

100% ONLINE

MASTER OF SCIENCE DATA SCIENCE IN FINANCE

Data science and machine learning is integral to the financial industry and will be even more so in the future. With Purdue's Data Science in Finance masters degree, you will develop highly sought-after expertise in machine learning and the tools necessary to advance a career in a quantitative financial field.

The courses are designed and taught by Purdue faculty, who are industry experts and practice-oriented. The courses teach skills for the workplace, with the ability to tailor the degree for your professional needs.

The plan of study of the 30 credit degree is provided below:

PLAN OF STUDY BY FOCUS AREA	CREDITS
<i>DATA SCIENCE FOUNDATION</i>	6
<i>PROGRAMMING, OPTIMIZATION AND COMPUTING</i>	4
<i>QUANTITATIVE FINANCE</i>	3
<i>FOUNDATIONAL FINANCE</i>	3
<i>MACHINE LEARNING IN FINANCE</i>	6
<i>MANAGEMENT ELECTIVES</i>	7
<i>SEMINAR</i>	1
GRAND TOTAL	30

DATA SCIENCE FOUNDATION COURSES

Probability

A first course in probability, intended to serve as a background for statistics and other applications. Sample spaces and axioms of probability, discrete and continuous random variables, conditional probability and Bayes' theorem, joint and conditional probability distributions, expectations, moments and moment generating functions, law of large numbers, and central limit theorem.

Applied Statistics

Inference in simple and multiple linear regression, residual analysis, transformations, polynomial regression, model building with real data, nonlinear regression. One-way and two-way analysis of variance, multiple comparisons, fixed and random factors, analysis of covariance.

Statistical Inference

A basic course in statistical theory covering standard statistical methods and their application. Estimation including unbiased and maximum likelihood estimation; testing hypotheses for standard distributions and contingency tables; confidence intervals and regions; introduction to concepts of sufficiency, loss functions, and risk functions.



College of Science

PROGRAMMING, OPTIMIZATION AND COMPUTING COURSES

Data Engineering I

This course introduces students to the fundamentals of Data Engineering, which are critical components of the larger field of Data Science. Specifically, this short module will focus on methods to gather, construct, manipulate, summarize, and visualize data sets, as a means to extract knowledge. This course provides hands on data engineering experience using Python. Completion of this course directly prepares learners for additional instruction in Data Engineering II and Foundations of Decision Making, but more broadly prepares learners to work with their own data sets as needed.

Data Engineering II

This course introduces students to the fundamentals of database management systems (DBMS) from a user's perspective. The principles of modeling an enterprise using Entity-Relationship diagrams and transforming the model into a relational or NoSQL database are illustrated through a range of examples. The SQL language is used to create, query, aggregate, and update a relational database. NOSQL databases and the related data models (column, graph, and document-based) are introduced. Experience in Python Programming is required.

Foundations of Decision Making

This course provides an overview of data science methods used for data-driven discovery, extraction of knowledge, and informed decision making. The course covers fundamental computational methods and statistical techniques used to correctly reason about uncertainty, conduct hypothesis tests, infer causal relationships, and apply and evaluate predictive models. The course highlights how sampling biases can impact fairness in decision making. Throughout, students get hands-on experience on how to make correct and explainable inferences from data. Experience in Python Programming, Probability, Statistics and Linear Algebra is required.

Numerical Computing for Data Science

Topics include numerical modeling of data, applications and methods of linear systems & eigenvalues

on networks, massive matrix methods for data analysis including singular value decomposition, principle components, and regression; numerical optimization including linear programming and data.

QUANTITATIVE FINANCE COURSE

Quantitative Finance 1

An introduction to the mathematical tools and techniques of modern finance theory, in the context of Black-Scholes option pricing. Brownian motion and its stochastic calculus, Ito's formula, and Feynman-Kac formula. Pricing and hedging of claims on Black-Scholes assets. Incomplete markets. Path-dependent options. Stochastic portfolio optimization.

FOUNDATIONAL FINANCE COURSE

Financial Management

This course is an introduction to Financial Management, approached from the view of a general manager. The objective of the course is to provide you with the conceptual and practical framework necessary to evaluate the financial impact of operating decisions. Readings, case analysis, and problem sets focus on the basic tools used by financial analysts and financial decision makers. The course is devoted to the two basic financial problems that all companies face: (1) On what should funds be spent (i.e., investment decisions)? and (2) From where should funds be obtained (i.e., financing decisions)? In this course, we consider such topics as financial statement analysis, financial planning, stock and bond valuation, project analysis (i.e., capital budgeting), estimating and using the cost of capital in practice, understanding the differences among financing alternatives, understanding financing decisions, and estimating the value of an operating business.

MACHINE LEARNING IN FINANCE COURSES

Machine Learning in Finance 1

This overview course introduces basic concepts of probability and statistics necessary to study quantitative finance and machine learning. The course also investigates structuring your financial data in a way that is amenable to machine learning algorithms. Once completed, students will be equipped with the foundations of machine learning and have an understanding of their applications in finance and be prepared for Machine Learning in Finance 2.

Machine Learning in Finance 2

This course focuses on reinforcement learning, an area of machine learning, and its application to modern finance problems. It will build on DSF 541 and prepare you for Machine Learning in Finance 3. Once completed, you will be able to recognize when reinforcement learning can be used to make strategic decisions based on existing data.

MANAGEMENT ELECTIVE COURSES

HR Strategy

This is an introductory course on the topic of Strategic Human Resource Management. As such, our discussions will focus on HR from the C suite level. We will explore how human resource function can assist management in meeting its various goals and objectives. Finally, within this course there will be a strategic HR project included which will require you survey various theories and techniques used in human resource management within organizations that require HRM to function in a strategic manner. Emphasis is placed on HRM, Strategic HRM, Managing Human Resources Globally, and Strategically Managing Human Resource Functions.

Spreadsheet Modeling

This course covers up-to-date and practical spreadsheet modeling and simulation tools that can be applied to a wide variety of business problems in finance, marketing, and operations. The topical coverage mainly consists of the following four modules: (1) deterministic and stochastic optimization techniques

to determine the best managerial actions under internally- and/or externally-imposed constraints; (2) probability distribution fitting techniques to find the most likely description of the uncertainty in future business; (3) simulation modeling techniques to discover and analyze the risk and uncertainty in business environment and processes; (4) application of spreadsheet modeling and simulation techniques in forecasting asset dynamics (stock price) and pricing options and real investment opportunities. This course provides hands-on experience of computer applications using Microsoft Excel and the spreadsheet add-ins @RISK, RISKOptimizer, SimQuick, etc.

Business Analytics

The techniques learned in this course will help you infer data and as such make better-informed decisions. The course covers basic probability, decision analysis, statistical analysis (hypothesis testing and regression analysis), and simulation and provides an introduction to optimization techniques. Probability models provide tools to handle uncertainty and risk. The statistical analysis focuses on the presentation of data and techniques to draw useful and valid inferences from data. Optimization models and decision analysis focus on techniques that use data to inform decision-making.

Leadership

Leadership is essential to the realization of organizational goals. Successful leaders can inspire and enliven followers and influence them to pursue particular courses of action. This course focuses on leadership from a managerial perspective. Participants will explore leadership models, learn about current research findings, investigate examples of leadership in practice, and engage in developmental activities to evaluate and enhance their leadership skills.

Organizational Behavior

Individual and group behavior are the central components of the study of behavior in organizations. Focus is on the managerial application of knowledge to issues such as motivation, group processes, leadership, organizational design structure, and others. The course employs cases, exercises, discussions, and lectures.

Talent Acquisition

This course focuses on the effective management of the flow of talent into and through organizations. It covers workforce planning, recruiting and selection, career transitions, and other workforce movement. It is designed to teach students the skills to recruit and select the best talent to help drive organizational strategy. Students will also learn how to design a process and framework for final individual or group selection. Lastly, they will learn several strategies to successfully orient and onboard new employees.

Microeconomics

This course covers microeconomic concepts relevant to managerial decision making. Topics may include: demand and supply analysis; consumer demand theory; production theory; price discrimination; perfect competition; partial equilibrium welfare analysis; externalities and public goods; risk aversion and risk sharing; hidden information and market signaling; moral hazard and incentives; rudimentary game theory; oligopoly; reputation and credibility; and transaction cost economics.

Python Programming

The course is an introduction to the Python programming language and its applications in business settings. Lectures will be problem-driven and mostly group-work based. Students will gain hands-on experience with a wide range of business problems. The focus of the course is to learn the basic elements of Python as a foundation for advanced topics such as data analytics. The main purpose is to develop the ability to write programs to solve real-world business problems.

Web Data Analytics

This industry-agnostic course is focused on training leaders to be able to talk to and manage the people who are collecting data and are making inferences from the data, and then make data-driven decisions. It will cover tools to collect, manipulate, and analyze data from the web and other sources, with the objective of making students data-savvy and comfortable with deriving insights from real-world, large datasets. Students will be exposed to the power of clickstream analysis and the possibilities that can be unleashed from testing and experimentation. The emphasis of the course will be on data savviness and practical usefulness.

Accounting

This course is an introduction to Financial Management. As such, the course addresses the two basic financial problems that all companies face: (1) On what should funds be spent (i.e., investment decisions)? and (2)

From where should funds be obtained (i.e., financing decisions)? Specific topics include financial statement analysis, financial planning, stock and bond valuation, project analysis (i.e., capital budgeting), estimating the cost of capital, understanding capital structure, and estimating firm value. Readings, case analyses, and problem sets focus on the basic tools used by financial analysts and financial decision-makers.

Operations Management

As goods and services are produced and distributed, they move through a set of interrelated operations or processes in order to match supply with demand. The design of these operations for strategic advantage, investment in improving their efficiency and effectiveness, and controlling these operations to meet performance objectives is the domain of Operations Management.

IT for Innovation

The Internet and other information technologies have reshaped the economic, organizational, cultural and personal landscape. Managers, consultants, and entrepreneurs are all expected to effectively utilize the technology to achieve the organizational goals. Organizations are now expected to not just adapt to technology changes, but also innovate taking advantage of the benefits of the technology and thrive using their new capabilities. Accordingly, the objective of the course is from the perspective of the Information Technology Leadership interested in enhancing the organization's competitive advantage. Specifically, in the course, we will study in detail what the different types of technologies are, how they can be taken advantage of, and what the critical success factors are for successful implementation of each type. The course will also focus on teaching analytics tools such as SQL, Excel PowerPivot, etc. The course material will be delivered by using case-discussions, lectures, and examples.

Exploring Diversity, Equity, and Inclusion

Navigating diverse workplaces is an important skill every business professional must know and understand. This course allows students to explore diversity issues in work. Leading research experts and industry professionals will discuss current research findings and workplace policies designed to create a more inclusive and equitable work environment. At the end of this course, students will design an action plan to combat diversity issues in the workplace and create an equitable workplace for all employees.

DATA SCIENCE IN FINANCE

Using R for Analytics

This course exposes students to RStudio and the R programming language as tools for data analytics. Students will develop a small portfolio of projects that demonstrate fundamental knowledge of programming, study reproducibility, data reshaping, exploratory data analysis, data visualization, and basic predictive modeling techniques such as regularization and shrinkage using R.MGMT 59000: Predictive Analytics.

Marketing Management

The objective of this course is to familiarize students with the methods and frameworks necessary to execute strategic plans in a marketing context. Marketing managers must be able to properly identify the needs of their given consumer base and design strategic plans to align the different dimensions of the marketing mix; such as pricing, promotional campaigns, product characteristics, and the necessary distribution channels, while taking into consideration the offerings of the competitors. To this end, we offer an immersive course, which leverages both lectures and case discussions, to enhance the thought process and presentation of hallmark marketing frameworks.

Talent Management

This course focuses on the employer-employee relationship and how managers work with employees to improve their performance. Attention is given to Talent, Talent Management, and Performance Management in work settings, with an emphasis, however, on contemporary approaches to managing the employer-employee relationship and the systems for managing talent.

Big Data Analytics in the Cloud

Cloud computing and big data technologies are rapidly enhancing an organization's business intelligence ecosystem. The two modules of the course are specially designed for future leaders and data scientists to gain valuable hands-on experience of collecting, cleaning, formatting, integrating, and storing massive amounts of data that may be structured or unstructured, archived, or streaming in a cloud platform. The first module will introduce the fundamentals of cloud computing, its enabling technologies, main building blocks, and hands-on experience through projects utilizing one of the public cloud infrastructures such as Google Cloud Platform (GCP), Amazon Web Services (AWS), and Microsoft Azure. The second module will cover processes for creating data pipelines in the cloud so that students will be able to curate big data for training, analysis, and prediction using AI/ML and other data science techniques.

Visualization and Persuasion

The Communication and Persuasion course enhances student professionalism in business contexts by improving oral communication skills. In this special course designed for MS Business Analytics students, you will focus on developing and presenting data-driven messages that are professional, clear, concise, and persuasive. By the end of the course, you will develop your ability to: present yourself professionally in diverse business communication contexts (e.g., presentations, group discussions, informal interactions, etc.); explain data and analyses in ways that are clearly understood by receivers; provide concise explanations that quickly get to the point without losing important context or content; demonstrate mastery at being data-driven by (a) translating data and analyses into a narrative that provides context for your message AND (b) creating informative, clutter-free data visualizations to support your message; make persuasive recommendations that convince receivers to adopt a particular belief or take a course of action.

Data Mining

Simon (1977) stated that managerial decision-making is synonymous with the entire process of management. In order to make intelligent decisions, one must have access to data and information. Today's electronically networked world provides a nearly infinite number of opportunities for data collection. The issue thus becomes: How does one approach these large quantities of data with the purpose of intelligent decision-making? The purpose of this course is to introduce the concepts, techniques, tools, and applications of data mining. The material is approached from the perspective of a business analyst, with an emphasis on supporting tactical and strategic decisions.

Strategic Management

Strategic Management is concerned with understanding how organizations might achieve advantage relative to competitors. In particular, it deals with the organization, management, and strategic positioning of the firm so as to gain long-term competitive advantage. To address this issue, we take on the role of general managers, or integrators – that is, managers who make decisions that cut across the functional and product boundaries of a firm. By focusing on what makes managers effective, we shall develop the ability to evaluate different situations and give you usable skills regardless of the business context in which you want to work.

DATA SCIENCE IN FINANCE

Negotiations in Organizations

This course focuses on developing your negotiating skills and making you a more confident negotiator. By the conclusion of this course, you will have improved your ability to diagnose negotiation situations, strategize and plan upcoming negotiations, and engage in more fruitful negotiations, even in situations where you are dealing with difficult negotiation counterparts. Because negotiating agreements is as much art as science, learning in this course will take place mainly by doing experiential exercises and will draw on negotiations research to supplement this learning.

Change Management

The purpose of this course is to provide you with essential tools and concepts you need to help create and sustain needed change in your personal and/or professional life, your work teams and your organizations. The course is taught in an executive-style format intended for working future managers. Emphasis is placed on knowledge application and experiential learning.

Total Rewards

This course will focus on the tangible and intangible aspects of compensation. Using the lens of a total reward philosophy, we will examine how an organization attracts, motivates, and retains employees, including scientists and engineers. While preparing students to build a fair and responsible compensation system, this course examines the underlying elements of alignment with an organization's strategy and business model, internal and external competitiveness, and benefits. We will discuss relevant psychological and economic theories. We will also discuss how compensation impacts society, including topics most relevant as well as living wage, essential workers, and executive compensation.

Strategic Sourcing and Procurement

With the relentless trend of globalization, procurement has moved from fighting for organizational significance to playing pivotal roles in the success of firms. In firms' profit and loss accounts, the share of material cost and the share of purchased services are growing continuously, underscoring the increasing strategic importance of sourcing and procurement management. This course will address the process of procurement including terminology, metrics, and decision making. We will also explore the sourcing decision and the strategic ramifications of producing/providing goods and services internally or purchasing them from external organizations.

Supply Chain Analytics

Supply Chain Analytics focuses on data-driven and rigorous decision making in supply chain management. It is a complete problem solving and decision making process, and integrates a broad set of analytical methodologies that enables the creation of business value.

Ethical and Sustainable Supply Chain

In today's business environment, companies rely on globally dispersed and complex supply chains to manufacture their goods and services. While this strategy provides a competitive advantage in cost, quality, or variety, it also brings in significant challenges, especially in the context of environmental, social, and ethical practices. And, how can a firm ensure such practices are adopted throughout its entire globally dispersed supply chain? We answer these questions in this course through a mix of lectures, case discussions, simulations, and activities/exercises.

Macroeconomics

This course examines how the US economy functions and develops a theoretical framework permitting an analysis of the forces affecting national income, employment, unemployment, interest rates, and the rate of inflation. Emphasis is placed upon the role of government fiscal and monetary policy in promoting economic growth and stable prices. Throughout the semester we will discuss both the theory and the empirical evidence on aggregate macroeconomic measures; consumption, savings, and investment; labor supply and demand; employment and unemployment; economic growth; money and banking; and macroeconomic stabilization techniques.

Project Management

This course seeks to introduce different phases of managing projects from conception to termination with particular emphasis on quantitative tools for planning, scheduling, resource allocation, monitoring, and control. In addition, topics such as risk management, communication, and conflict management will be covered. Students will also gain a working knowledge of both @Risk and MSProject softwares.

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Supply Chain Management

A supply chain includes supply, production, storage, distribution, and selling facilities that are connected by material, informational, and financial links. Supply Chain Management is an important part of every organization, whether small or large. Supply chain management is not a standalone function. The successful design, planning, execution, monitoring and control of the supply chain activities require the knowledge of not just material flow, but also information flow and cash flow, which underscores the coordination of different functions within an organization and the coordination of business partners within a value chain. In this course, we introduce the components of the supply chains, discuss the key management concepts, and analyze different models for building flexible, sustainable and resilient supply chains.

Advanced Manufacturing Management

The course starts with introducing the basic concepts and models for manufacturing planning and control. Building on the basic knowledge, we discuss the recent trends in manufacturing management triggered by Cyber-Physical Systems (CPSs) and Industrial Internet of Things (IIoT), which underscores the importance of data-driven decision making.

Marketing Analytics

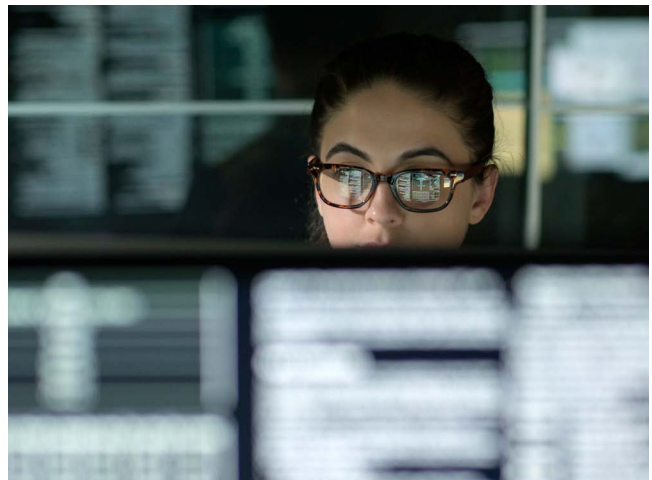
Irrespective of your career choice, you will often be required to effectively evaluate marketing research proposals, interpret, review and criticize the subsequent reports, and appraise its usefulness to management. You may also be required to formulate marketing strategies that create greater value for the company. The objective of this course is to equip you with tools required to address fundamental marketing decision problems. We will cover techniques such as: Discriminant and Logit Analysis, Cluster Analysis, Factor Analysis and Conjoint Analysis. These techniques are useful in Market Segmentation, Targeting, Positioning and Product Design. We will also discuss popular marketing decision models like New Product Diffusion Models, Advertising Response Models, Salesforce and Channel Decision Models, and Price and Sales Promotion Decision Models.

DATA SCIENCE IN FINANCE SEMINAR

MORE MANAGEMENT ELECTIVE COURSES

***Storytelling with Business Data
Financing New Ventures
Frontiers in Manufacturing
Managerial Economics
Legal & Social Foundations of Management
Collaborative Innovation
Technology Strategy***

NOTE: All courses are subject to change and semester availability may vary.



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