



Class of 2018 Resume Book

Mathematics in Finance M.S. Program

Courant Institute of Mathematical Sciences
New York University

March 15, 2018

For the latest version, please go to

http://math.nyu.edu/financial_mathematics

Job placement contact: Michelle Shin, (212) 998-3009

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New York University

A private university in the public service

Courant Institute of Mathematical Sciences
Mathematics in Finance MS Program
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Dear Colleague,

We are pleased to provide you with the resumes of second semester students in the Courant Institute's Mathematics in Finance Master's Program. They are in their second semester and will graduate from our Master's program in December 2018. We hope you consider them for summer internship positions at your firm.

We believe our students are the most elite, the most capable, and the best trained group of students of any program. This year, we admitted less than 8% of those who applied. The resumes you find here describe their distinguished backgrounds. For the past ten years we have a placement record close to 100% both for summer internships and full-time positions. Our students enter into front office roles such as trading or risk management, on the buy and the sell side. Their computing and hands-on practical experience makes them productive from day one.

Our curriculum is dynamic and challenging. For example, the first semester investments class does not end with CAPM and APT, but is a serious data driven class that, examines the statistical principles and practical pitfalls of covariance matrix estimation. During the second semester electives include a class on modern algorithmic trading strategies and portfolio management. Instructors are high-level industry professionals and faculty from the Courant Institute, the top ranked department worldwide in applied mathematics. You can find more information about the curriculum and faculty at the end of this document, or at http://math.nyu.edu/financial_mathematics/.

Sincerely yours,
Leif Andersen, Industry Adviser
Paul Bourgade, Chair
Petter Kolm, Director

KUN JOO MICHAEL ANG
(646) 981-8143 ■ mak809@nyu.edu

EDUCATION

NEW YORK UNIVERSITY

New York, NY

The Courant Institute of Mathematical Sciences

MS in Mathematics in Finance (expected – Jan. 2019)

- **Coursework:** OOP in Java, stochastic calculus, dynamic asset pricing models, risk management, derivative security pricing, Black-Litterman model
- **Future Coursework:** Algorithmic trading strategies, interest rate and FX models, portfolio management and optimization, time-series analysis, continuous time finance

UNIVERSITY OF CAMBRIDGE (ST EDMUND'S COLLEGE)

Cambridge, United Kingdom

BA in Mathematics (2014 - 2017)

- **Coursework:** Optimization and control methods, stochastic financial models, analysis, numerical analysis, statistical modeling, quantum mechanics, mathematical methods

EXPERIENCE

NEW YORK UNIVERSITY

New York, NY

Teaching Assistant (Sep 2017 – present)

- Conducted recitations for 55 students
- Prepared lesson handouts, wrote and graded quizzes, explained intuition behind concepts.

UNIVERSITY OF CAMBRIDGE

Cambridge, United Kingdom

Research Assistant (June 2017 – Aug 2017)

- Reviewed developments in network traffic management over the last decade
- Compared the accuracy, spatial stability and temporal stability of the multilayered perceptron to other popular machine learning classification techniques
- Designed experiments to optimize the neural network find its rate of convergence

SINGAPORE ARMED FORCES

Singapore, Singapore

Infantry Officer (Jan. 2012 – Dec. 2013)

- Developed and coordinated company training programs for 900-1000 men
- Resolved logistical problems faced by companies during on-the-ground training
- Managed the discipline, manpower, morale, and personal issues of a team of 10 staff
- Created new system for cataloguing information and streamlining workflow

PROJECTS

Market Mimicry as a Measure of Collective Panic (Dec. 2017)

- Wrote programs in Java to test for indicators of market mimicry based on fully connected network of influencer nodes.
- Identified optimal training window for predicting future mimicry levels in time-series data.
- Developed toolbox for extending research to similar indicators, time-series analysis and managing different data types

Analysis of Performance Data (Mar. 2016 – Apr. 2017)

- Performed statistical analysis in MATLAB and R on unemployment and academic data
- Statistical tools used : Newton-Raphson for MLE search, Cramer-Rao to create asymptotic confidence intervals, chi-square test for homogeneity, hypothesis testing with linear models

Parabolic Partial Differential Equations (Dec. 2016 – Jan. 2017)

- Found approximate solutions to boundary-value PDE via Fourier series decomposition in MATLAB
- Compared accuracy and stability of approximation schemes: FTCS, Richardson, Crank-Nicholson

COMPUTER SKILLS/OTHER

Programming Languages And Other Software: Java, MATLAB, R, Python, Bloomberg, LaTeX, Office

Languages: English (native), Mandarin (fluent), French (proficient), Arabic (beginning)

Publications: “Network Traffic Classification via Neural Networks” (Technical Report)

MARTIN ARIENMUGHARE
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EDUCATION

NEW YORK UNIVERSITY

New York, NY

The Courant Institute of Mathematical Sciences

MS in Mathematics in Finance (expected – January 2019)

- **Coursework:** OOP in JAVA, stochastic calculus (conditional expectation, martingales), Black-Litterman model, Monte Carlo and finite difference methods, applications of Black-Scholes formula to stochastic processes, risk management, time series analysis, regression models
- **Future Coursework:** Risk management (VaR, stress testing), continuous time finance, interest rates & FX models (fixed income models, vanilla options, first-generation exotics), statistical arbitrage (Kalman filter, pairs trading strategies)

HOWARD UNIVERSITY

Washington, DC

Ph.D. (Aug. 2010 – May 2016)

- **Coursework:** Markov process, hypothesis testing, decision functions, regression, PDEs, Black-Scholes, Ito's lemma, numerical methods, energy derivatives, VaR, portfolio models

LINCOLN UNIVERSITY

Lincoln University, PA

BSc. in Physics & Mathematics (Aug. 2005 – Dec. 2008)

EXPERIENCE

MIAMI REGIONAL UNIVERSITY

Miami Springs, FL

Faculty (Nov. 2016 – June 2017)

- Used MyStatLab & Excel to conduct statistical analyses to real data
- Taught nursing students how to create confusion matrices using real drug testing results
- Analyzed data of rehospitalization and discharge of newborns to forecast rehospitalization odds

MARYMOUNT UNIVERSITY

Arlington, VA

Adjunct Faculty (Jan. 2016 – May 2016)

- Used Excel to perform linear regression, and compare linear models for a given data set
- Instructed students in optimization and decision analyses, to perform risk and sensitivity analysis

PROJECTS

HOWARD UNIVERSITY

Washington, DC

Dissertation: Modeling Quasi-Linear Hyperbolic Systems Using MATLAB

- Built and tested HLLC-NC Riemann solver to model hydrodynamic systems
- Developed simplification to HLLEM-NC model, resulting in up to 20.4% flop count reductions

UNIVERSITY of MICHIGAN

Ann Arbor, MI

Millennium Simulation Galaxy Clusters Analysis Using FORTRAN

- Analyzed velocity distributions of dark matter halos using the Navarro-Frenk-White profile
- Obtained instances of dark matter halos that failed to possess intrinsically non-Gaussian flat-topped velocity distributions; further analysis indicated possible mergers

PERSONAL PROJECTS

German Credit Data Analysis Using R

- Developed machine-learning model to predict a credit applicant's probability of default (PD)

Finding Arbitrage in Currency Exchange Cycles Using C++ Boost Graph Library

- Updated Bellman-Ford algorithm in BGL to track arbitrage cycles in currency exchange cycles

COMPUTER SKILLS/OTHER

Programming Languages: C++, Java, R, MATLAB

Languages: English (Native), Urhobo (Intermediate)

Leadership: Howard Plaza Towers Building Coordinator, HU Yearbook Policy Board Member

MADHUR BHATTAD
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EDUCATION

NEW YORK UNIVERSITY, NY, NY

January 2019

The Courant Institute of Mathematical Sciences

MS in Mathematics in Finance

- *Coursework:* Stochastic calculus, risk management, OOP in Java, regression models, fixed income, equity derivatives, Greeks, active portfolio management, securitized products
- *Recitation leader:* Introduction to Mathematical Modeling

INDIAN INSTITUTE OF TECHNOLOGY, GUWAHATI, INDIA

May 2017

B.Tech in Mathematics and Computing

- *Coursework:* Calculus, probability, statistics, optimization, financial engineering, data structures and algorithms, scientific computing, Monte Carlo methods, economics

Certifications: CFA Level 1 (CFA Institute), Lean Six Sigma Green Belt (KPMG)

EXPERIENCE

RBT ALGO SYSTEMS, MUMBAI, INDIA

June 2016-July 2016

Algorithmic Trading Intern

- Implemented and back-tested machine learning based positional trading strategy for Index futures
- Pitched the strategy to a group of 30 brokers explaining the benefits and the limitations

INDIAN INSTITUTE OF TECHNOLOGY, GUWAHATI, INDIA

July 2016 – March 2017

Finance and Economics Club Mentor

- Initiated and led quantitative finance lecture series, workshops and mentoring programs
- Researched, prepared and delivered lectures on topics including CAPM, algorithmic trading, VaR, global financial crisis, and derivative securities to around 100 campus students

INDIAN INSTITUTE OF SCIENCE, BANGALORE, INDIA

May 2015-July 2015

Research Assistant

- Computationally analyzed behavior of Simple Totally Asymmetrical Simple Exclusion process
- Wrote simulations in R to verify previous research findings on conditional probability distributions

PROJECTS

Forex Price Prediction Using Neural Networks (Indian Institute of Technology- Guwahati)

- Observed the long memory effect in the exchange rates between INR and a few major currencies
- Used Elman-Jordan Neural Networks for forecasting subsequent values in the currency time series

Option Pricing in Matlab (Indian Institute of Technology- Guwahati)

- Valuated European, American, Asian, Look-Back and Barrier options using binomial model
- Simulated geometric Brownian motion to price European and Asian options
- Priced European option via Black Scholes PDE using finite difference schemes

Exchange simulation (NYU Courant)

- Simulated exchange with efficient bid and offer books giving participants send-order and cancel-order functionalities in Java

Toy OAS model (NYU Courant)

- Calculated implied OAS for a given pass-through of mortgages using Monte Carlo over different interest rate paths, a given PSA curve and the present value of the MBS

COMPUTER SKILLS/OTHER

Programming Languages: Java, Python, R, Matlab, C, C++, MySQL

Languages: English (fluent), Hindi (Native), Marathi (fluent)

Achievements: Selected as a delegate for Asia Investment Banking Conference in Hong Kong (2016), earned gold certificate in Bloomberg aptitude test (2014), all India rank 2nd in national mathematics talent contest

SIMEON BIKORIMANA
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EDUCATION

NEW YORK UNIVERSITY New York, NY
The Courant Institute of Mathematical Sciences
MS in Mathematics in Finance (expected – January 2019)

- **Current Coursework:** Portfolio optimization, option pricing, econometrics, risk management, asset pricing, CAPM, OOP in Java

THE CITY COLLEGE OF THE CITY UNIVERSITY OF NEW YORK New York, NY
Ph.D. in Electrical Engineering (September 2012 – September 2017)
B.E. in Electrical Engineering (January 2009 – December 2011)

EXPERIENCE

THE CITY COLLEGE OF THE CITY UNIVERSITY OF NEW YORK New York, NY
Instructor for Advanced Photonics Engineering Lab (January 2015 – July 2017)

- Guided students on how to collect and analyze data from undergoing optical experiments
- Taught how to determine the reproducibility and statistical variation of the experimental setup

Adjunct Lecturer for Engineering Economics Course (January 2013 – May 2017)

- Taught how to solve economic problems involving comparison and selection of alternatives by using present worth, annual worth, future worth, rate of return, and payback period analysis
- Evaluated students' performance and provided grades for 100 students

NORVATIS CAPITAL MANAGEMENT, LLC New York, NY
Analyst Intern (June – August 2016)

- Researched and analyzed data regarding investment opportunities in agribusiness in Rwanda
- Built a valuation DCF model in Excel for small enterprises

JOURNAL OF THE AMERICAN CHEMICAL SOCIETY Washington, DC
Volunteer Reviewer (December 2016 – September 2017)

- Reviewed manuscripts submitted for publication in a peer-reviewed scientific journal of Langmuir
- Provided feedback and comments to authors to improve their manuscripts' quality

PROJECTS

THE CITY COLLEGE OF THE CITY UNIVERSITY OF NEW YORK New York, NY
Development of Dual-Wavelength Semiconductor Optical Amplifier-based Fiber Compound-Ring Laser for Continuous-Wave Terahertz Photomixing (Dissertation)

- Designed and investigated the performance of a novel fiber laser resonator

Terahertz Time-Domain Spectroscopy

- Designed, simulated, and characterized thin-film-based THz photoconductive antennas
- Analyzed experimental data in frequency domain using the Fast Fourier Transform in MATLAB
- Calibrated and redesigned antenna structures to meet specification requirements

Nonlinear Optical Characterization of Nanomaterials

- Built optical test-beds to study ultrafast dynamics in multilayer and semiconductor nanomaterials
- Retrieved third-order nonlinear optical coefficients of samples using data-fitting with MATLAB

TCP/IP Denial of Service (DoS) Attack Mechanism

- Developed an algorithm to launch a TCP DoS attack using socket programming in Python
- Used time-dependent variation of traffic and its statistical parameters to detect the DoS attack

COMPUTER SKILLS/OTHER

Programming Languages: Java, Python, VBA
Other Software: MATLAB, LabVIEW/Automation, HFSS, CST Microwave Studio simulation tools
Award/Honors: CUNY-NASA SOLARPREP research scholarship, Tau Beta Pi, Eta Kappa Nu
Languages: Kinyarwanda (native), English (fluent), French (intermediate)

MING CHENG

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<https://www.linkedin.com/in/linda-chengm/>

EDUCATION

NEW YORK UNIVERSITY

New York, NY

The Courant Institute of Mathematical Sciences

MS in Mathematics in Finance (expected - January 2019)

- **Coursework:** Derivative securities pricing, portfolio optimization (mean-variance analysis and Black-Litterman Model), risk management (VaR and Factor Models), active portfolio management (transaction cost model), market microstructure (sequential trading model), numerical methods, OOP and data structures in Java

UNIVERSITY OF TORONTO

Toronto, ON

Honors BS in Mathematical Finance with High Distinction (September 2013 – June 2017)

- **Coursework:** Statistical inference, linear regression, time series analysis, differential equations, nonlinear optimization, CAPM

EXPERIENCE

PUDONG DEVELOPMENT BANK

Beijing, China

Quantitative Research Assistant (May 2016 – August 2016)

- Evaluated prospective corporate bond purchases based on debt structure analysis according to leverage, equity and liquidity ratios to determine their internal credit ratings
- Executed investigations on newly launched regulations and their impacts on different financial markets to help traders improve their trading strategies
- Analyzed client histories and requests in support of portfolio customization

MEITUAN.COM

Beijing, China

Data Analyst Intern (May 2015 – August 2015)

- Cleaned large amount of data using VBA to build database for products
- Calibrated a factor model for profits in collaboration with 10 team members and successfully forecasted the future profit with historical data to a desired level of precision

PROJECTS

NEW YORK UNIVERSITY

New York, NY

Algorithm Design based on Monte Carlo simulation

- Developed an algorithm to price options and back-tested its performance with market data
- Applied antithetic variates method to accelerate convergence
- Utilized parallel computing and OpenCL to accelerate the implementation

Machine Learning: K-Means Clustering

- Conducted two different K-Means algorithms with random initialization of clusters
- Applied generic template techniques and test-driven principals in Java
- Implemented metrics to evaluate and compare performance of the 2 algorithms

Portfolio Optimization

- Cleaned the Dow Jones industrial average index historical data and analyzed the filtering impact on descriptive statistics, such as annualized return, Sharpe ratio, and covariance matrix
- Performed mean-variance portfolio optimization through shrinkage estimation and PCA
- Evaluated its numerical stability with its condition number

Research on the microstructure of CBL's trading in 2008

- Reproduced BBO spreads according to Roll model, using rolling 30-minutes intervals
- Implemented the full Lee-Ready algorithm to classify trades then implemented the full multi-period Glosten-Milgrom model to plot the sequence of δ_k , the probability of value depreciation

SKILLS

Programming Languages: Java, Python, R, MATLAB, Excel VBA

YINING (LILY) CHENG
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EDUCATION

NEW YORK UNIVERSITY

New York, NY

The Courant Institute of Mathematical Sciences

MS in Mathematics in Finance (September 2017 – January 2019)

- **Coursework:** Risk & portfolio management, factor models, derivatives pricing and Greeks, Black-Scholes formula, stochastic calculus, OOP in Java, fixed income math

EMORY UNIVERSITY

Atlanta, GA

BS in Mathematics, High Honor (August 2013 – May 2017)

- **Coursework:** ODEs and PDEs in Finance, numerical analysis, econometrics, data structures, abstract algebra, complex and real analysis, regression analysis

EXPERIENCE

INDUSTRIAL SECURITIES CO., LTD

Beijing, China

Equity Products Research Intern (June 2017 – July 2017)

- Developed semi-annual sales reports of equity products for Beijing branches in Excel and in PPT
- Assisted analyzing and comparing the revenue growth of equity products to 13 other branches
- Researched over 20 industry reports and over 30 financial statements, compared the historical stock price patterns to select a growing stock, and resulted a 7.8% return in 20 days
- Cooperated with the intern team in designing an employee incentive and compensation system to improve working efficiency and quality, and led to an approval by the senior management

ZHONGHELIAN E-COMMERCE CO., LTD

Jinhua, China

Software Internship (May 2015 – July 2015)

- Adopted the Objective-C (OC) language and IOS user interfaces(UI) controls
- Cooperated with the supervisor in developing an E-Commerce IOS App

PROJECTS

New York University

New York, NY

Options Pricing using Monte Carlo Simulation

- Priced European and Asian options using Monte Carlo Simulation with antithetic decorator in Java
- Implemented distributed simulation using client/server framework to accelerate computation
- Used GPU (OpenCL) to generate Gaussian random variables by Box Muller transformation

Robust Portfolio Optimization

- Performed mean-variance optimization on seven Vanguard funds; achieved a reasonable portfolio allocation by using robust estimators of statistics and covariance matrices in Python
- Constructed a Black-Litterman portfolio integrating market views and market capitalization

K-Means Clustering in Two Dimensions

- Implemented K-Means algorithm to group 2D points in test-driven development in Java
- Modified K-Means by clustering points into fix-sized groups; compared the traditional and modified K-Means performances and convergence rates under different initial conditions

The Philips Curve in 1950-2016

- Researched the lagged relationship between inflation and unemployment rate; fitted a linear model of Philips Curve in Python; evaluated the significance of fitted coefficients using hypothesis test
- Studied the causality of inflation due to unemployment using Granger causality test

COMPUTER SKILLS/OTHER

Programming Languages: Java, Matlab, Python, R

Other Software: Microsoft Office, LaTeX

Languages: Chinese (native), English (fluent), German (beginner)

ZIHAO GAO

(917) 476-6815 ■ zg763@nyu.edu

EDUCATION

NEW YORK UNIVERSITY

New York, NY

The Courant Institute of Mathematical Sciences

MS in Mathematics in Finance (August 2017 – January 2019)

- **Coursework:** Derivative securities, risk management, Monte-Carlo simulation, portfolio optimization, stochastic calculus, algorithm trading, active portfolio management, interest rate and FX model

UNIVERSITY OF MICHIGAN, ANN ARBOR

Ann Arbor, MI

BS in Financial Mathematics, Statistics, Minor in Computer Science (August 2015 – April 2017)

- **Coursework:** Numerical analysis, probability, data structure, applied regression, data mining

EXPERIENCE

JUPAI INVESTMENT COMPANY

Beijing, China

Financial Advisor Intern (August 2016 – August 2016)

- Collected information concerning the private placement funds such as fundraising amount, term of funds and compensation rate
- Analyzed and advised customers on duration, highlights and potential risks of funds
- Tracked and updated the remaining volume for each fund on a daily basis
- Improved customers experience by communicating updated information to coworkers

CHANGJIANG FINANCING SERVICES CO., LIMITED

Beijing, China

Summer Analyst Intern (May 2015 – June 2015)

- Analyzed previous due diligence reports to retrieve information about IPO market and policies
- Communicated directly with client's manager to obtain information about the company
- Assisted in drafting due diligence report for target company

CHINA JINGU INTERNATIONAL TRUST CO., LTD

Beijing, China

Summer Analyst Intern (July 2014 – July 2014)

- Acquired more than 5 client companies to gather information such as asset/debt, board members, and cash flow from due diligence report
- Gathered and entered financial statements information into corresponding spreadsheets with underlying algorithms
- Calculated potential risk level of projects and adjusting credit level based on suggestions

PROJECTS

New York University

New York, NY

Simulations of K-Means Algorithms in Java

- Conducted simulations of 2 different K-means algorithms with random initialization of clusters
- Applied test driven development by writing unit tests on functions and classes
- Implemented metric to evaluate and compare performances of 2 algorithms

Option Pricing in Java

- Constructed Monte Carlo Simulation method to calculate European Call option price
- Applied Box-Muller transformation to get Standard Gaussian from Uniform random variable
- Simulated over 10,000 stock price trajectories in Java OpenCL

University of Michigan, Ann Arbor

Ann Arbor, MI

Data Mining: Best Model to Predict Full Load Electrical Power Output in R

- Applied several different criteria and ridge regression to select appropriate predictors for models
- Built different models based on selected predictors and utilized cross-validation method to choose the best model for prediction

COMPUTER SKILLS/ OTHER

Programming Languages: C++ (proficient), Java (intermediate), R (intermediate), Python (intermediate)

Other Software: Microsoft Office, MATLAB, SQL

Languages: Mandarin (native), English (fluent)

LOUIS GUIGO

(702) 353-9291 ■ louis.guigo@nyu.edu ■ <https://www.linkedin.com/in/louis-guigo/en>

EDUCATION

NEW YORK UNIVERSITY (2017 – 2019) New York, USA

The Courant Institute of Mathematical Sciences, MS in Mathematics in Finance

- **Coursework Includes:** Stochastic analysis, Monte Carlo simulation, derivative securities pricing, options Greek, Black-Litterman model, object-oriented programming for finance
- **Future Coursework Includes:** Equity derivatives with PDE, credit and rate models, market impact models, statistical arbitrage, correlation and volatility trading, scientific computing
- **Activities:** Recitation leader for Algebra and Combinatorics (up to 80 students in charge)

ENSIMAG (2016 – 2018) Grenoble, FRANCE

“Grande École” Engineer Degree (BS & MS) in Applied Mathematics & Computer Science: Financial Engineering and Quantitative Analysis Track

- **Coursework Includes:** Numerical methods, convex optimization, ODE, probability models, stochastic processes, hypothesis testing, linear regression, PCA, forward and futures contracts, options, swaps valuation, modern portfolio theory, CAPM, algorithms and discrete optimization

LYCÉE SAINTE-GENEVIÈVE (2013 – 2015), **French Preparatory School** Versailles, FRANCE

EXPERIENCE

CNRS – French National Center for Scientific Research Grenoble, FRANCE

Research Assistant in the European Financial Data Institute (EUROFIDAI) (May – Aug. 2017)

- Utilized shell scripting and C++ to develop high frequency financial databases for European Exchange (Eurex) and Xetra Stock Exchange market data
- Wrote programs to clean, store, and reconstruct order books from processed data
- Studied compatibility of programs with powerful grid computing network (France Grilles)

CRÉDIT AGRICOLE CIB Paris, FRANCE

CIO Office Summer Intern (July – Sept. 2016)

- Designed VBA program to retrieve and consolidate data on associates, which saved days of work
- Automated the tenure analysis of the IT systems department of the investment bank

PROJECTS

NYU Courant: Options Pricing via Monte Carlo Simulation (Java) and Trinomial Trees (R) (Oct. 2017)

- Built a Java framework using Monte Carlo simulation to price European and Asian options
- Performed variance reduction, and built a Java middleware to implement distributed simulations
- Priced options on SPY using trinomial trees in R, computed Greeks and implied volatilities

ENSIMAG: Risk Measurement (VaR, CVaR) using C++ and R (Feb. – May 2017)

- Studied stochastic approximation method (Robbins-Monro) to compute VaR and CVaR
- Implemented it in C++ using Importance Sampling on canonical examples

ENSIMAG: Agile Development of a Compiler using Java and Assembly Code (Jan. – Feb. 2016)

- Developed it incrementally during a one-month dedicated period, as part of team of 4
- Experienced test-driven development, continuous integration and pair programming techniques

ENSIMAG: Modeling of Guitar Strings and Tympanic Membranes in Scilab (Feb. – May 2016)

- Built and computed sound and 3D animations of two vibration models
- Applied finite difference methods to solve ODE and PDE; performed stability analysis

STE-GEN.: Modeling of Pedestrian Motions in Emergency Situations using Python (Jan. – June 2015)

- Utilized behavioral studies, Euler and RK4 methods to devise soft congestion model

COMPUTER SKILLS/OTHER

Programming Languages: C, Java, Bash (3 years); C++, Python, ADA, R (2 years)

Other: Scilab (~MATLAB), DBMS (SQL), LaTeX, Git, Maven, Bloomberg Market Concepts (BMC)

Languages: French (native), English (fluent), Spanish (intermediate)

JINGANG (JASON) HE
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EDUCATION

NEW YORK UNIVERSITY

New York, NY

The Courant Institute of Mathematical Sciences

MS in Mathematics in Finance (expected – Jan. 2019)

- **Coursework:** Black-Scholes, Monte Carlo simulation and option price, stochastic processes, risk management (portfolio optimization, fixed income)
- **Future Coursework:** Time series analysis, statistical arbitrage, advanced econometrics

UNIVERSITY OF CALIFORNIA, LOS ANGELES

Los Angeles, CA

BS in Mathematics of Computation, BS in Physics (2014-2017)

- **Coursework:** Machine learning, optimization, numerical methods (Root Finding, Numerical Differentiation, Numerical ODE), PDE (Schrodinger's Equation, Wave Equation), Probability
- **Honors:** Dean's Honor list, graduated with Cum Laude Latin Honor

EXPERIENCE

NEW YORK UNIVERSITY

New York, NY

Teaching Assistant (Sept 2017- Dec. 2016)

- Planned and led the discussion session for more than 70 students
- Held office hours and provided homework and exam preparation help to students

VOXELCLOUD

Los Angeles, CA

Software Engineer Intern (June – Sept. 2017)

- Applied matrix transformations, change in color map and normalization to augment training data
- Changed softmax layer of inception model to sigmoid layer to enable multi-label classification
- Built a new model based on Inception-ResNet, which improved the classification accuracy by 5%
- Utilized Tensorboard to monitor the loss function and training accuracy to find the best parameters

HONGSHU TECH CO.LTD

Shenzhen, China

Summer Intern (Aug – Sept. 2016)

- Researched on various trading strategies and presented their implementations to the clients
- Added Python-based momentum strategies to Goldminer platform's library

PROJECTS

NEW YORK UNIVERSITY

Monte Carlo Simulation (Sept-Nov. 2017)

New York, NY

- Coded Monte Carlo Simulation in Java to price European and Asian style call option
- Utilized antithetic variate method to accelerate the convergence of the algorithm

UNIVERSITY OF CALIFORNIA, LOS ANGELES

Los Angeles, CA

Two Sigma Rental Listing Inquires (Jan – March. 2017)

- Applied extreme gradient boosting to RentHop's rental dataset to predict the preferred apartment types in New York City
- Encoded string features based on frequency to extract more information from the data set
Fine-tuned the model by testing different hyper-parameters (i.e. learning rate, max depth) and achieved a log-loss of 0.546 (ranked 150 out of 2000 participating teams)

COMPUTER SKILLS/OTHER

Programming Languages: Python, C/C++, Java, R, MATLAB, Shell

Other Software: Latex, Markdown, Mathematica, LabVIEW, Microsoft Office

Languages: Madarin (native), English (fluent)

RUI (RAY) JIANG
(309) 750-5543 ■ rij1294@nyu.edu

EDUCATION

NEW YORK UNIVERSITY

New York, NY

The Courant Institute of Mathematical Sciences

MS in Mathematics in Finance (expected – Dec. 2018)

- **Current Coursework:** Stochastic calculus, Monte Carlo and finite difference methods, Black-Scholes formula, Brownian motion, Java OOP, derivatives

ILLINOIS WESLEYAN UNIVERSITY

Bloomington, IL

BA in Mathematics and History (2013-2017)

- **Coursework:** wavelet transforms, spline functions, numerical methods, combinatorics
- **Honors:** Phi Beta Kappa, 4-year Alumni Scholarship, 4-year Dean's List

EXPERIENCE

NEW YORK UNIVERSITY

New York, NY

Recitation Leader (Teaching Assistant) (Sep. 2017 - present)

- Lead undergraduate calculus sessions, grade quizzes, and establish a good rapport with students

CreditEase Wealth Management

Beijing, China

VC/PE Summer Analyst (Jul. 2017 - Aug. 2017)

- Assisted in management of offshore fund of funds (FoFs), by conducting due diligence, reference check and on-going monitoring on 8 global funds of venture capital and private equity
- Met with representatives from 3 global funds, and wrote conference memos
- Collected fund information from quarterly reports, and calculated data, including IRR, multiples and loss ratio, to construct and monitor portfolio models using Excel VBA
- Helped to write quarterly and semi-annual reports about each invested fund and startups

ILLINOIS WESLEYAN UNIVERSITY

Bloomington, IL

Teaching Assistant (2014 - 2017)

- Tutored undergraduate-level linear algebra and calculus courses and Mathematica programming
- Graded all homework and exams for students enrolled in linear algebra and calculus courses

Student Assistant (2015 - 2017)

- Edited and updated the department website, and composed articles for department
- Assisted in researches for professors, collected American and Chinese governmental documents on agricultural lands and economic data, translated Chinese source
- Assisted with academic presentations at Illinois Farm Bureau for 2 years

PROJECTS

ILLINOIS WESLEYAN UNIVERSITY

Bloomington, IL

Irregular Triangulation of Spline Functions and Wavelet Functions (*1st author of paper*) (2015-2017)

- Generated algorithms to construct spline functions and wavelet functions over irregular triangulation in Barycentric coordinate in one and higher dimension with respect to Bernstein-Bezier polynomial with MATLAB
- Applied to numerical approximation, data fitting, and filtering with MATLAB
- Presented the results on *The 3rd International Symposium on Riordan Arrays and Related Topics*

Share Ownership Structure and Insider Trading in America (2016-2017)

- Studied the relationship between share ownership structure and early regulations of insider trading during the early 20th century

COMPUTER SKILLS/OTHER

Programming and Software: Java, Python, MATLAB, Mathematica, R; Microsoft Office (Excel VBA)

Languages: Mandarin (native), English (fluent)

SHUO LI

(404) 861-6738 ■ sl4142@nyu.edu

EDUCATION

NEW YORK UNIVERSITY

New York, NY

The Courant Institute of Mathematical Sciences

MS in Mathematics in Finance (September 2017 — January 2019)

- **Coursework:** Black Scholes model, stochastic calculus, derivative pricing, Monte Carlo simulation, Linear regressions, CAPM model, algorithms and data structures, mean variance analysis

EMORY UNIVERSITY

Atlanta, GA

BS in Mathematics & BS in Computer Science, *magna cum laude* (August 2013 — May 2017)

- **Thesis:** “Lattice Packings in R^2 ”

EXPERIENCE

DATAHUB, LLC

Chicago, IL

Data Analyst Remote Intern (November 2016 — May 2017)

- Participated in weekly conference calls and prepared step-by-step method for data analysis
- Manipulated raw data in SPSS Modeler and obtained two data mining certificates from IBM
- Learned to build models to solve business problems such as detecting frauds, identifying bridge appointments, enhancing HEDIS scores by identifying key variables and their relationships

HONGTA SECURITIES CO. LTD

Shanghai, China

Quantitative Analyst Intern (May 2016 — August 2016)

- Analyzed trading strategies on ETF arbitrage and backtested trading systems with 50ETF, 300ETF
- Studied future arbitrage strategies including arbitrage on futures with same and different expirations
- Proposed arbitrage strategy for rubber futures with different expirations and evaluated performance

CHINA PACIFIC INSURANCE CO. LTD

Shanghai, China

Actuarial Intern (June 2015 — August 2015)

- Determined premiums and reserves for insurance products by Equivalence Principle and Euler method
- Priced different insurance products such as disability, accident, joint life, DC/DB pensions in Excel
- Forecasted impact of risks by proposing five possible scenarios ranging from pessimistic to optimistic
- Performed Monte Carlo simulations in Excel and proposed risk mitigation strategies for each scenario

EMORY MATHEMATICAL MODELING ASSOCIATION

Atlanta, GA

Co-Founder & Vice President, Emory University (October 2015 — May 2017)

- Invited professors, participated in lectures in EMMA and applied for academic credits for participants
- Participated in setting up official website of EMMA in PHP and HTML and made posts

PROJECTS

ALGORITHMIC TRADING PROJECT

Atlanta, GA

Research, Goizueta Business School (February 2016 — May 2017)

- Gathered, cleaned, enhanced and analyzed data from WRDS in Java and R
- Designed strategies and backtested by enhanced dataset with different thresholds for trades
- Evaluated and identified key variables that affect performance and indicated strategy weakness

RESEARCH IN BLOOD FLOWS AND HEART DISEASES

Atlanta, GA

Research Assistant, Emory University (September 2015 — May 2017)

- Smoothed, fixed, and added meshes on geometries of patients' arteries from in Netgen
- Gathered, processed patients' data in MATLAB and run simulation to solve Navier Stokes equations

COMPUTER SKILLS & OTHERS

Programming Languages: C/C++, Java, R, MySQL, MATLAB, Python, Mathematica, Latex, SPSS Modeler

Languages: Shanghainese (native), Mandarin (fluent), English (fluent), French (basic)

Certificates: CFA Level I Candidate, SOA Exams P, FM, MFE, SOA FAP Module 1-5,

IBM Certified Specialist in SPSS Modeler Data Analysis, IBM Certified Specialist in Data Mining

SULIN (SHIRLEY) LIU
(201) 912-9841 ■ sulin.liu@nyu.edu

EDUCATION

NEW YORK UNIVERSITY

New York, NY

The Courant Institute of Mathematical Sciences

MS in Mathematics in Finance (expected - January 2019)

- **Course Highlights:** Stochastic Calculus, Risk & Portfolio Management with Econometrics, Derivative Pricing, Object-Oriented Design in Java, Fixed Income, Machine Learning

WUHAN UNIVERSITY

Wuhan, China

BS in Mathematics & BA in Economics (Sept 2013 - Jun 2017) **GPA:3.9/4.0**

- **Awards:** Outstanding Student, Meritorious Winner in Interdisciplinary Contest in Modeling

EXPERIENCE

ERNST & YOUNG

Beijing, China

Assurance Intern (Jul - Aug 2016)

- Analyzed and visualized audited data to identify the risk in a food processing company (Excel, R)
- Constructed audit platform to process data and increase efficiency of regulatory work (Excel VBA)
- Identified problems in interim audit and communicated with clients during on-sited due diligence

ACCENTURE

Wuhan, China

Analyst Intern (Apr - Jun 2016)

- Implemented principal component analysis and capacity assessment to develop and calibrate scoring models and rating systems for process valuation (MATLAB)
- Performed strategy relevance matrix and capacity analysis to develop process improvement plan to achieve 100 billion sales in 5 years
- Designed management process mechanism in BPM (business process management) project

CHANGJIANG SECURITIES

Wuhan, China

Researcher Intern (Jul - Aug 2015)

- Researched alpha in China A-share stock market and developed trading strategy, with back-test Sharpe ratio >2 (MATLAB)
- Performed data collection and analysis of energy industry; drafted issuance materials

PROJECTS

NEW YORK UNIVERSITY

New York, NY

Option Pricing using Monte Carlo Simulation (Oct 2017)

- Simulated stock price paths using Monte Carlo simulation to price Asian and European options
- Implemented variance reduction method using Antithetic decorator (Java)

WUHAN UNIVERSITY

Wuhan, China

Research Assistant: Stock market, Bond Credit Spread and Credit Rating (Feb 2016 - Mar 2017)

- Simulated a Bitcoin trading algorithm using Latent Source Model with high dimensional data and earned more than 15% return (MATLAB)
- Implemented ridge regression and credit risk structure model to analyze bond credit spread using 5000+ companies' data retrieved from Wind (R)

UNIVERSITY OF CALIFORNIA, BERKELEY

Berkeley, CA

Global Financial Data Project: Analysis of Private Companies using Big Data (Aug - Dec 2016)

- Implemented fully-connected Neural Network (Caffe, MATLAB), regression models and Spearman Rank Correlation (R) to track private companies' financial performance based on 100000+ public companies' data

COMPUTER SKILLS/OTHER

Programming Languages: Java, C++, Python, Excel VBA, R, SAS, MATLAB, STATA, LaTeX

Certification: CFA Level II Candidate, Interactive Programming in Python (Coursera)

ANDREW (YUSONG) PAN

1 River Court, New Jersey, NJ 07310 | 201-885-8009 | yp910@nyu.edu

EDUCATION

New York University, the Courant Institute of Mathematical Sciences

Master of Science in Financial Mathematics

Relevant Coursework: Stochastic calculus and Brownian motion; OOP in Java and algorithm optimization; Monte Carlo method, pricing using Black-Scholes; portfolio optimization, Machine Learning, Time Series

New York, NY

Expected Jan. 2019

University of Michigan

Bachelor of Science in Mathematics and Statistics

Ann Arbor, MI

Sept. 2015 – May. 2017

Syracuse University

Bachelor of Science in Mathematics and Statistics

Syracuse, NY

Sept. 2013 – May. 2015

RELEVANT EXPERIENCE

GuoYuan Securities Co., Ltd

Quantitative Strategist Intern (Python)

Shanghai, China

Jun. 2017 – Aug. 2017

- Utilized various data mining and machine learning techniques to analyze portfolio excess returns based on 6 factor asset pricing model, including Mean Variance Analysis, PCA, etc
- Implemented Trinomial tree model to price American options; calibrated implied volatility using Bisection method and compared the calculated values with historical vols; evaluated theoretical boundary of early exercising
- Developed pairs and straddle trading strategies based on price movements analysis; back-tested the strategy based on historical data and analyzed its returns and P&L attribution
- Monitored adherence to risk exposure for all trading activities using quantitative measure, which include Value at Risk (VaR), and Credit Valuation Adjustment (CVA)
- Highly motivated, organized with excellent analytical and communication skills in establishing effective task priorities as a team player with result oriented attitude

The Bank of China

Quantitative Research Summer Internship (Python, R)

Shanghai, China

Jun. 2016 – Sept. 2016

- Identified analytical needs with Business Officers for clients and business banking and gave clients specific project presentation for discovering new growth opportunities with products (wine)
- Developed ARIMA and Logistic model for wine companies to predict future revenue and maintained the research database, renew and improve it by SQL server in UNIX platform
- Performed advanced data and statistical analysis in support of and the creation of statistical models, including PCA, Time Series analysis, regression and multivariate models

RESEARCH EXPERIENCE & PROJECTS

Computing in Finance (Java)

New York, NY

- Priced vanilla European and Asian Option by Monte Carlo Simulation, utilized Anti-Thetic decorator to reduce variance
- Implemented Lloyd's algorithm to cluster multidimensional objects based on re-definable factors
- Implemented an exchange execution management system (EMS) with sweeping orders, resting orders and fills
- Preprocessed high frequency data in sequence for the convenience of backtesting

Equity Statistical Arbitrage Strategy Development (Python)

New York, NY

- Identified different types of signals for equity statistical arbitrage strategy, including technical (price and volume), fundamental (financial ratios and analysts' consensus), and non-conventional signals (sentiments)
- Constructed alphas based on the base features; analyzed and compared each alpha's strength, decay, turnover, coverage and orthogonality
- Conducted extensive research on portfolio optimization techniques and parameter selections
- Researched on transaction cost model which involves each stock's liquidity, volatility and other market microstructures
- Performed series of back-tests to optimize the model's hyper-parameters; implemented walk-forward cross validation methodology to ensure stable out-of-sample strategy performance

SKILLS, ACTIVITIES & INTERESTS

Languages: fluent in Mandarin; conversational proficiency in English

Skills: experienced with Java, Python, C/C++, MATLAB, R, Microsoft Office Suite, SAS, SQL, Bloomberg, UNIX

Interests: Poker, Basketball, Football

XIAOHAN SHI

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EDUCATION

NEW YORK UNIVERSITY

New York, NY

The Courant Institute of Mathematical Sciences

MS in Mathematics in Finance (expected - Dec. 2018)

- **Coursework:** Algorithmic trading and quantitative strategies, derivatives, Monte Carlo Method, Black-Scholes formula and applications, interest rate models
- **Future Coursework:** Risk management, big data applications and statistical arbitrage

ZHEJIANG UNIVERSITY

Hangzhou, China

BS in Statistics (Aug. 2013 - Jun. 2017)

- **Coursework:** Calculus, probability theory and statistics, linear algebra, stochastic processes, data structure and algorithms

EXPERIENCE

ZHEJIANG MOFENG INVESTMENT MANAGEMENT LLC

Hangzhou, China

Equity Research Intern (May 2016 - Jun. 2017)

- Researched on comparison between the Chinese A shares and H shares stock market based on trading rules, valuation difference and investment behaviors
- Led team in a research on equities in IT, real estate and healthcare sectors and formulated investment strategies with equities in cyclic industries based on value investing

CHINA CITIC BANK

Xi'an, China

Risk Management Intern (Jul. 2015 - Sept. 2015)

- Executed pre-loan investigation of corporates based on debt structure analysis according to LEV, equity ratio and liquidity ratio
- Conducted post-loan management and evaluated LGD with modified Credit Metrics Model and Z-score Model using Python
- Assisted in the integrated management of non-performing assets

CITIGROUP

Beijing, China

Intern-Young Talent Program (Dec. 2015)

- Trained on personal wealth management and modern portfolio theory
- Constructed model on the Vanke takeover battle based on game theory and developed theory on the function of insurance capital in stock market

PROJECTS

ZHEJIANG UNIVERSITY

Hangzhou, China

Senior Thesis: Stochastic Analysis and its Application in Finance (Mar. 2017 - May 2017)

- Compared efficiency of Monte Carlo Method and quasi-Monte Carlo Method with Asian Option
- Identified the characteristics of high frequency data and evaluated its activity of jumps with Blumenthal-Gettoor index

Research on Option Pricing Utilizing the Levy Process (Mar. 2015 - Jun. 2016)

- Analyzed the sample path of SSE500 index driven by Levy process, especially based on Merton and Kou model using Python
- Conducted test on whether high frequency sample path of SSE500 index is continuous with 5 ticks per second using R

COMPUTER SKILLS/OTHER

Programming Languages and Software: C/C++, Python, Java, R, SQL

Other Software: LaTeX, Microsoft Office; MATLAB

Languages: Mandarin (native), Microsoft Office; MATLAB

SHUHAN (JENNY) TIAN
(814) 777-8161 ■ st3367@nyu.edu

EDUCATION

NEW YORK UNIVERSITY

New York, NY

The Courant Institute of Mathematical Sciences

MS in Mathematics in Finance (expected – January 2019)

- **Coursework:** Stochastic calculus, quantitative portfolio theory, object oriented programming, interest rate derivatives and one-factor models, Black-Scholes and its application
- **Future Coursework:** Risk management (market and credit risk, VAR and stress testing), advanced econometrics, big data applications, and continuous time finance, PDEs and dynamic programming

PENNSYLVANIA STATE UNIVERSITY

State College, PA

BS in Mathematics (Actuarial Option), BS in Economics (Schreyer Honors College) (2013-2017)

- **Coursework:** Differential equations, probability and statistics, linear algebra, linear programming, economics, econometrics, game theory, risk management and insurance, corporate finance

EXPERIENCE

BANK OF CHINA INSURANCE COMPANY

Beijing, China

Online Intern in Actuarial Department (Sept 2016 - Dec 2016)

- Refined Generalized Linear model by adjusting existing parameters and adding new parameters
- Participated and assisted in the reserve valuation by creating run-off triangle spreadsheet

Actuarial Intern in Actuarial Department (Jul 2016 - Aug 2016)

- Updated the auto policy dataset by classifying and merging relevant data in SAS
- Built a Generalized Linear model to price auto insurance in SAS

PENNSYLVANIA STATE UNIVERSITY

State College, PA

Research Assistant & Teaching assistant (Aug 2015 - May 2016)

- Met on a weekly basis for the project named “Negative vs. Positive Campaign Advertisements”
- Sorted out political election datasets and DMA (Designated Market Area) datasets by using Excel and STATA
- Constructed regression models of political variables to obtain empirical results by using STATA
- Assisted professor during classes, proctored and graded exams, and collected homework

PROJECTS

PENNSYLVANIA STATE UNIVERSITY

State College, PA

The Differences in Dynamic Changes in Social Networks

- Authored a paper, *The Differences in Networks between Chinese Community and India Community in Silicon Valley*, receiving acknowledgement as an Honors Thesis
- Investigated differences in social networks of Chinese and Indian community in Silicon Valley
- Constructed two social network models based on Erdős-Rényi model and Barabasi-Albert model, focusing on dynamic formation of Chinese and India community
- Simulated these two models in MATLAB and made some measurements such as probability distribution, degree distribution to show differences

Factors that Affect Incarceration Rate in the United States

- Sorted and analyzed the dataset and built additive model and interaction model based on the characteristics of variables in STATA
- Tested for significance of variables, fitness of models, and normality of errors

COMPUTER SKILLS/OTHER

Programming Languages: Java

Other Software: Microsoft Office; R, MINITAB, STATA, SAS, MATLAB

Languages: Mandarin (native), English (fluent)

Actuarial Exams: Exam P (Probability), Exam FM (Financial Mathematics)

VISMAYIE VANDANAPU

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EDUCATION

NEW YORK UNIVERSITY, Courant Institute of Mathematical Sciences New York, NY
MS in Mathematics in Finance (expected – December 2018)

- **Current coursework:** CAPM, fixed-income mathematics, Black-Scholes model, introduction to programming by JAVA, Black-Litterman model
- **Future coursework:** time series analysis, Monte – Carlo methods, interest rate & foreign exchange models, advanced risk management, scientific computing (python), active portfolio management

INDIAN INSTITUTE OF TECHNOLOGY, MADRAS Chennai, India
Bachelors in Chemical Engineering (August 2009 – May 2013)

- **Relevant Coursework:** partial differential equations, linear algebra, numerical methods, introduction to operations research, accounting for managerial control

EXPERIENCE

Dr. REDDY's LABORATORIES LIMITED Hyderabad, India
Assistant Manager (July 2013 – July 2017)

- Conducted correlation and regression analysis, hypothesis tests and ANOVA tests to identify the cause effect relationship for a set of parameters in manufacturing processes to suggest process improvements
- Investigated the stability and reliability of processes using scenario analysis and performed the process capability analysis to estimate the probability of failure

PROJECTS

NEW YORK UNIVERSITY New York, NY
Pricing of Call and Put options using Monte Carlo Simulations

- Priced the European and Asian options in Java for a given error tolerance
- Implemented the antithetic decorator design pattern to reduce variance and used computing by GPU to increase the speed of computation

Mean- Variance portfolio optimization

- Performed Markowitz optimization for a portfolio with six different types of funds
- Simulated the efficient frontier and calculated the maximum Sharpe ratio portfolio
- Computed the allocation weights using the Black-Litterman model for a given set of subjective views

Dr. REDDY's LABORATORIES LIMITED Hyderabad, India
Optimal Portfolio Allocation

- Working in a team of 4 members to identify the portfolio of drugs that can be taken up for generic manufacturing to maximize the bottom-line of the company basis the profit margin, market projection for each drug with the manufacturing capacity as the constraint

COMPUTER SKILLS/OTHER

Programming Languages: Python, Java

Other Software: MATLAB, STATISTICA, MINITAB

Languages: English (Fluent), Telugu (Native), Hindi (Fluent)

Certifications: CFA level-3, Actuarial Sciences (fixed income securities), Lean Six Sigma Green Belt

Interests: Roller Hockey (professional player), Basket Ball

YICHEN WANG
(610) 704-3059 ■ yw3388@nyu.edu

EDUCATION

NEW YORK UNIVERSITY New York, NY

The Courant Institute of Mathematical Sciences

MS in Mathematics in Finance (expected – January 2019)

- **Coursework:** probability, CAPM and multi-factor model, Brownian motion, risk management, VaR, fixed income, Monte Carlo simulation, OOP and data structure in Java, econometrics

BRYN MAWR COLLEGE

Bryn Mawr, PA

BA (Honor) in Mathematics, Minors in Economics and Statistics (2013-2017)

GPA: 3.8/4.0

EXPERIENCE

EXCELLIS HEALTH SOLUTIONS New Hope, PA

Business Analytics Intern (May 2017-August 2017)

- Built pricing models on life science cloud master data service based on revenue & cost analysis
- Performed model tests on forecasted revenue using relative performance method; stress tested the model under different market scenarios using Excel and Salesforce
- Provided analytical support to client's supply chain management, which was adopted and expanded the client's customer pool to 7 registered U.S. clients

WHARTON SCHOOL, UNIVERSITY OF PENNSYLVANIA

Philadelphia, PA

Statistics Research Assistant (February 2016-August 2016)

- Built an R algorithm implementing the Bayesian changepoint model to solve the Parasite Clearance Estimation (PSE) problem
- Optimized estimates of the treatment effects and reduced mean square error of the estimator by 75% via utilizing individual-level data

PROJECTS

NEW YORK UNIVERSITY New York, NY

Monte Carlo Simulation and Middleware Implementation for Options Pricing (October 2017)

- Built an extendable Java-based Monte Carlo pricing framework for European and Asian options
- Implemented the antithetic variate technique via a decorator design pattern, which reduced the variance of simulation results and achieved faster convergence rate
- Achieved parallel computing via middleware using Java Message Service and ActiveMQ

K-Means Clustering (September 2017)

- Implemented and improved the Lloyd's algorithm to perform generic multi-dimensional point clustering and fixed-size clustering
- Compared numbers of iterations to achieve convergence between Lloyd's algorithm and its modified counterparty

BRYN MAWR COLLEGE

Bryn Mawr, PA

Senior Thesis: Two-parameter Generalized Exponential Model (May 2016-May 2017)

- Compared an adapted two-parameter Generalized Exponential Model and the Exponential Model including their hazard rate functions and applied the latter in survival analysis
- Developed a Maximum likelihood estimates algorithm in R and Mathematica using frequentist approach and Newton's Method, and obtained estimates for parameters in an observational study

Risk Analysis in Oil Futures Market, Math Department (January 2016-May 2016)

- Applied first-order Autoregressive model to analyze crude oil future prices from 1983 to 2016 based on geometric Brownian motion assumptions in Excel
- Deduced a calendar spread strategy of longing CLM contracts and shorting CLZ contract with ratios of slope estimates

COMPUTER SKILLS/OTHER

Programming Languages & Other Software: Java, R, Mathematica, SPSS, STATA, LaTeX

Certificates: Passed Actuarial Exam P and Exam FM; Financial Intensive Certificate(Wharton)

Languages: Mandarin(native), English(fluent), Spanish(basic)

TONG WU

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EDUCATION

NEW YORK UNIVERSITY

New York, NY

The Courant Institute of Mathematical Sciences

MS in Mathematics in Finance (expected – January 2019)

- **Coursework:** Arbitrage, risk-neutral valuation, the Black-Scholes formula, American options, mean variance portfolio optimization, robust portfolio optimization, Black-Litterman, factor and principle-component models, CAPM, Ito calculus, applications of programming in financial asset trading, portfolio management, and risk management, OOP in JAVA
- **Future Coursework:** Continuous time finance, scientific computing in quantitative finance, Bayesian regression, multilevel/hierarchical regression models, generalized linear models, Hidden Markov Models time series analysis, statistical arbitrage, trading strategies using high frequency data, algorithmic trading

UNIVERSITY OF CALIFORNIA, LOS ANGELES

Los Angeles, CA

BS in Mathematics/Economics with specialization in computing (September 2013 – June 2017)

- **Coursework:** Calculus, original differential equations, probability theory, linear algebra, numerical methods, basic derivative pricing theory, programming in C++ and JAVA, basic regression analysis in econometrics

EXPERIENCE

TIANFENG SECURITIES CO., LTD

Hubei, Wuhan, China

Analyst (August 2016 – September 2016)

- Reviewed investment proposal and due diligence report of previous investment projects
- Investigated companies' ownership structures, financial reports, industry background, etc.
- Analyzed the risks of investing in these companies and wrote research reports

RENDEZVOUS CAFETERIA

Los Angeles, CA

Student Worker (March 2014 – June 2014)

- Received and processed customer food orders
- Communicated with kitchen staff concerning client orders
- Processed cash and credit transactions for client purchases

PROJECTS

NEW YORK UNIVERSITY

New York, NY

Simulation of K-Mean Clustering Algorithms by Object-oriented Programming

- Developed JAVA program to process and group data into clusters using the K-mean algorithm
- Applied principle of test-driven development and OOP
- Created a metric to define the quality of the solution and applied the metric to compare the results of different algorithms

UNIVERSITY OF CALIFORNIA, LOS ANGELES

Los Angeles, CA

Word Frequency Analysis of Writers Using JAVA

- Built JAVA program to count frequency of word stems in novels
- Analyzed the vocabulary of Writers based on the number of distinct word stems in their novels

The "Snake" Game by C++ and Qt

- Implemented the "Snake" game in C++ and Qt
- Used 2D graphics functions in Qt

COMPUTER SKILLS/OTHER

Programming Languages: C++, JAVA, MATLAB

Other Software: Microsoft Office

Languages: Chinese (native), English (fluent), Japanese (elementary)

EDUCATION

- NEW YORK UNIVERSITY** New York, NY
The Courant Institute of Mathematical Sciences
MS in Mathematics in Finance (expected – January 2019)
- **Coursework:** Monte Carlo Simulation, CAPM, Black–Litterman model, derivative pricing, fixed income and interest rate derivatives, Greeks, VaR, Ito’s Lemma, Brownian motion
 - **Future Coursework:** Market microstructure, continuous time finance, credit derivatives
- BRYN MAWR COLLEGE** Bryn Mawr, PA
A.B. in Mathematics and Economics (2013-2016)
- **Coursework:** Econometrics, probability, Bayesian inference, linear regression, ODE, Granger causality test

EXPERIENCE

- JUMORE E-COMMERCE CO.** Beijing, China
Strategic Development Intern (Summer 2016)
- Analyzed the corporate risk using the adjusted VaR model by including the current market volatility
 - Automated data updates of the online platform using VBA and improved process efficiency and reliability
- TREASURY INTERNAL REVENUE SERVICE** Philadelphia, PA
Tax Consultant (January 2016 - April 2016)
- Provided client-facing service, filing over 50 tax returns to help low-income families meet tax obligations
 - Obtained certificate granted by Department of the Treasury for the VITA programs
- BANK OF CHINA** Wuxi, China
Assistant Product Management Intern (Summer 2015)
- Gathered, cleaned, and analyzed data of exchange rates for small business clients to minimize their costs
 - Implemented a data handler in Java to increase the productivity of collecting monthly statements

PROJECTS

- NEW YORK UNIVERSITY** New York, NY
Computing in Finance
- Performed KMeans algorithm to cluster multi-dimensional points using Java
 - Used Monte Carlo Simulation and applied antithetic decorator to reduce variance in Java to generate random stock paths that follow geometric Brownian motion and price European and Asian call options
 - Simulated an exchange while optimizing data structures that allow quick adding and removing orders, sending corresponding messages to clients, and sweeping the exchange with incoming orders using Java
- Risk and Portfolio Management with Econometrics**
- Used R to construct portfolios that maximize Sharpe ratio
 - Ran time series regressions using Stata and R to examine the prediction power of the Phillips curve
- Derivative Securities**
- Calculated PNL for rolling positions in light sweet crude oil futures trading using Excel
 - Determined positions and the time horizon in BRL futures trading strategy to lock in a Brazilian asset

COMPUTER SKILLS/OTHER

- Programming Languages:** Java (intermediary), R (intermediary), Matlab (beginner)
Other Software: Stata, Processing, Microsoft Word, Excel, Bloomberg Terminal
Languages: Mandarin (native), English (fluent), Japanese (intermediary)
Professional Certifications: CFA Level I (passed)

TIANCI ZHU

(312) 361-7887 ■ tz1095@nyu.edu

EDUCATION

NEW YORK UNIVERSITY

New York, NY

The Courant Institute of Mathematical Sciences

MS in Mathematics in Finance (expected – January 2019)

- **Coursework:** Black-Scholes formula and applications to stochastic processes, Monte Carlo and finite difference models, quantitative portfolio theory, dynamic programming, risk management

ILLINOIS INSTITUTE OF TECHNOLOGY

Chicago, IL

BS in Applied Mathematics (August 2013 – May 2017)

- **Coursework:** Calculus, differential equations, probability, statistics, real analysis, time series analysis and forecasting, and computer science

EXPERIENCE

CHINA CONSTRUCTION BANK

Dalian, China

International Business Division Intern (June 2017)

- Checked files attached to Documentary Collection, Documentary Credit, and Open Accounting
- Researched various financial products, such as refinance and foreign exchange transactions
- Created an electronic list for physical documentation, which organized information for easy access

Investment Banking Division Intern (July 2017)

- Researched various investment products, such as financial leasing and fund
- Communicated with clients on their needs and advised them on appropriate products

ILLINOIS INSTITUTE OF TECHNOLOGY

Chicago, IL

Math Tutor (February 2015 – May 2017)

- Answered questions concerning various math courses
- Conducted exam reviews for course material after discussion with faculty

PROJECTS

NEW YORK UNIVERSITY

New York, NY

Computing in Finance (September 2017 - present)

- Priced European and Asian options using Monte Carlo simulation and antithetic method in Java
- Applied OpenCL technique to accelerate option pricing process in Java
- Built up trinomial tree to get American option's early exercising boundary in MATLAB
- Constructed exchange mechanism with sweeping, filling and canceling functions in Java
- Designed DBReader to merge high frequency trading records in high efficiency in Java

Portfolio Optimization (September 2017 - present)

- Constructed mean-variance and Black-Litterman model to optimize portfolio investment in Excel

ILLINOIS INSTITUTE OF TECHNOLOGY

Chicago, IL

Heston Stochastic Volatility Modeling (May 2016 – present)

- Modified existing Quadratic Exponential and Broadie-Kaya Scheme to extend the applicable range to the case when volatility of asset prices' volatility is approaching zero in MATLAB
- Implemented new algorithm in the Guaranteed Automatic Integration Library (GAIL)
- Presented a poster at the 2017 Menger poster session
- Working on publishing the finding

COMPUTER SKILLS/OTHER

Programming Languages: Java, R

Other Software: Microsoft Office, MATLAB, LATEX

Languages: Mandarin (Native), English (Fluent)

Awards: 'Meritorious Winner' for 2016 Mathematical Contest in Modeling, 2017 Applied Math Menger award, 2015 Summer Research Stipend, 4-year International Student scholarship, 4-year Dean's List

The Mathematics in Finance Masters Program
 Courant Institute, New York University
 Academic Year 2017-2018

The curriculum has four main components:

1. **Financial Theory and Econometrics.** These courses form the theoretical core of the program, covering topics ranging from equilibrium theory to Black-Scholes to Heath-Jarrow-Morton.
2. **Practical Financial Applications.** These classes are taught by industry specialists from prominent New York financial firms. They emphasize the practical aspects of financial mathematics, drawing on the instructor's experience and expertise.
3. **Mathematical Tools.** This component provides appropriate mathematical background in areas like stochastic calculus and partial differential equations.
4. **Computational Skills.** These classes provide students with a broad range of software skills, and facility with computational methods such as optimization, Monte Carlo simulation, and the numerical solution of partial differential equations.

	First Semester	Second Semester	Third Semester
Practical Financial Applications		Advanced Risk Management —	Fin. Eng. Models for Corp. Finance —
		Interest Rate and FX Models —	Credit Analytics: Bonds, Loans & Derivatives (1/2 Credit)
		Securitized Products & Structured Finance (1/2 Credit) —	Regulation & Regulatory Risk Models —
		Energy Market & Derivatives (1/2 Credit) —	Fixed Income Derivatives: Models & Strategies in Practice (1/2 Credit)
		Advanced Topics in Equity Derivatives (1/2 Credit) —	
		Market Microstructure (1/2	

			Credit)	
Financial Theory and Econometrics	Derivative Securities — Risk & Portfolio Mgmt. with Econometrics	Active Portfolio Management — Algorithmic Trading & Quant. Strategies — Continuous Time Finance	Project and Presentation — Time Series Analysis & Stat. Arbitrage — Adv. Econometrics Models & Big Data	
Mathematical Tools	Stochastic Calculus			
Computational Skills	Computing in Finance	Scientific Computing in Finance	Computational Methods for Finance Data Science in Quantitative Finance	

Practical Training. In addition to coursework, the program emphasizes practical experience. All students do Masters Projects, mentored by finance professionals. Most full-time students do internships during the summer between their second and third semesters.

See the program web page http://math.nyu.edu/financial_mathematics for additional information.

MATHEMATICS IN FINANCE MS COURSES, 2014-2015

PRACTICAL FINANCIAL APPLICATIONS:

MATH-GA 2752.001 ACTIVE PORTFOLIO MANAGEMENT

Spring term: J. Benveniste

Prerequisites: Risk & Portfolio Management with Econometrics, Computing in Finance.

The first part of the course will cover the theoretical aspects of portfolio construction and optimization. The focus will be on advanced techniques in portfolio construction, addressing the extensions to traditional mean-variance optimization including robust optimization, dynamical programming and Bayesian choice. The second part of the course will focus on the econometric issues associated with portfolio optimization. Issues such as estimation of returns, covariance structure, predictability, and the

necessary econometric techniques to succeed in portfolio management will be covered. Readings will be drawn from the literature and extensive class notes.

MATH-GA 2753.001 ADVANCED RISK MANAGEMENT

Spring term: K. Abbott

Prerequisites: Derivative Securities, Computing in Finance or equivalent programming.

The importance of financial risk management has been increasingly recognized over the last several years. This course gives a broad overview of the field, from the perspective of both a risk management department and of a trading desk manager, with an emphasis on the role of financial mathematics and modeling in quantifying risk. The course will discuss how key players such as regulators, risk managers, and senior managers interact with trading. Specific techniques for measuring and managing the risk of trading and investment positions will be discussed for positions in equities, credit, interest rates, foreign exchange, commodities, vanilla options, and exotic options. Students will be trained in developing risk sensitivity reports and using them to explain income, design static and dynamic hedges, and measure value-at-risk and stress tests. Students will create Monte Carlo simulations to determine hedge effectiveness. Extensive use will be made of examples drawn from real trading experience, with a particular emphasis on lessons to be learned from trading disasters.

MATH-GA 2757.001 REGULATION AND REGULATORY RISK MODELS

Fall term: K. Abott and L. Andersen

Prerequisites: Risk Management, Derivative Securities (or equivalent familiarity with market and credit risk models).

The course is divided into two parts. The first addresses the institutional structure surrounding capital markets regulation. It will cover Basel (1, MRA, 2, 2.5, 3), Dodd-Frank, CCAR and model review. The second part covers the actual models used for the calculation of regulatory capital. These models include the Gaussian copula used for market risk, specific risk models, the Incremental Risk Calculation (single factor Vasicek), the Internal Models Method for credit, and the Comprehensive Risk Measure.

MATH-GA 2798.001 INTEREST RATE AND FX MODELS

Spring term: F. Mercurio & T. Fisher

Prerequisites: Derivative Securities, Stochastic Calculus, and Computing in Finance (or equivalent familiarity with financial models, stochastic methods, and computing skills). The course is divided into two parts. The first addresses the fixed-income models most frequently used in the finance industry, and their applications to the pricing and hedging of interest-based derivatives. The second part covers the foreign exchange derivatives markets, with a focus on vanilla options and first-generation (flow) exotics. Throughout both parts, the emphasis is on practical aspects of modeling, and the significance of the models for the valuation and risk management of widely-used derivative instruments.

MATH-GA.2799-001 SECURITIZED PRODUCTS & STRUCTURED FINANCE

Spring term: R. Sunada-Wong

Prerequisites: Basic bond mathematics and bond risk measures (duration and convexity); Derivative Securities and Stochastic Calculus.

This half-semester course will cover the fundamentals of Securitized Products, emphasizing Residential Mortgages and Mortgage-Backed Securities (MBS). We will build pricing models that generate cash flows taking into account interest rates and prepayments. The course will also review subprime mortgages, CDO's, Commercial Mortgage Backed Securities (CMBS), Auto Asset Backed Securities

(ABS), Credit Card ABS, CLO's, Peer-to-peer / MarketPlace Lending, and will discuss drivers of the financial crisis and model risk.

MATH-GA.2800-001 ENERGY MARKETS AND DERIVATIVES

Spring term: D. Eliezer

Prerequisites: Derivative Securities and Stochastic Calculus.

This half-semester course focuses on energy commodities and derivatives, from their basic fundamentals and valuation, to practical issues in managing structured energy portfolios. We develop a risk neutral valuation framework starting from basic GBM and extend this to more sophisticated multi-factor models. These approaches are then used for the valuation of common, yet challenging, structures. Particular emphasis is placed on the potential pitfalls of modeling methods and the practical aspects of implementation in production trading platforms. We survey market mechanics and valuation of inventory options and delivery risk in the emissions markets.

MATH-GA.2801-001 ADVANCED TOPICS IN EQUITY DERIVATIVES

Spring term: S. Bossu

Prerequisites: Derivative Securities, Stochastic Calculus, and Computing in Finance or equivalent programming experience.

This half-semester course will give a practitioner's perspective on a variety of advanced topics with a particular focus on equity derivatives instruments, including volatility and correlation modeling and trading, and exotic options and structured products. Some meta-mathematical topics such as the practical and regulatory aspects of setting up a hedge fund will also be covered.

MATH-GA.2802-001 MARKET MICROSTRUCTURE

Spring term: G. Ritter

Prerequisites: Derivative Securities, Risk & Portfolio Management with Econometrics, and Computing in Finance or equivalent programming experience.

This is a half-semester course covering topics of interest to both buy-side traders and sell-side execution quants. The course will provide a detailed look at how the trading process actually occurs and how to optimally interact with a continuous limit-order book market.

We begin with a review of early models, which assume competitive suppliers of liquidity whose revenues, corresponding to the spread, reflect the costs they incur. We discuss the structure of modern electronic limit order book markets and exchanges, including queue priority mechanisms, order types and hidden liquidity. We examine technological solutions that facilitate trading such as matching engines, ECNs, dark pools, multiple venue problems and smart order routers.

The second part of the course is dedicated pre-trade market impact estimation, post-trade slippage analysis, optimal execution strategies and dynamic no-arbitrage models. We cover Almgren-Chriss model for optimal execution, Gatheral's no-dynamic-arbitrage principle and the fundamental relationship between the average response of the market price to traded quantity, and properties of the decay of market impact.

Homework assignments will supplement the topics discussed in lecture. Some coding in Java will be required and students will learn to write their own simple limit-order-book simulator and analyze real NYSE TAQ data.

MATH-GA.2803-001 FIXED INCOME DERIVATIVES: MODELS & STRATEGIES IN PRACTICE

Fall term: L. Tatevossian and A. Sadr

Prerequisites: Computing in Finance (or equivalent programming skills) and Derivative Securities (familiarity with Black-Scholes interest rate models)

This half-semester class focuses on the practical workings of the fixed-income and rates-derivatives markets. The course content is motivated by a representative set of real-world trading, investment, and hedging objectives. Each situation will be examined from the ground level and its risk and reward attributes will be identified. This will enable the students to understand the link from the underlying market views to the applicable product set and the tools for managing the position once it is implemented. Common threads among products – structural or model-based – will be emphasized. We plan on covering bonds, swaps, flow options, semi-exotics, and some structured products.

A problem-oriented holistic view of the rate-derivatives market is a natural way to understand the line from product creation to modeling, marketing, trading, and hedging. The instructors hope to convey their intuition about both the power and limitations of models and show how sell-side practitioners manage these constraints in the context of changes in market backdrop, customer demands, and trading parameters.

MATH-GA.2804-001 CREDIT ANALYTICS: BONDS, LOANS AND DERIVATIVES

Fall term: B. Fleasker

Prerequisites: Derivate Securities and Computing in Finance (or equivalent familiarity with financial models and computing skills)

This half-semester course introduces the institutional market for bonds and loans subject to default risk and develops concepts and quantitative frameworks useful for modeling the valuation and risk management of such fixed income instruments and their associated derivatives. Emphasis will be put on theoretical arbitrage restrictions on the relative value between related instruments and practical applications in hedging, especially with credit derivatives. Some attention will be paid to market convention and related terminology, both to ensure proper interpretation of market data and to prepare students for careers in the field.

We will draw on the fundamental theory of derivatives valuation in complete markets and the probabilistic representation of the associated valuation operator. As required, this will be extended to incomplete markets in the context of doubly stochastic jump-diffusion processes. Specific models will be introduced, both as examples of the underlying theory and as tools that can be (and are) used to make trading and portfolio management decisions in real world markets.

FINANCIAL THEORY AND ECONOMETRICS:

MATH-GA 2707.001 TIME SERIES ANALYSIS AND STATISTICAL ARBITRAGE

Fall term: F. Asl and R. Reider

Prerequisites: Derivative Securities, Scientific Computing, and familiarity with basic probability.

The term "statistical arbitrage" covers any trading strategy that uses statistical tools and time series analysis to identify approximate arbitrage opportunities while evaluating the risks inherent in the trades (considering the transaction costs and other practical aspects). This course starts with a review of Time Series models and addresses econometric aspects of financial markets such as volatility and correlation models. We will review several stochastic volatility models and their estimation and calibration techniques as well as their applications in volatility based trading strategies. We will then focus on statistical arbitrage trading strategies based on cointegration, and review pairs trading strategies. We will present several key concepts of market microstructure, including models of market impact, which

will be discussed in the context of developing strategies for optimal execution. We will also present practical constraints in trading strategies and further practical issues in simulation techniques. Finally, we will review several algorithmic trading strategies frequently used by practitioners.

MATH-GA 2708.001 ALGORITHMIC TRADING AND QUANTITATIVE STRATEGIES

Spring term: P. Kolm and L. Maclin

Prerequisites: Computing in Finance, and Capital Markets and Portfolio Theory, or equivalent. In this course we develop a quantitative investment and trading framework. In the first part of the course, we study the mechanics of trading in the financial markets, some typical trading strategies, and how to work with and model high frequency data. Then we turn to transaction costs and market impact models, portfolio construction and robust optimization, and optimal betting and execution strategies. In the last part of the course, we focus on simulation techniques, back-testing strategies, and performance measurement. We use advanced econometric tools and model risk mitigation techniques throughout the course. Handouts and/or references will be provided on each topic.

MATH-GA 2751.001 RISK AND PORTFOLIO MANAGEMENT WITH ECONOMETRICS

Fall term: P. Kolm. Spring term: M. Avellaneda

Prerequisites: univariate statistics, multivariate calculus, linear algebra, and basic computing (e.g. familiarity with Matlab or co-registration in Computing in Finance).

A comprehensive introduction to the theory and practice of portfolio management, the central component of which is risk management. Econometric techniques are surveyed and applied to these disciplines. Topics covered include: factor and principal-component models, CAPM, dynamic asset pricing models, Black-Litterman, forecasting techniques and pitfalls, volatility modeling, regime-switching models, and many facets of risk management, both theory and practice.

MATH-GA 2755.001 PROJECT AND PRESENTATION

Fall term and spring term: P. Kolm

Students in the Mathematics in Finance program conduct research projects individually or in small groups under the supervision of finance professionals. The course culminates in oral and written presentations of the research results.

MATH-GA 2791.001 DERIVATIVE SECURITIES

Fall term: M. Avellanda. Spring term: B. Flesaker

An introduction to arbitrage-based pricing of derivative securities. Topics include: arbitrage; risk-neutral valuation; the log-normal hypothesis; binomial trees; the Black-Scholes formula and applications; the Black-Scholes partial differential equation; American options; one-factor interest rate models; swaps, caps, floors, swaptions, and other interest-based derivatives; credit risk and credit derivatives.

MATH-GA 2792.001 CONTINUOUS TIME FINANCE

Fall term: A. Javaheri & S. Ghamami. Spring term: B. Dupire and F. Mercurio

Prerequisites: Derivative Securities and Stochastic Calculus, or equivalent.

A second course in arbitrage-based pricing of derivative securities. The Black-Scholes model and its generalizations: equivalent martingale measures; the martingale representation theorem; the market price of risk; applications including change of numeraire and the analysis of quantos. Interest rate models: the Heath-Jarrow-Morton approach and its relation to shortrate models; applications including mortgage-backed securities. The volatility smile/skew and approaches to accounting for it: underlyings with jumps, local volatility models, and stochastic volatility models.

MATHEMATICAL TOOLS:

MATH-GA 2902.001 STOCHASTIC CALCULUS

Fall term: P. Bourgade. Spring term: A. Kuptsov

Prerequisite: Basic Probability or equivalent.

Discrete dynamical models: Markov chains, one-dimensional and multidimensional trees, forward and backward difference equations, transition probabilities and conditional expectations. Continuous processes in continuous time: Brownian motion, Ito integral and Ito's lemma, forward and backward partial differential equations for transition probabilities and conditional expectations, meaning and solution of Ito differential equations. Changes of measure on paths: Feynman-Kac formula, Cameron-Martin formula and Girsanov's theorem. The relation between continuous and discrete models: convergence theorems and discrete approximations.

COMPUTATIONAL SKILLS:

MATH-GA 2041.001 COMPUTING IN FINANCE

Fall term: E. Fishler and L. Maclin

This course will introduce students to the software development process, including applications in financial asset trading, research, hedging, portfolio management, and risk management. Students will use the Java programming language to develop object-oriented software, and will focus on the most broadly important elements of programming - superior design, effective problem solving, and the proper use of data structures and algorithms. Students will work with market and historical data to run simulations and test strategies. The course is designed to give students a feel for the practical considerations of software development and deployment. Several key technologies and recent innovations in financial computing will be presented and discussed.

MATH-GA 2043.001 COMPUTATIONAL METHODS FOR FINANCE

Fall term: J. Guyon & B. Liang

Prerequisites: Scientific Computing or Numerical Methods II, Continuous Time Finance, or permission of instructor.

Computational techniques for solving mathematical problems arising in finance. Dynamic programming for decision problems involving Markov chains and stochastic games. Numerical solution of parabolic partial differential equations for option valuation and their relation to tree methods. Stochastic simulation, Monte Carlo, and path generation for stochastic differential equations, including variance reduction techniques, low discrepancy sequences, and sensitivity analysis.

MATH-GA 2046.001 ADVANCED ECONOMETRICS AND BIG DATA

Fall term: G. Ritter

Prerequisites: Derivative Securities, Risk & Portfolio Management with Econometrics, and Computing in Finance (or equivalent programming experience).

A rigorous background in Bayesian statistics geared towards applications in finance, including decision theory and the Bayesian approach to modeling, inference, point estimation, and forecasting, sufficient statistics, exponential families and conjugate priors, and the posterior predictive density. A detailed treatment of multivariate regression including Bayesian regression, variable selection techniques, multilevel/hierarchical regression models, and generalized linear models (GLMs). Inference for classical time-series models, state estimation and parameter learning in Hidden Markov Models (HMMs) including the Kalman filter, the Baum-Welch algorithm and more generally, Bayesian networks and belief propagation. Solution techniques including Markov Chain Monte Carlo methods, Gibbs Sampling, the EM algorithm, and variational mean field. Real world examples drawn from finance to include stochastic volatility models, portfolio optimization with transaction costs, risk models, and multivariate forecasting.

MATH-GA.2047-001 DATA SCIENCE IN QUANTITATIVE FINANCE

Fall term: P. Kolm and I. Dimov

Prerequisites: Risk & Portfolio Management with Econometrics, Scientific Computing in Finance (or Scientific Computing) and Computing in Finance (or equivalent programming experience).

This is a full semester course focusing on practical aspects of alternative data, machine learning and data science in quantitative finance. Homework and hands-on projects form an integral part of the course, where students get to explore real-world datasets and software.

The course begins with an overview of the field, its technological and mathematical foundations, paying special attention to differences between data science in finance and other industries. We review the software that will be used throughout the course.

We examine the basic problems of supervised and unsupervised machine learning, and learn the link between regression and conditioning. Then we deepen our understanding of the main challenge in data science – the curse of dimensionality – as well as the basic trade-off of variance (model parsimony) vs. bias (model flexibility).

Demonstrations are given for real world data sets and basic data acquisition techniques such as web scraping and the merging of data sets. As homework each student is assigned to take part in downloading, cleaning, and testing data in a common repository, to be used at later stages in the class.

We examine linear and quadratic methods in regression, classification and unsupervised learning. We build a BARRA-style implicit risk-factor model and examine predictive models for county-level real estate, economic and demographic data, and macro economic data. We then take a dive into PCA, ICA and clustering methods to develop global macro indicators and estimate stable correlation matrices for equities.

In many real-life problems, one needs to do SVD on a matrix with missing values. Common applications include noisy image-recognition and recommendation systems. We discuss the Expectation Maximization algorithm, the L1-regularized Compressed Sensing algorithm, and a naïve gradient search algorithm.

The rest of the course focuses on non-linear or high-dimensional supervised learning problems. First, kernel smoothing and kernel regression methods are introduced as a way to tackle non-linear problems in low dimensions in a nearly model-free way. Then we proceed to generalize the kernel regression method in the Bayesian Regression framework of Gaussian Fields, and for classification as we introduce Support Vector Machines, Random Forest regression, Neural Nets and Universal Function Approximators.

MATH-GA 2048.001 SCIENTIFIC COMPUTING IN FINANCE

Spring term: Y. Li and

Prerequisites: multivariable calculus, linear algebra; programming experience strongly recommended but not required.

A practical introduction to scientific computing covering theory and basic algorithms together with use of visualization tools and principles behind reliable, efficient, and accurate software. Students will program in C/C++ and use Matlab for visualizing and quick prototyping. Specific topics include IEEE arithmetic, conditioning and error analysis, classical numerical analysis (finite difference and integration formulas, etc.), numerical linear algebra, optimization and nonlinear equations, ordinary differential equations, and (very) basic Monte Carlo.