Anuj **Nagpal**

Analyst - Goldman Sachs

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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**, 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*

Analyst | Credit Quant and Algo Trading — *June 2018 - Present*

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

- 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 price a subset of the incoming trade inquiries based on real-time 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.

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

Bayes-Nash Equilibria Computation in Combinatorial Auctions

- 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.

Mechanism Design in Social Networks

- 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.

Bayesian Approaches to Learn Causal 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.

Probabilistic Word Sense Embeddings

- 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.

Deep Reinforcement Learning in Portfolio Management

- 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.

Other Relevant Projects

Deep Reinforcement Learning Against Pong AI

- Developed a policy gradient network and a double duelling deep Q 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

- 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.

Zoobar Server Security Improvements

- Exploited overflow, format string and DoS vulnerabilities, and crafted browser based attacks on a dummy 'zoobar' server code, followed by improving its security by fixing code bugs and implementing principle of least privileges to separate various processes.

Java to x86 Assembly Compiler

- Implemented a Java to x86 compiler from scratch using python and ply while incorporating advanced features like short circuiting, register allocation optimization as well as object oriented programming concepts like classes.

Joint Seat Allocation Algorithm

- 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 students
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 Text Mining and Social Network Analysis (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.