **[details]**
- Dept. of Maths & Statistics, IIT Kanpur *September 2020-Present*

- Undergraduate Teaching Assistant for a graduate level statistics course. Responsible for setting and grading the quizzes, mid-sem and end-sem exams; engaging on forums for doubt discussions.

To Bayes or Not to Bayes **[details]**
- Dept. of Computer Science and Engineering, IIT Kanpur *Jan 2020-May 2020*

- Mentoring 6 freshmen in Bayesian computation, analysis of Markov chains, probabilistic ML algorithms

SUMMER SCHOOL

Harvard University, Cambridge **June 2019 - August 2019**
8-week on campus residency program in Cambridge, USA

Financial and Managerial Economics **[details]**
Prof. James Owers, Department of Finance, Harvard Extension School

- Explored NP value, risk analysis, capital budgeting, mergers, dividends and restructuring in corporate.
- Built cash flow models, analysed income and balance sheets of top valued S&P500 companies using Excel.
- Secured 'A' grade for exceptional overall performance in a highly specialised course.

RELEVANT COURSEWORK AND TECHNICAL SKILLS

Statistics	MCMC, Bayesian Econometrics, Stochastic Processes*, Probability Theory*, Inference* Statistical Simulations and Data Analysis, Time Series, Financial Engineering*
Mathematics	Linear Algebra, Several Variable Calculus, Real & Complex Analysis, ODE, PDE*
Programming	Data Structures and Algorithms, Scientific Computing, Fundamentals of Computing
Languages	R, RCpp/RcppArmadillo, Python, C/C++, Matlab, LaTeX, SQL, VBA, Markdown, Git
Frameworks	keras, tensorflow, scikit-learn, qbld, mcmcse, scipy, pandas, numpy, tidyverse, ggplot2
Software	Jupyter notebook, R studio, OpenSesame, Bloomberg, Excel, Powerpoint

*: in progress

ACHIEVEMENTS AND ACCOLADES

- **All India Rank 765** among 1,500,000 in IIT Joint Entrance Examination (JEE) Mains.
- **National top 1%** in National Standard Examination in Chemistry, level 1 of IChO.
- **Kishore Vigyan Protsahan Yojana(KVPY)** fellowship by Indian Institute of Science, Bangalore
- Recipient of **INSPIRE** scholarship by Department of Science & Technology, Govt of India
- Bagged **1st** position in Mandakini, a national astronomy competition organised by IIT-Kanpur.
- Active trader in the Indian equity market, generated **returns of upto 47%** over a 2 year period

EXTRACURRICULARS

Leadership	*Coordinator*, Mathematics and Statistics Society, IIT Kanpur
	Senior Editor, Vox Populi (Journalism Cell), IIT Kanpur
Positions	*Editorial Executive*, Science and Technology Council, IIT Kanpur
	Student Guide, Counselling Service, IIT Kanpur
Talks	Adaptive Metropolis–Hastings methods, Dept. of Economics, IIT Kanpur [slides]
	Is Happiness a choice?, Dept. of Psychology, IIT Kanpur [slides]
Other	Completed *2 semesters* of German, Foreign Language Program, IIT Kanpur
	Attended Violin classes in Indian Classical music at IIT-Kanpur.