Anuj **Nagpal**

Associate, Goldman Sachs | B. Tech. CSE, IIT Kanpur

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Education

Indian Institute of Technology, Kanpur
Kanpur, India

B.Tech., Computer Science and Engineering — *2014 - 2018*

- CPI: **9.3/10.0**, Completed the program with **Distinction**
- Awarded **Academic Excellence Award** for term 2014-15 and 2016-17

Bal Mandir Model Sen. Sec. School
Mandi Dabwali, India

Central Board For Secondary Education — *2000 - 2014*

- **96.2%** marks in Class 12^{th} and CGPA **10.0/10.0** in Class 10^{th}

Work Experience

Goldman Sachs
Bangalore, India

Associate | FICC ION Credit Strats — *June 2018 - Present*

- Working as a quantitative and algorithmic market making analyst with area of focus in electronic and automated trading of corporate bonds, credit default swaps and money market products.
- Developed and supported applications that stream algorithmic prices to electronic trading platforms as well as automatically quote a subset of the incoming trade inquiries using live market data, product attributes, and manual trader inputs.
- Designed and built robust, scalable, and maintainable systems that can handle the inevitable increased loads while collaborating with a talented peer group scattered across cross-geographic teams.

Goldman Sachs
Bangalore, India

Summer Analyst | Credit Quant and Algo Trading — *May 2017 - July 2017*

- Added support for electronic trading of fractional-tenor single name credit default swaps on a major trading venue in New York and London.
- Automated scenario tests for a cardinal trading venue in New York with anticipated reduction of manual testing before every code release.
- Unified and made robust FIX (Financial Information eXchange) message dictionaries used for electronic trade negotiations.

Course Tutor | IIT Kanpur
Kanpur, India

Fundamentals of Programming (ESC101) — *January 2018 - April 2018*

- Helped students in grasping the concepts by conducting weekly tutorials for clarifying their doubts and lab sessions for applying these concepts readily to build programming solutions.
- Designed exams, quizzes and lab assignments for a class size of 470 students and supervised them with a team of teaching assistants, which helped students to assess their learning of the course contents.

Key Projects

Deep Reinforcement Learning in Portfolio Management
Quantitative Finance

- Tested the performance of Deep Deterministic Policy Gradient, Proximal Policy Optimization and Policy Gradient in portfolio management.
- Used risk-adjusted accumulative portfolio value as objective function and found Policy Gradient method to be better in assets allocation.
- Assessed an adversarial training method proposed by Liang et al. having better average daily return, training efficiency and Sharpe ratio.

Bayes-Nash Equilibria Computation in Combinatorial Auctions
Algorithmic Game Theory

- Worked on algorithms to find approximate bayes-nash equilibria (ϵ-BNE) in combinatorial auctions based on a paper by Bosshard et al.
- Evaluated a novel algorithm which separates the search phase for finding ϵ-BNE, from the verification phase for computing the ϵ-BNE.
- Implemented the algorithm to almost accurately find ϵ-BNE in a multi-minded LLLLGG domain with eight goods and six bidders.

Bayesian Approaches to Learn Causal Networks
Bayesian Networks

- Showed that any causal network can be represented as a special type of influence diagram using the work by Heckerman and Shachter.
- Reviewed Bayesian methods for learning acausal networks and adapted these methods for learning ordinary influence diagrams.
- Extended these methods to learn influence diagrams that correspond to causal networks under additional assumptions of mechanism and component independence.

Mechanism Design in Social Networks
Mechanism Design

- Studied an auction design problem to sell a commodity in a social network where each individual can communicate with its neighbours.
- Analyzed an Information Diffusion Mechanism (IDM) which incentivizes the buyers to propagate the information to all their neighbours.
- Proved that IDM's revenue is always greater than or equal to the revenue of Vickrey–Clarke–Groves (VCG) mechanism in social networks.

Probabilistic Word Sense Embeddings *Probabilistic Machine Learning*

- Proposed a generative model for probabilistic word vector generation by building upon prior work on Multimodal Word Distributions.
- Implemented a Gaussian Mixture Model with senses modeled as gaussian mixtures and words as mixtures over their senses.
- Did complete inference modelled on Gibbs Sampling and reduced the number of parameters to be estimated by a factor of 100.

Other Relevant Projects

Deep Reinforcement Learning Against Pong AI *Reinforcement Learning*

- Developed a double duelling deep Q network and a policy gradient network that was able to beat a self-coded Pong learner which used Monte Carlo policy gradients to learn the optimal policy directly instead of value functions.

GDP Forecasting Using Time Series Modelling *Time Series Analysis*

- Modelled an ARIMA process for forecasting India's GDP with the aid of Holt Winters Seasonal Smoothing, Augmented Dickey-Fuller Test, KPSS Test, Ljung Box Test and AIC/BIC criteria applied to prior data for deciding process order.

Graph Theoretic Analysis of Discrete Markov Chains *Stochastic Processes*

- Implemented a matlab library that utilizes common graph algorithms and transition matrix of a discrete markov chain to compute its periodicity, strongly connected components, hitting probabilities and stationary distribution if positive recurrent.

Joint Seat Allocation Algorithm *Design and Analysis of Algorithms*

- Designed and implemented an efficient joint seat allocation algorithm which leaves minimum number of vacancies for undergraduate admission of 1.2 million students while accounting for all the quotas, reservations, supernumerary seats, admission rules and merit lists.

Achievements

2014	All India Rank **190, JEE Advanced** among 150,000 filtered candidates
2014	All India Rank **220, JEE Mains** among 1.4 million candidates with **State Rank of 4**
2013	Selected for **KVPY Fellowship** among 40,000 exam candidates
2013	Qualified National Standard Examination in Chemistry (**NSEC**) and Astronomy (**NSEA**)
2014-18	Secured **A* in 5 courses** for exceptional performance including Microeconomics, Computer Systems Security, Computing Laboratory II and Monetary Economics
2017	Won an Intra-IITK **Startup Pitch Competition** "Pitch Prime" during Entrepreneurship Summit
2018	Completed Alpha Development's **Financial Training** in **Goldman Sachs, New York City**

Relevant Coursework

Maths and Economics	Linear Algebra and Differential Equations, Probability and Statistics, Applied Stochastic Processes Time Series Analysis, Discrete Mathematics, Microeconomics, Macroeconomics, Monetary Economics
Machine Learning	Machine Learning Techniques, Probabilistic Machine Learning, Deep Learning (deeplearning.ai)$^+$, Mathematics for ML (ICL)$^+$, Applied Data Science with Python (UMichigan) $^+$
Computer Systems	Computer Systems Security, Computer Networks, Blockchains (SUNY-UB)$^+$, Operating Systems, Compiler Design, Functional Programming (EPFL)$^+$, Principles of Database Systems

$^+$ *- Coursera Certified*

Technical Skills

Programming	C, C++, Python, Java, Scala, JavaScript, Haskell, Bash, R, LaTeX, Verilog, Assembly, PHP, SQL, HTML, CSS
Software / Libraries	TensorFlow, Numpy, scikit-learn, Keras, Pandas, Git, Matlab, IntelliJ, React.js, Flask, Ruby on Rails, Node.js

Extra Co-Curricular Activities

Volunteer, Community Team Works (CTW) *June 2017 - Present*

- Active member of Goldman Sachs' Community Team Works contributing to social as well as environmental causes.

Coordinator, Association of Computing Activities (ACA) *July 2016 - July 2017*

- Served as the coordinator of the computer science departmental club responsible for many activities, events and talks.
- Floated semester long computer science projects to 150 first year students as well as personally mentored 10 students out of them.
- Conducted ACA Summer School open to students from all colleges with around 500 registered students and 5 courses.

Secretary, Programming Club IIT Kanpur *July 2015 - July 2016*

- Helped the coordinators in conducting lectures, workshops and hackathons to foster the programming culture in campus.