

Spring 2017 Course Syllabus

Fintech and Big Data Financial Analytics

Course #: FIN 6368, section 001

Jindal School of Management, The University of Texas at Dallas

Course Information

Course

Course Title	Fintech and Big Data Financial Analytics
Course Number	FIN 6368.001 (27582)
Dates	Friday 1-3:45 PM
Room	JSOM 2.102

Professor Contact Information

Professor	Eric Zheng
Office Phone	972-883-5914
Email Address	ericz@utdallas.edu
Office Location	SOM 3.404
Office Hour:	Thursday, 2:00-3:00 PM or by appointment
Other Information	http://www.utdallas.edu/~ericz

TA Contact Information:

1. TBA

Course Pre-requisites, Co-requisites, and/or Other Restrictions

None, but knowledge on statistics, quant, algorithm is a plus.

Course Description

IT-enabled innovations have reshaped the finance industry, leading to the emergence of Fintech. Big data analytics in particular have changed how financial information is disseminated, processed and analyzed. Individual investors and financial institutes who are able to leverage the new IT to analyze the big financial data will have a leading edge. This class discusses these new opportunities and challenges. It seeks to equip students with these highly coveted skills in the market. Topics to be covered (but not limited to) will include: machine learning in financial analytics, statistical arbitrage, Quant and computational finance, big data-driven alpha models, high frequency trading, social trading, artificial intelligence (deep learning), P2P lending and Blockchain. The class will be based on R.

The class will be organized into the following five parts:

- I. Seeking Smart alpha – big data factor model, big-data technical analysis, Quant, text and social media analytics
- II. Algorithm trading and High Frequency Trading – DMA, AlgoTrading, HFT, StatArb, Pairs Trading, Exploratory Trading, mean reverting and trend following strategies,
- III. Big Data Financial Analytics – BDA, Micro-structure analysis, event arbitrage
- IV. Data Mining and Artificial Intelligence – DM, AI, deep learning, trading with DNN
- V. Emerging Fintech techniques – Social trading, P2P lending, Blockchain

Suggested Textbooks and Materials

1. Ernest Chan's Quantitative Trading (2008) and Algorithm Trading (2013)
2. Ruey Tsai's Analysis of Financial Data with R (2013)
3. Financial Analytics with R, by Mark Bennett and Dirk Hugen, 2016

Tentative Reading List and Handouts (to be updated over the class)

1. Economist 2014: The great third wave http://cdn.static-economist.com/sites/default/files/sponsorships/jl06/20141004_World_economy_WF.pdf
 - Automation and anxiety, Economist 2016 (Optional)
 - The rise of Fintechs in supply chains, <https://hbr.org/2016/06/the-rise-of-fintech-in-supply-chains>
2. The robots are coming for Wall Street, NY Times, 2016. Kensho-Goldman Sachs, http://www.nytimes.com/2016/02/28/magazine/the-robots-are-coming-for-wall-street.html?_r=0
3. Alpha model handout
 - a. The Barra model (optional)
 - b. Technical analysis handout (optional)
4. R Econometrics (Farnsworth 2008) and R text mining handouts
5. Andrew Lo (2010) financial Turing test
6. Beginner's guide to Quant
7. Choose one of the following:
 - a. Choosing programming language for algorithm trading
 - b. Algorithm trading challenges
 - c. Bloomberg 2013 HFT rise and fall; computerized HFT
 - d. Microstructure survey (Madhavan 2000)
8. Market making (Ch10) or ACM HFT or HFT introduction by Breckenfelder (2012) and Hendershott (2014)
 - a. Pairs trading handouts (optional)
 - b. StatArb handouts (optional)
9. Exploratory trading (Adam 2013)
 - a. How to make microfinance work, HBR 16, <https://hbr.org/2016/10/making-microfinance-more-effective>
10. Microstructure handout or Event driven backtesting
11. Inside a moneymaking machine like no other, Bloomberg, Nov. 2016, <http://www.bloomberg.com/news/articles/2016-11-21/how-renaissance-s-medallion-fund-became-finance-s-blackest-box>
12. Choose two of the following
 - a. SNA and Social media analytics handouts
 - b. Social hedge fund
 - c. Quantifying trading behavior using Google trends (Preis 2013)
13. Choose two of the following
 - a. The rise of the artificially intelligent hedge fund <https://www.wired.com/2016/01/the-rise-of-the-artificially-intelligent-hedge-fund/>
 - b. Stanford AI report 2016 "Artificial intelligence and life in 2030"
14. Social trading handout and P2P lending handouts
15. CIO explainer: "what is Blockchain"

Academic calendar

DATES	TOPIC	Readings/Assignments
Week 1 01/13	<ul style="list-style-type: none"> • Course overview • R Warm-up 	<ul style="list-style-type: none"> • Syllabus • Reading #1 (the great third wave Economist 14)
Week 2 01/20	<ul style="list-style-type: none"> • Fintech: IT-enabled financial innovations and the current trend • R basics (Ra data processing, R programming) <ul style="list-style-type: none"> ◦ Short R Introduction.pdf 	<ul style="list-style-type: none"> • R handout • Reading #2: The robots are coming for Wall Street (NYTimes 16) • <i>Special assignment 1:</i> The Kensho business model and its counterparts elsewhere
Week 3 01/28	<p>Part I. Seeking Smart alpha <i>Big Data Alpha Model 1</i></p> <ul style="list-style-type: none"> • Intro. to Big data, finance big data and analytics • The alpha model using big data <ul style="list-style-type: none"> ◦ Alpha model basics ◦ Light intro on Technical analysis ◦ Big data factors • R financial module 1 (Quantmod, Rmetrics, TTR) 	<ul style="list-style-type: none"> • R documents on Financial modules • Reading #3: Alpha model handout • <i>Special assignment 2:</i> Emerging 'RobAdvisor' (e.g. Wealthfront, LearnWest)
Week 4 02/03	<p><i>Big Data Alpha Model 2</i></p> <ul style="list-style-type: none"> • Text analytics & Social media Analytics <ul style="list-style-type: none"> ◦ R text mining from social media data • Construct big data factors • R time-series data analysis (FinTS) 	<ul style="list-style-type: none"> • Readings #4: R econometrics and R Text Mining handouts • Project 1: Construct trading strategy with a smart alpha model
Week 5 02/10	<p><i>Big Data Alpha Model 3</i></p> <ul style="list-style-type: none"> • Construct and Implement Trading strategy <ul style="list-style-type: none"> ◦ Seeking smart alpha and beta ◦ Backtesting & evaluation • Improving the alpha model 	<ul style="list-style-type: none"> • Reading #5: Financial Turing test (Lo 2011) • <i>Special Assignment 3:</i> SoFi and Neighborly Investing (VentureHacks, Crowdcube, Sofi, neighborly)
Week 6 02/17	<p>Part II Algorithm Trading and High Frequency Trading <i>AT and HFT 1</i></p> <ul style="list-style-type: none"> • Algorithm trading basics <ul style="list-style-type: none"> ◦ Infrastructure: DMA, setting up a platform ◦ Mechanisms: trading rules, liquidity, bid-ask-spread, order imbalance, risk management, backtesting 	<ul style="list-style-type: none"> • Readings #6: Beginner's guide to Quant • Algo trading handout • AT and Info (Hendershott 2011) • <i>Special Assignment 4:</i> New trading platforms (Robinhood, InteractiveBorker, Ninjatrade)

	<ul style="list-style-type: none"> • Quant 1 (StatArb, Paris-Trading, Advanced TA) 	
Week 7 02/24	<p>AT & HFT 2</p> <ul style="list-style-type: none"> • High frequency trading overview <ul style="list-style-type: none"> ○ Performance and Capacity of HFT strategies (Ch 6) ○ HFT congress report 2014 	<ul style="list-style-type: none"> • Readings #7: Bloomberg 2013 HFT rise and fall; computerized HFT • Microstructure survey (Madhavan 2000) • <i>Special Assignment 5:</i> Microloan and Personalized Finance (Digit, LendStreet, Kreditech) • Project 1 due
Week 8 03/03	<p>AT & HFT 3</p> <ul style="list-style-type: none"> • Quant 2 (building quant trading strategies) <ul style="list-style-type: none"> ○ Mean reversion, Trend following • Empirical finance in R (http://cran.r-project.org/web/views/Finance.html) 	<ul style="list-style-type: none"> • Readings #8: Market making (Ch 10), HFT (ACM) or HFT Introduction (Hendershott 14) • Project 2: Identifying profitable HFT strategies from tick data; Or data mining/AI/event arbitrage for financial analytics
Week 9 03/10	<p>Part III: Big data financial analytics BDFA 1</p> <ul style="list-style-type: none"> • Light intro on Hadoop&Spark • Utilizing Big data in Finance <ul style="list-style-type: none"> ○ Intraday trading, Tick data, level-2 data, microsecond data ○ New big data in finance (GoogleTrends etc.) • Student presentations on project1 	<ul style="list-style-type: none"> • Readings #9: Exploratory trading (Adam 13) • <i>Special assignment 6:</i> Microfinance and Personalized Budgeting and (LevelMoney, Acorns. Billguards, Paribus)
Week 10 03/13-19	Spring Break No Class	
Week 11 03/24	<p>BDFA 2</p> <ul style="list-style-type: none"> • Big data based trading strategies <ul style="list-style-type: none"> ○ Microstructure analysis ○ Event Arbitrage ○ Other big data driven trading strategy ○ Dark side of big data analytics 	<ul style="list-style-type: none"> • Readings #10: Microstructure handout or Event-driven backtesting • <i>Special assignment 6:</i> Personalized Budgeting and Virtual Piggy Bank (LevelMoney, Acorns. Billguards, Paribus)
Week 12 03/31	<p>Part IV: Data Mining and Artificial Intelligence DMAI 1</p> <ul style="list-style-type: none"> • Basic Data mining techniques for financial analytics 	<ul style="list-style-type: none"> • Readings # 11: Inside a moneymaking machine (Bloomberg 16) • <i>Special assignment 7:</i> AI based trading (Aidyia,

	<ul style="list-style-type: none"> ○ Association rule, Clustering, classification etc. 	Sentient Technology)
Week 13 04/07	DMAI 2 <ul style="list-style-type: none"> ● Advanced data mining techniques <ul style="list-style-type: none"> ○ SVM, Bayesian network ○ Social network analysis and graph theory ○ Neural network & Other DM techniques 	<ul style="list-style-type: none"> ● Readings #12: Handout on social network and social media analytics ● Social Hedge Funds
Week 14 04/14	DMAI 3 <ul style="list-style-type: none"> ● Deep learning <ul style="list-style-type: none"> ○ Understanding artificial intelligence ○ Deep Neural Network ○ Trading using DNN 	<ul style="list-style-type: none"> ● Readings #13: AI hedge fund ● Special Assignment 8: Disruptive Fintech 2017
Week 15 04/21	Part V: Emerging Fintech Topics EFT 1 <ul style="list-style-type: none"> ● Social Trading, peer to peer lending, Credit reassessment 	<ul style="list-style-type: none"> ● Readings 14: Social trading handout and P2P lending handout ● Project 2 due ● <i>Special Assignment 9: new P2P payment (Flint, Amazon Go)</i>
Week 16 04/28	EFT2 <ul style="list-style-type: none"> ● Blockchain & Other new topics ● Student presentation ● Class wrap-up and final review 	<ul style="list-style-type: none"> ● Readings 15: Blockchain articles ● <i>Special assignment 10: new Blockchain techniques (Bitshare)</i>
Week 17 05/05	<ul style="list-style-type: none"> ● Final Exam 	

Student Assessments and Grading

Components	Grades
Class Participation	10%
Attendance	5%
Presentations	5%
Assignments	40%
Project 1	15%
Project 2	15%
Special Assignment	10%
Final Exam	50%
Total	100%

Note: The grading distribution may change as necessary. Students can check their grades by clicking "My Grades" under Course Tools after the grade for each assessment task is released.

ATTENDANCE, PARTICIPATION and Discussion

Attendance and participation are extremely important in the determination of your final grade! The class participation consists of:

- Attendance: Students that attend classes often score much higher on exams and assignments and receive significantly better grades.
- Class Participation: Students are expected to participate in class discussions of case studies and assigned readings and be able to respond to general and individual questions based on assigned readings.
- Class Presentation and discussion board participation: We'll have a list of extra readings/cases and special assignments for you. Each student will need to present at least once (in the form of groups) or work on one ad-hoc assignment or post at least two comments in the discussion board.

Assignment submission instructions

You will submit a hard copy of your assignments and if needed also a digital copy to the 'digital drop box' at elearning. Please see the Assignments link on the course menu or see the icon on the designated page. You can click each assignment name link and follow the on-screen instructions to upload and submit your file(s). Please refer to the Help menu for more information on using this tool. **Please note**: each assignment link will be deactivated after the assignment due time. After your submission is graded, you may click each assignment's "Graded" tab to check the results and feedback.

For the team project assignment, one group member will submit the assignment for the group and all group members will be able to view the results and feedback once it's been graded.

elearning

Much of the class information can be found at the e-learning Portal. Students will use their UTD NetID account to login to the course at: <http://elearning.utdallas.edu>. Please see the [course access and navigation information](#).

The data which can be found there include the class schedule, assignments, the lecture slides and class news. This is also where you will access the Discussion Board. Posting comments on the discussion board will be counted towards class participation.

If you have any problems with your UTD account or with the UTD elearning server, you may send an email to: assist@utdallas.edu or call the UTD Computer Helpdesk at: **972-883-2911**. If you encounter any technical difficulties within the course site, please send an email to gmbasupport@utdallas.edu.

Scholastic Honesty

The University has policies and discipline procedures regarding scholastic dishonesty. Detailed information is available on the [Scholastic Dishonesty](#) web page. All students are expected to maintain a high level of responsibility with respect to academic honesty. Students who violate University rules on scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and/or dismissal from the University. Since such dishonesty harms the individual, all students and the integrity of the University, policies on scholastic dishonesty will be strictly enforced

Course Evaluation

As required by UTD academic regulations, every student must complete an evaluation for each enrolled course at the end of the semester. An online instructional assessment form will be made available for your confidential use. Please look for the course evaluation link on the course Homepage towards the end of the course.

University Policies

Student Conduct & Discipline

The University of Texas System and The University of Texas at Dallas have rules and regulations for the orderly and efficient conduct of their business. It is the responsibility of each student and each student organization to be knowledgeable about the rules and regulations which govern student conduct and activities. General information on student conduct and discipline is contained in the UTD publication, *A to Z Guide*, which is provided to all registered students each academic year.

The University of Texas at Dallas administers student discipline within the procedures of recognized and established due process. Procedures are defined and described in the *Rules and Regulations, Board of Regents, The University of Texas System, Part 1, Chapter VI, Section 3*, and in Title V, Rules on Student Services and Activities of the university's *Handbook of Operating Procedures*. Copies of these rules and regulations are available to students in the Office of the Dean of Students, where staff members are available to assist students in interpreting the rules and regulations (SU 1.602, 972/883-6391).

Academic Integrity

The faculty expects from its students a high level of responsibility and academic honesty. Because the value of an academic degree depends upon the absolute integrity of the work done by the student for that degree, it is imperative that a student demonstrate a high standard of individual honor in his or her scholastic work.

Scholastic dishonesty includes, but is not limited to, statements, acts or omissions related to applications for enrollment or the award of a degree, and/or the submission as one's own work or material that is not one's own. As a general rule, scholastic dishonesty involves one of the following acts: cheating, plagiarism, collusion and/or falsifying academic records. Students suspected of academic dishonesty are subject to disciplinary proceedings.

Plagiarism, especially from the web, from portions of papers for other classes, and from any other source is unacceptable and will be dealt with under the university's policy on plagiarism (see general catalog for details). This course will use the resources of turnitin.com, which searches the web for possible plagiarism and is over 90% effective.

Withdrawal from Class

The administration of this institution has set deadlines for withdrawal of any college-level courses. These dates and times are published in that semester's course catalog. Administration procedures must be followed. It is the student's responsibility to handle withdrawal requirements from any class. In other words, I cannot drop or withdraw any student. You must do the proper paperwork to ensure that you will not receive a final grade of "F" in a course if you choose not to attend the class once you are enrolled.

Student Grievance Procedures

Procedures for student grievances are found in Title V, Rules on Student Services and Activities, of the university's *Handbook of Operating Procedures*.

In attempting to resolve any student grievance regarding grades, evaluations, or other fulfillments of academic responsibility, it is the obligation of the student first to make a serious effort to resolve the matter with the instructor, supervisor, administrator, or committee with whom the grievance originates (hereafter called "the respondent"). Individual faculty members retain primary responsibility for assigning grades and evaluations. If the matter cannot be resolved at that level, the grievance must be submitted in writing to the respondent with a copy of the respondent's School Dean. If the matter is not resolved by the written response provided by the respondent, the student may submit a written appeal to the School Dean. If the grievance is not resolved by the School Dean's decision, the student may make a written appeal to the Dean of Graduate or Undergraduate Education, and the dean will appoint and convene an Academic Appeals Panel. The decision of the Academic Appeals Panel is final. The results of the academic appeals process will be distributed to all involved parties.

Incomplete Grade Policy

As per university policy, incomplete grades will be granted only for work unavoidably missed at the semester's end and only if 70% of the course work has been completed. An incomplete grade must be resolved within eight (8) weeks from the first day of the subsequent long semester. If the required work to complete the course and to remove the incomplete grade is not submitted by the specified deadline, the incomplete grade is changed automatically to a grade of **F**.

Disability Services

The goal of Disability Services is to provide students with disabilities educational opportunities equal to those of their non-disabled peers. Disability Services is located in room 1.610 in the Student Union. It is the student's responsibility to notify his or her professors of the need for such an accommodation. Disability Services provides students with letters to present to faculty members to verify that the student has a disability and needs accommodations. Individuals requiring special accommodation should contact the professor after class or during office hours.

Religious Holy Days

The University of Texas at Dallas will excuse a student from class or other required activities for the travel to and observance of a religious holy day for a religion whose places of worship are exempt from property tax under Section 11.20, Tax Code, Texas Code Annotated.

The student is encouraged to notify the instructor or activity sponsor as soon as possible regarding the absence, preferably in advance of the assignment. The student, so excused, will be allowed to take the exam or complete the assignment within a reasonable time after the absence: a period equal to the length of the absence, up to a maximum of one week. A student who notifies the instructor and completes any missed exam or assignment may not be penalized for the absence. A student who fails to complete the exam or assignment within the prescribed period may receive a failing grade for that exam or assignment.

Off-Campus Instruction and Course Activities

Off-campus, out-of-state, and foreign instruction and activities are subject to state law and University policies and procedures regarding travel and risk-related activities. Information regarding these rules and regulations may be found at the website address given below. Additional information is available from the office of the school dean.
(http://www.utdallas.edu/Business Affairs/Travel_Risk_Activities.htm)

These descriptions and timelines are subject to change at the discretion of the Professor.