Graduate Syllabus Template

Instructor Contact Information

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Course Description

The course introduces machine learning with business applications. It provides a survey of statistical and machine learning algorithms and techniques including the machine learning framework, regression, classification, regularization and reduction, tree-based methods, unsupervised learning, and fully-connected, convolutional, and recurrent neural networks. Students implement machine learning models with open-source software for data science. They explore data and learn from data, finding underlying patterns useful for data reduction, feature analysis, prediction, and classification.

Course Objectives

Practical Machine Learning covers the subsequent, numbered learning outcomes. Each course objective is assessed, and those assessments are annotated in parentheses with A=Assignment and D=Discussion).

1. Apply an ML framework for model building (A1 through A9, D1)
2. Build and interpret regression models (A2 and A5, D2 and D5)
3. Build and interpret classification models (A3 and A4, D3 and D4)
4. Apply and interpret regularization and data reduction methods (A5, D5)
5. Build and interpret tree-based models for regression and classification (A6, D6)
6. Build and interpret unsupervised / semi-supervised learning models (A7, D7)
7. Build and interpret different types of neural network models (A8 and A9, D8 through D10)

Prerequisites

MSDS 400-DL Math for Data Scientists, MSDS 401-DL Applied Statistics with R, and MSDS 402-DL Introduction to Data Science or MSDS 403-DL Data Science in Practice.

In addition, a priori knowledge of Python and regression modeling is useful to completion of the requirements.

Diversity Statement

Data science is a team sport. To be successful as a Learning Team, we must respect the diversity of ideas and cultures that we represent. Respect each other and your beloved professor.

Required and Optional Readings and Resources

Required Readings

- James, Gareth, et al. An introduction to statistical learning. Vol. 112. New York: Springer, 2013.
- Python code for above text.
- Friedman, Jerome, Trevor Hastie, and Robert Tibshirani. The elements of statistical learning. Vol. 1. No. 10. New York: Springer series in statistics, 2001.
- Aurélien, Géron. Hands-on machine learning with scikit-learn & tensorflow. 2d Edition. Geron Aurelien (2017). ISBN 9781492032649
- Source code for above text
- Goodfellow, Ian, et al. Deep learning. Vol. 1. No. 2. Cambridge: MIT press, 2016.
- Python 3.X and / or Google Colab

Additional required readings and media are posted on Canvas, including timely news articles, academic research, and videos that you will review in order to complete some assignments and participate in discussion forums.

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Optional Readings and Resources

- Chollet, Francois. Deep learning with Python. Vol. 361. New York: Manning, 2018.
- Source Code for above text
- Of special interest are Linkedin Learning / Lynda courses in Python programming, JavaScript, web development, and Git/GitHub.

Assigned readings posted on Canvas, including timely news articles and academic research that you will read in order to complete some assignments and participate in discussion forums.

Assignment Overview and Grading Breakdown

All work will be completed and graded in Canvas, and grades will generally be provided within one week after the due date unless notified via announcement. Each assignment will be graded by the published rubric associated with it (see the assignment description). You should review these rubrics each week.

This course has nine graded assignments worth 50 points each, a final project worth 100 points, and 10 discussions worth 100 points total. The discussions have two parts plus follow-up requirements, and the instructor will select one of two possible assignments. The combined points in the course are 450 + 100 + 100 = 650.

Module	Assignment	Description	Points / %
Module 1. Machine Learning Framework: EDA, Resampling, Feature Generation	Discussion	Overfitting & Titanic Exploratory Data Analysis	10 / 1.5%
	Assignment	1. House Prices or 2. Claims EDA	50 / 7.7%
Module 2. Supervised Learning, Regression - Of Lines, Curves, Steps, & Splines,	Discussion	Linear Models / Week 1 Code Sharing	10 / 1.5%
	Assignment	1. House Prices or 2. Claims Regression	50 / 7.7%
Module 3 Supervised Learning, Selection and Regularization- Best Subsets, Stepwise, Lasso, Ridge, ElasticNet	Discussion	Best subsets, stepwise, lasso, ridge, and ElasticNet models / Code Sharing	10 / 1.5%
	Assignment	1. House Prices or 2. Claims Regularization	50 / 7.7%
Module 4. Supervised Learning, Classification- Of Points, Discriminants, and Neighbors	Discussion	Measures of Performance (Metrics) / Code Sharing	10 / 1.5%
	Assignment	1. Titanic or 2. Bankruptcy Classification 1	50 / 7.7%
Module 5. Supervised Learning, Selection	Discussion	Importance of Trees / Code Sharing	10 / 1.5%

and Regularization			
	Assignment	1. Titanic or 2. Bankruptcy Classification 2	50 / 7.7%
Module 6. Unsupervised Learning, Principal Components Analysis and Clustering	Discussion	Peer-Reviewed Article / Code Sharing	10 / 1.5%
	Assignment	1. MNIST or 2. Kannada MNIST	50 / 7.7%
Module 7. Supervised Learning, Classification & Regression-Of Dendrites, Axons, and Synapses.	Discussion	Peer-Reviewed Article / Code-Sharing	10 / 1.5%
	Assignment	1. MNIST or 2. Kannada MNIST	50 / 7.7%
Module 8. Supervised Learning, Of Filters, Channels, Padding, and Strides. Convolutional Neural Networks (CNN)	Discussion	Deep Learning / Code Sharing	10 / 1.5%
	Assignment	1. Dogs vs. Cats **Redux** or 2. Leaf Classification	50 / 7.7%
Module 9. Recurrent Neural Networks (RNN) and Proctored Examination	Discussion	RNN	10 / 1.5%
	Assignment	1. NLP Disaster Tweets 2. S&P 500 RNN Models (bonus)	50 /7.7%
Module 10.	Discussion	Summary of the Course	10 / 1.5%
	Assignment	Final Group Project	100 / 16.6%
Total			650 /100%

Grading Scale

Grade	Percent	Total Points (out of 650)
A	93-100%	602+ points
A-	90-92%	582-601 points
B+	87-89%	563-581 points
B	83-86%	537-562 points
B-	80-82%	517-536 points
C+	77-79.9%	498-516 points
C	73-76%	472-497 points
C-	70-72%	452-471 points
F	0%-69%	0-451 points

The School of Professional Studies does not award D grades in graduate coursework.

Discussion Assignments (10 points each x 10 discussions = 100 points)

Each week, you will have two discussion parts as well as a follow-up discussion requirement. In one part of the discussion, you will respond to comprehension-based questions. In the second part, you will post Python code examples largely from the previous week's work. In addition, you are required to contribute by engaging with your colleagues. Part 1 and 2 of the discussion are to be posted by Wednesday at midnight CT to facilitate engagement. Follow-up responses are due by Sunday at midnight. You will learn more by sharing repeatedly on the discussion board. Code improvements are a common contribution along with respectful critique of thoughts. Late discussions are never accepted, as they are monologues rather than contributory discussion. Standard information about discussion contributions follow.

Homework Assignments (50 points each x 9 assignments = 450 points)

You will be assigned one of two possible homework assignments for weeks 1 through 9. In these assignments, you will be required to apply the skills learned during the week to a real-world problem. Rubrics for each of the assignments exist under the assignment link, and you will be graded using these tools. Several of the assignments will compare your model's performance versus those of your peers in the class. Homework assignments are always due Sunday at midnight CT.

Final Project (100 points)

A final project will be assigned for completion of the residency requirement. It will be due on the last day of class.

Late Work Policy

1. Discussions submitted after the due date are monologues that will not be read or graded.

2. Late work submitted without a priori coordination is penalized at 20% per day. With coordination, an agreed upon late submission date may be available.

3. Late final examinations are never accepted.

Online Communication and Interaction Expectations

Discussion Forums

It is imperative to remain respectful of all viewpoints and positions and, when necessary, agree to respectfully disagree. While active and frequent participation is encouraged, cluttering a discussion board with inappropriate, irrelevant, or insignificant material will not earn additional points and may result in receiving less than full credit. Frequency matters but contributing

content that adds value is most important. Please remember to cite appropriately to avoid plagiarism. Please post your viewpoints first and then discuss others' viewpoints.

The quality of your posts and how others view and respond to them are the most valued. A single statement mostly implying "I agree" or "I do not agree" or "good job" is not counted as a post. Explain, clarify, politely ask for details, provide details, persuade, and enrich communications for a great discussion experience. Please note, there is a requirement to respond to at least two fellow class members posts.

Online Communication Etiquette

Beyond interacting with your instructor and peers in discussions, you will be expected to communicate by Canvas message, email, and sync session. Your instructor may also make themselves available by phone or text. In all contexts, keep your communication professional and respect the instructor's posted availability. To learn more about professional communication, please review the Communicating Effectively with Faculty guide.

Just as you expect a response when you send a message to your instructor, please respond promptly when your instructor contacts you. Your instructor will expect a response within two business days. This will require that you log into the course site regularly and set up your notifications to inform you when the instructor posts an announcement, provides feedback on work, or sends you a Canvas message. For guidance on setting your notifications, please review How do I set my Canvas notification settings as a student? It is also recommended that you check your u.northwestern e-mail account regularly, or forward your u.northwestern e-mail to an account you check frequently.

Participation and Attendance

This course meets as specified by the MSDS course schedule. All course goals, session learning objectives, and assessments are supported through classroom elements that can be accessed at any time. To measure class participation (or attendance), your participation in discussion boards is required, graded, and critical to your success in this course. Please note that any scheduled synchronous meetings are optional. While your attendance is highly encouraged, it is not required and you will not be graded on your attendance or participation.

Faculty Observer

Please note that this course may have a faculty observer for this term. The observer is present in the Canvas site and some Zoom sessions exclusively for training purposes. They will not be responsible for, or engage in, any in-class interactions, student assessment or grading, or any other aspect of course delivery. If you have questions or concerns about the faculty observer, please contact your instructor.

Student Support Services

AccessibleNU

This course is designed to be welcoming to, accessible to, and usable by everyone, including students who are English-language learners, have a variety of learning styles, have disabilities, or are new to online learning. Be sure to let me know immediately if you encounter a required element or resource in the course that is not accessible to you. Also, let me know of changes I can make to the course so that it is more welcoming to, accessible to, or usable by students who take this course in the future.

Northwestern University and AccessibleNU are committed to providing a supportive and challenging environment for all undergraduate, graduate, professional school, and professional studies students with disabilities who attend the University. Additionally, the University and AccessibleNU work to provide students with disabilities and other conditions requiring accommodation a learning and community environment that affords them full participation, equal access, and reasonable accommodation. The majority of accommodations, services, and auxiliary aids provided to eligible students are coordinated by AccessibleNU, which is part of the Dean of Students Office.

SPS Student Services

The Department of Student Services supports the academic and professional growth of SPS students. The Student Services team guides students through academic planning, policies, and administrative procedures, and promotes a supportive environment to foster student success. Students are encouraged to actively make use of the resources and staff available to assist them: Academic and Career Advisers, Counseling and Health Services, Student Affairs, Legal Services, Financial Aid and Student Accounts, among other services.

For a comprehensive overview of course and program processes and policies and helpful student resources, please refer to your SPS Student Handbook.

Academic Support Services

Northwestern University Library

As one of the leading private research libraries in the United States, Northwestern University Library serves the educational and information needs of its students and faculty as well as scholars around the world. Visit the Library About page for more information or contact Distance Learning Librarian Tracy Coyne at 312-503-6617 or tracy-coyne@northwestern.edu.

Remote access to the library databases and many other university services requires Multi-Factor Authentication (MFA).

Program-Specific Library Guides

Here is the library guide for Data Science. This guide will help you find library resources that might be helpful to you.

Additional Library Resources

- Connectivity: Campus Wireless and Off-Campus Access to Electronic Resources
- Getting Available Items: Delivery to Long-Distance Patrons
- Quick Access to Major Newspapers
- Reserve a Library Study Room
- Resources for Data Analysis
- Schaffner Library Top Resources
- Sign up for an in-person or online Research Consultation Appointment
- Social Science Data Resources

The Writing Place

The Writing Place is Northwestern's center for peer writing consultations. Consultations are free and available to anyone in the Northwestern community: undergraduates, graduate students, faculty, or staff. To book an appointment, go to The Writing Place website.

The Math Place

The Math Place is a free tutorial service provided to students currently enrolled in Northwestern University's School of Professional Studies courses or in other Northwestern University courses. Students of all levels can benefit from the individual tutoring provided from this service, whether they are taking undergraduate or graduate level courses. To book an appointment, go to The Math Place website.

SPS Learning Studios

Learning studios are available to students who would like additional support in commonly used tools and topics, including statistics, Excel, and coding in R. An instructor is available to answer your questions as you work through self-paced content and exercises. Students can self-enroll for free by visiting the SPS Academic Services page.

Read&Write Gold

Read&Write Gold is an optional text reading and writing program with numerous beneficial features. Originally developed to assist users with print disabilities, such as visual impairments, dyslexia, ADHD, etc., this program provides a wide array of tools to assist with reading, writing, and notetaking. One of the most useful tools is the text-to-speech function, which students may use to convert digital text into an audio format.

Read&Write Gold is available for free to all Northwestern students, faculty, and staff. Visit the Northwestern IT site on Read&Write Gold for more information about the software, as well as instructions on how to download it.

Academic Integrity at Northwestern

Students are required to comply with University regulations regarding academic integrity. If you are in doubt about what constitutes academic dishonesty, speak with your instructor or graduate coordinator before the assignment is due and/or examine the University website. Academic dishonesty includes, but is not limited to, cheating on an exam, obtaining an unfair advantage, and plagiarism (e.g., using material from readings without citing or copying another student's paper). Failure to maintain academic integrity will result in a grade sanction, possibly as severe as failing and being required to retake the course, and could lead to a suspension or expulsion from the program. Further penalties may apply. For more information, visit The Office of the Provost's Academic Integrity page.

Some assignments in SPS courses may be required to be submitted through Turnitin, a plagiarism detection and education tool. You can find an explanation of the tool here.

Course Technology

This course will involve a number of different types of interactions. These interactions will take place primarily through the Canvas system. Please take the time to navigate through the course and become familiar with the course syllabus, structure, and content and review the list of resources below.

Systems Requirements for Distance Learning

Students and faculty enrolled in SPS online classes should have access to a computer with the Minimum System Requirements.

Canvas

The Canvas Student Center includes information on communicating in Canvas, navigating a Canvas course, grades, additional help, and more. The Canvas at Northwestern website provides information of getting to know Canvas at Northwestern and getting Canvas support. The Canvas Student Guide provides tutorials on all the features of Canvas. For additional Canvas help and support, you can always click the Help icon in the lower left corner to begin a live chat with Canvas support or contact the Canvas Support Hotline.

The Canvas Accessibility Statement and Canvas Privacy Policy are also available.

Zoom

We will use Zoom for optional synchronous meetings. The Zoom support page provides additional guidance for using Zoom, and the Zoom for Students in Canvas page has guidance specifically for students.

The Zoom Privacy Policy and the Accessibility Features on Zoom are also available.

Please note that any scheduled synchronous meetings are optional. While your attendance is highly encouraged, it is not required and you will not be graded on your attendance or participation. These synchronous sessions will be recorded, so you will be able to review the session afterward.

Panopto

Videos in this course are hosted in Panopto. If you have not used Panopto in the past, you may be prompted to login to Panopto for the first time and authorize Panopto to access your Canvas account. You can learn more about using Panopto and login to Panopto directly by visiting the Panopto guide on the Northwestern IT Resource Hub. Depending on the assignment requirements of this course, you may be asked to create videos using Panopto in addition to viewing content that your instructor has provided through Panopto.

The Panopto Privacy Policy and the Accessibility Features on Panopto are also available.

Required Technical Skills

Students in an online program should be able to do the following:

- Communicate via email and Canvas discussion forums.
- Use web browsers and navigate the World Wide Web.
- Use the Canvas Learning Management System
- Use integrated Canvas tools (e.g., Zoom, Panopto, Course Reserves).
- Use the Microsoft suite of applications
- Use Python for machine learning

Required Digital Literacy Skills

In order to be successful in an online course, students should be able to locate, evaluate, apply, create, and communicate information using technology.

Students in this online course should be able to do the following:

- Create, name, compose, upload, and attach documents.
- Download, modify, upload, attach document templates.
- Create, name, design, and upload presentations.
- Access and download Course Reserve readings; read and review PDF documents.

- Access and use a digital textbook.
- Record and upload video taken with a webcam or smartphone.
- Use the library website for scholarly research tasks.
- Search the Internet strategically and assess the credibility of Internet sources.
- Participate in threaded discussions by contributing text responses, uploading images, sharing links.
- Coordinate remote work with peers, which may include contacting each other by e-mail, phone, video conference, or shared document.
- Edit and format pages in the course site using a WYSIWIG (What You See is What You Get) editor or basic HTML.
- Using a quizzing tool to answer multiple choice, true/false, matching, and short response questions within a given time period.
- Follow directions to engage with a remote proctor by text, webcam, and audio.
- Use a video player to review content, including pausing and restarting video.

Master's in Data Science — Minimum Hardware Requirements

To successfully complete the assignments and activities in the Master's of Data Science Program, you must use a laptop or desktop computer that meets the following specifications:

- Processor: 8th Generation Intel® CoreTM i7-8700 Processor (3.20GHz, up to 4.60GHz with Turbo Boost, 12MB Cache)
- Operating System: Windows 10 Pro 64
- Memory: 16.0GB DDR4 2666 MHz
- Hard Drive: 500 GB 7200 RPM + 256GB SSD
- Graphics: NVIDIA GeForce GTX 1050Ti 4GB
- Keyboard: Wireless English Keyboard
- Pointing Device: Wireless Mouse
- Network: 802.11 AC adapter or Gigabit Ethernet
- Webcam

NOTE: SPS IT does not recommend using a Mac because they do not support all software used by MSDS classes.

Technical Help and Support

The SPS Help Desk is available for Faculty, Students and Staff to support their daily IT needs. For additional technical support, contact the Northwestern IT Support Center.

Permissions

Instructional Materials

This course was developed in partnership with Distance Learning staff in the School of Professional Studies at Northwestern University. Every effort has been made to responsibly acquire instructional materials for this class, by adhering to copyright law, obtaining permission from copyright holders, selecting Open Educational Resources (OERs) and Creative Commons (CC) materials, and using citations to credit the work of others.

The same is expected of students in this course. Please review the Academic Integrity statement for more information.

Sharing Course Content

Content within this course--including assignment descriptions, exam questions, and other course components--may not be distributed outside of the course, either to other students or on the Internet more broadly.

Student Ownership of Content

Students retain ownership of all content developed while completing this course, as dictated by the university Copyright Policy (“copyright ownership resides with the Creator(s) of copyrightable works”).

Per the Family Educational Rights and Privacy Act (FERPA), if your instructor wishes to share your work with future students, your permission must be obtained in writing.

Your instructor may limit access to the course after a cutoff date. When you complete the course, please ensure that you have saved all work. You may not be able to return to the course to download your submissions.

Course Schedule

Module 1. Machine Learning Framework: EDA, Resampling, Feature Generation

Learning Objectives

- Apply an ML Framework to a real-world data problem
- Conduct EDA including outlier analysis and feature creation
- Build cross-validation data subsets for use in model evaluation
- Discuss overfitting in ML modeling

Readings & Media

Required Readings

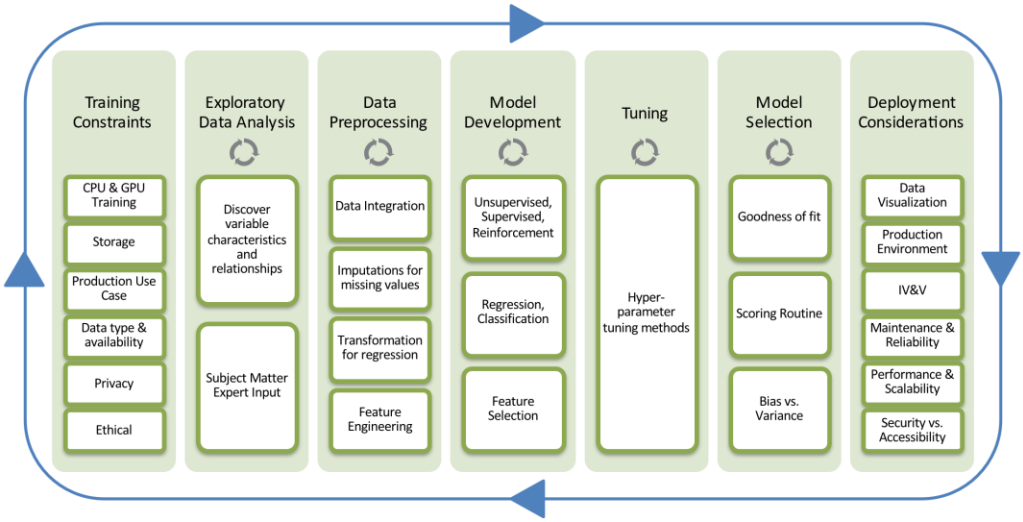
- James, Read Chapters 1 (13 pp), 2.1-2.2 (22 pp), 5.1-5.2 (11 pp)
- Geron, Chapter 1 (30 pp)

Recommended Readings

- Hastie, Introduction
- Geron, Scan Chapter 2 (46 pp)

Media

- EDA & Machine Learning
- Introduction to Colab
- Lecture 1



Assignments

Discussion 1 (10 points). Initial post due Wednesday at midnight CT.
Assignment 1 (50 points). Machine Learning Project, due Sunday night at midnight CT.
Knowledge check

Module 2. Supervised Learning, Regression - Of Lines, Curves, Steps, & Splines

Learning Objectives

- Build and evaluate simple linear regression models
- Build and evaluate multiple linear regression models
- Evaluate common problems with regression models
- Discuss polynomial, indicator, dichotomous, & piecewise elements for regression
- Transform data to improve regression performance
- Evaluate performance metrics for regression
- Apply an ML Framework to real-world data

Readings & Media

Required Readings

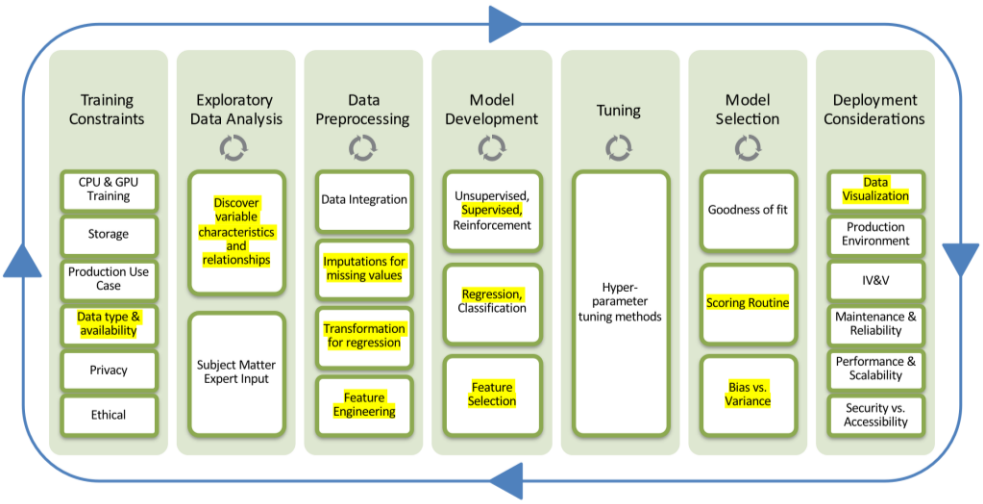
- James, Chapter 3.1 to 3.5 (42 pp)
- Géron, Chapter 4 up to Regularization (39 pp)

Recommended Readings

- James, 7.1 to 7.7 (22 pp)
- Hastie, 3.1 to 3.3 (20 pp)

Media

- Lecture 2



Assignments

Discussion 1 (10 points). Initial post due Wednesday at midnight CT.
Assignment 1 (50 points). Machine Learning Project, due Sunday night at midnight CT.
Knowledge check

Module 3. Supervised Learning, Selection and Regularization- Best Subsets, Stepwise, Lasso, Ridge, ElasticNet

Learning Objectives

- Build and evaluate lasso, ridge, and ElasticNet regularization models
- Apply stepwise regression techniques for model selection using various metrics
- Discuss best subset selection and its limitations

- Apply an ML Framework to real-world data

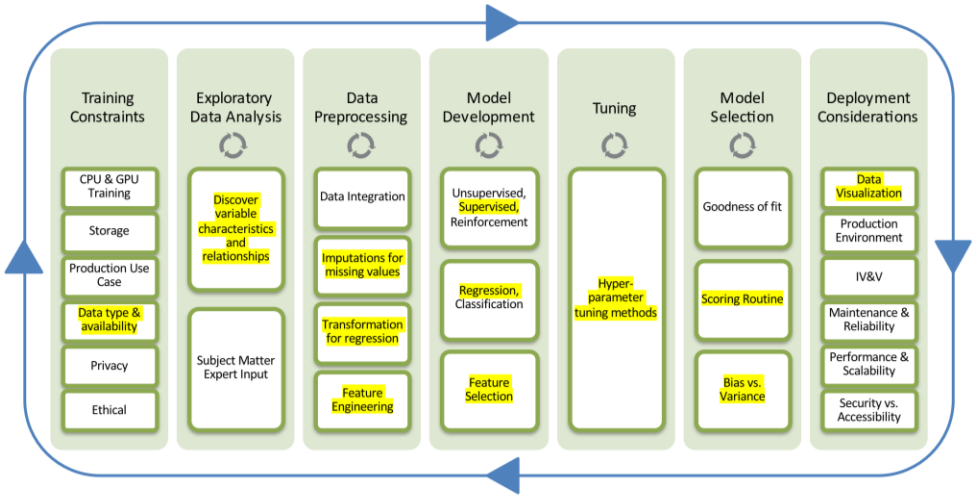
Readings & Media

Required Readings

- James, Chapter 6.1 to 6.4 (37 pp)
- Géron, Chapter 4 (Regularized Linear Models, 20 pp)

Media

- Lecture 3



Assignments

Discussion 1 (10 points). Initial post due Wednesday at midnight CT.
Assignment 1 (50 points). Machine Learning Project, due Sunday night at midnight CT.
Knowledge check

Module 4. Supervised Learning, Classification- Of Points, Discriminants, and Neighbors. Logistic Regression (LR), Linear Discriminant Analysis (LDA), Quadratic Discriminant Analysis (QDA), K-Nearest Neighbors (KNN), and Support Vector Machines (SVM)

Learning Objectives

- Build and evaluate logistic regression models
- Build and evaluate LDA and QDA models
- Build and evaluate KNN models
- Build and evaluate SVM models
- Compare LR and LDA models
- Evaluate performance metrics for classification
- Apply an ML Framework to real-world data

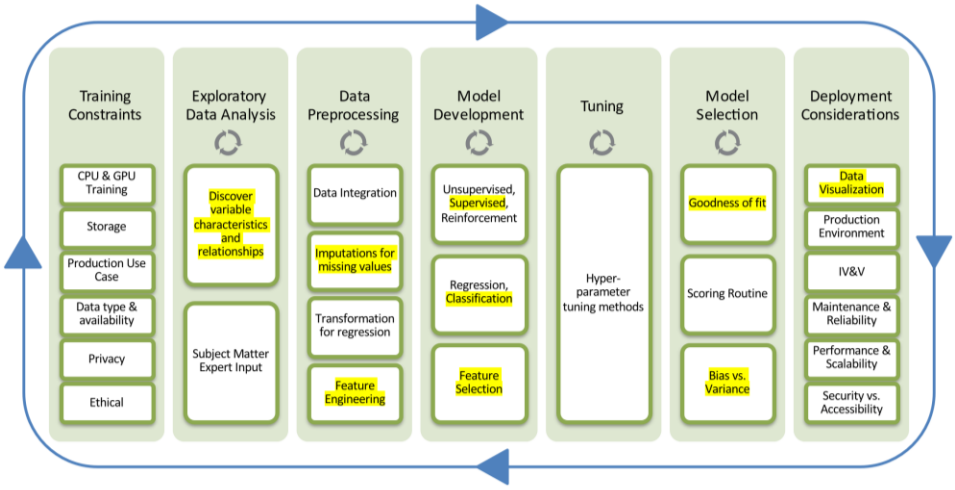
Readings & Media

Required Readings

- James, Chapter 4.1 to 4.5 (26 pp), Chapter 9.1 to 9.5 (22 pp)
- Géron, Chapter 3 (22 pp), Chapter 5 (19 pp)

Media

- Lecture 4



Assignments

Discussion 1 (10 points). Initial post due Wednesday at midnight CT.
Assignment 1 (50 points). Machine Learning Project, due Sunday night at midnight CT.
Knowledge check

Module 5. Supervised Learning, Classification & Regression-Of Trees & Forests. Bagging, Boosting, Random Forests, and Ensembles

Learning Objectives

- Build and evaluate tree-based models for classification or regression
- Compare performance of tree-based models with more traditional models
- Discuss impurity measures
- Apply an ML Framework to real-world data

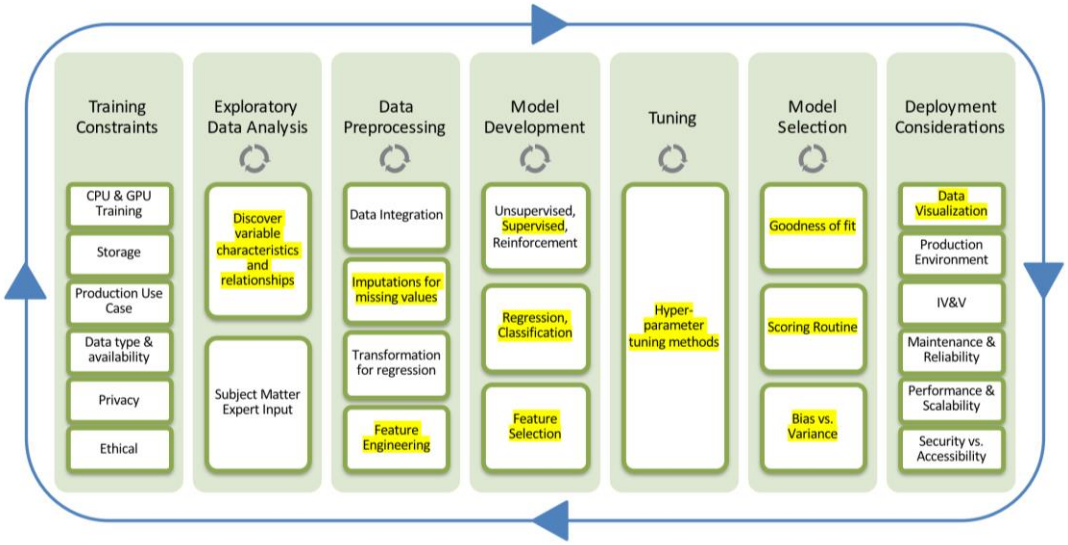
Readings & Media

Required Readings

- James, Chapter 8.1 to 8.2 (22 pp)
- Géron, Chapter 6 (11 pp) and 7 (22 pp)

Media

- Lecture 5



Assignments

Discussion 1 (10 points). Initial post due Wednesday at midnight CT.
Assignment 1 (50 points). Machine Learning Project, due Sunday night at midnight CT.
Knowledge check

Module 6. Unsupervised Learning, Principal Components Analysis and Clustering

Learning Objectives

- Build and evaluate K-means and hierarchical clustering models
- Build and evaluate models based on principal components data restructuring
- Apply an ML Framework to real-world data

Readings & Media

Required Readings

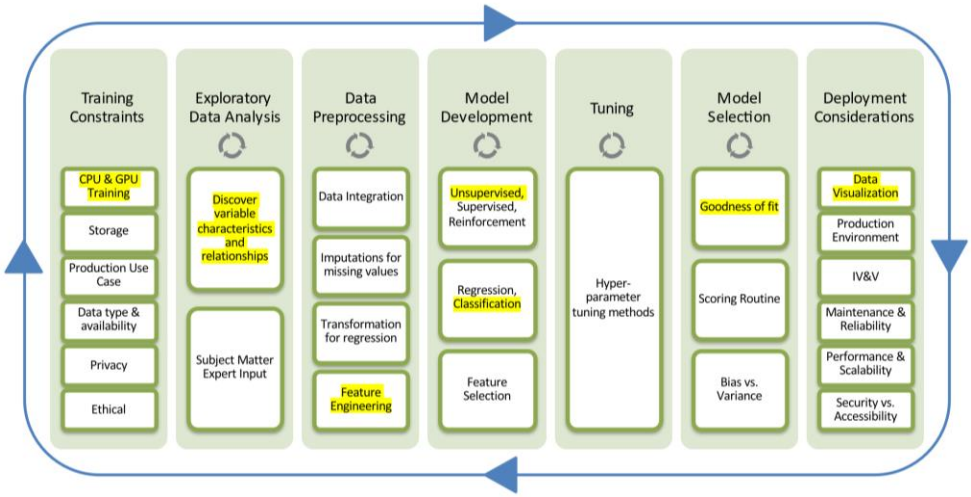
- James, Chapter 10.1 to 10.3 (30 pp)
- Géron, Chapter 8 and 9 (33 pp)

Recommended Readings

- Hastie Chapters 13 and 14

Media

- Lecture 6



Assignments

Discussion 1 (10 points). Initial post due Wednesday at midnight CT.
Assignment 1 (50 points). Machine Learning Project, due Sunday night at midnight CT.
Knowledge check

Module 7. Supervised Learning, Classification & Regression-Of Dendrites, Axons, and Synapses. Neural Networks

Learning Objectives

- Build, evaluate, and train neural network models for classification and regression
- Build design of experiments to evaluate the construction of neural networks
- Describe the elements of neural networks
- Apply an ML Framework to real-world data

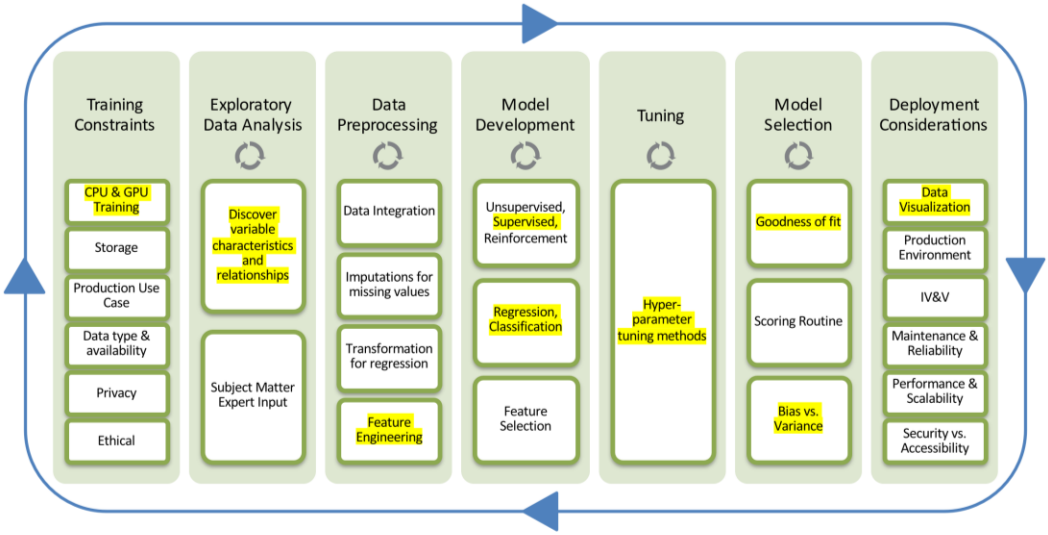
Readings & Media

Required Readings

- Géron, A. Chapters 10 through 13
- Hastie, Chapter 11

Media

- Lecture 7



Assignments

Discussion 1 (10 points). Initial post due Wednesday at midnight CT.
Assignment 1 (50 points). Machine Learning Project, due Sunday night at midnight CT.
Knowledge check

Module 8. Supervised Learning, Of Filters, Channels, Padding, and Strides. Convolutional Neural Networks (CNN)

Learning Objectives

- Build, evaluate, and train CNN models for classification
- Build design of experiments to evaluate the construction of CNN
- Describe the elements of CNN
- Apply an ML Framework to real-world data

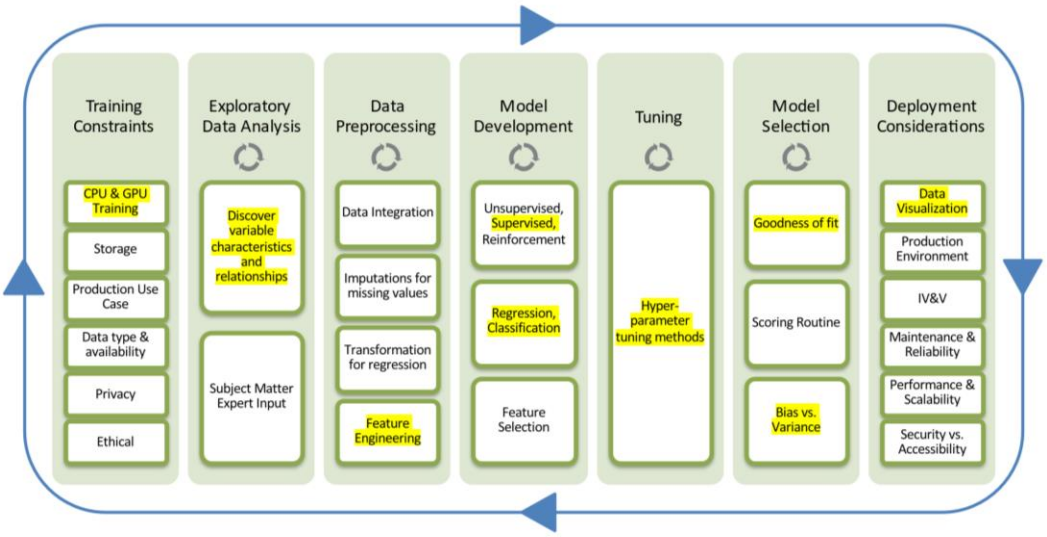
Readings & Media

Required Readings

- Géron, A. Chapter 14
- Goodfellow, Chapter 9

Media

- Lecture 8



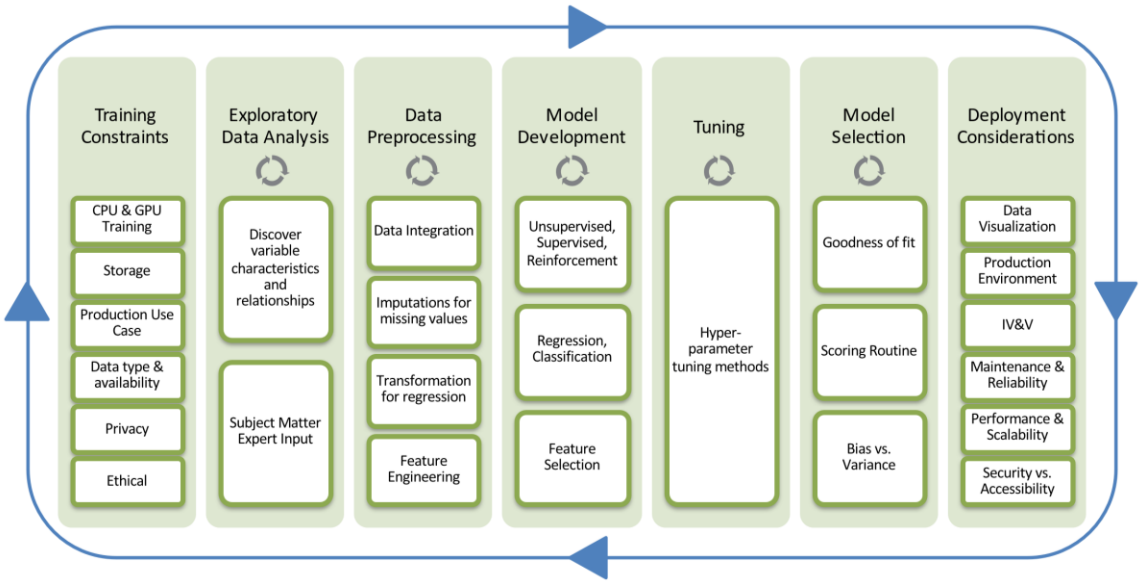
Assignments

Discussion 1 (10 points). Initial post due Wednesday at midnight CT.
Assignment 1 (50 points). Machine Learning Project, due Sunday night at midnight CT.
Knowledge check

Module 9. Recurrent Neural Networks (RNN) and Proctored Examination

Learning Objectives

- Build, evaluate, and train RNN models for classification
- Build design of experiments to evaluate the construction of RNN
- Describe the elements of RNN
- Apply an ML Framework to real-world dataReadings & Media



Required Readings

- Géron, Chapters 15 and 16
- Goodfellow et al., 2016. Deep Learning. Chapter 10.

Assignments

Discussion 1 (10 points). Initial post due Wednesday at midnight CT.
Assignment 1 (50 points). Machine Learning Project, due Sunday night at midnight CT.
Knowledge check

Module 10. Final Self-Proctored Examination

Learning Objectives

No new learning objectives

Readings & Media

None for this week

Assignments

Discussion 1 (10 points). Initial post due Wednesday at midnight CT.
Final Exam (50 points). Due Sunday night at midnight CT.