
FNCE 5352 – Financial Programming and Modeling
January 19, 2021

# 1. Course Description:

This course will introduce the students to a wide variety of algorithms that are used in machine learning applications. Students will code a few algorithms completely and learn to use software packages that implement others. Instruction and assignments will use the R and Python programming ecosystems. Students will be exposed to Machine Learning at scale using the Keras and TensorFlow libraries. Throughout the course, special attention will be given to applications of these algorithms to finance.

# 2. Instructors

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**Barry Zhang (TA):** zizheng.zhao@uconn.edu

# 3. Course Delivery

14 lectures

# 4. Academic Integrity

Students must adhere to the University of Connecticut Student Code, which can be found at: https://community.uconn.edu/the-student-code-pdf/. Assignments and/or quizzes must be completed individually.

# 5. Required Texts

## Part 1 (R and RStudio)

We will be using the book "R for Data Science" by Hadley Wickham and Garrett Grolemund. The book is available online at https://r4ds.had.co.nz/index.html. It is free and licensed under the Creative Commons Attribution-NonCommercial-NoDerivs 3.0

If you'd like a hard copy of the book, it is available from Amazon (https://www.amazon.com/Data-Science-Transform-Visualize-Model/dp/1491910399/ref=sr_1_3?ie=UTF8&qid=1548809834&sr=8-3&keywords=r+for+data+science)

Additionally, we will use the book "Feature Engineering and Selection" by Max Kuhn and Kjell Johnson. Physical copies are sold by **Amazon** and **Taylor & Francis**. An online version is available at https://bookdown.org/max/FES/

### Part 2 (Python)

We will be using selections from the 2 books listed here. These books can be read using the O'Reilly website, which also comes as an app that you can use. You can read while connected and you can also download many titles. This includes O'Reilly titles, Manning titles, and a variety of others. This is a great resource!

1) Géron, Aurélien. *Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems*. O'Reilly, 2020.
2) Tatsat, Hariom, et al. *Machine Learning and Data Science Blueprints for Finance: from Building Trading Strategies to Robo-Advisors Using Python*. O'Reilly Media, 2020.
3) Machine Learning and Data Science Blueprints for Finance

## 6. Part 1 (R and RStudio) Prerequisites

### Course Materials

Course materials can be found at https://github.com/mattmcd71/fnce5352_spring2021

### R Fundamentals

The course assumes some intermediate understanding of the R programming language. If you would like to get a basic introduction to the R programming language, please visit the following link:

https://www.rstudio.com/online-learning/

### R Installation

We will be periodically using R and RStudio interactively during the class instruction. If you would like to follow along during the class, please follow these instructions

*Local Installation Instructions:*

#### R

We'll be using the most recent version of R locally but I believe that anything > 3.4.1 should be fine.

R can be downloaded from the following link: https://www.r-project.org/

#### RStudio

RStudio is an Interactive Development Environment for the R programming language. It is very useful. You can download it at:


https://www.rstudio.com/products/rstudio/download/

## R Packages

The package installation instructions are:

```
install.packages(
  c(
    'AmesHousing',
    'C50',
    'devtools',
    'discrim',
    'earth',
    'ggthemes',
    'glmnet',
    'klaR',
    'lubridate',
    'modeldata',
    'party',
    'pROC',
    'rpart',
    'stringr',
    'textfeatures',
    'tidymodels'
  ),
  repos = "http://cran.rstudio.com"
)
```

That `install.packages` command may additionally install over 100 more packages.

To verify the installation, try running:

## Installing packages from github (optional)

The caret and Recipe package may need to be installed from github to get all functionality presented in class. Instructions for that are below:

The package installation instructions are:

```
devtools::install_github(c(
  "tidymodels/tidymodels",
  "tidymodels/tune",
  "tidymodels/textrecipes",
  "koalaverse/vip",
  "gadenbuie/countdown"
))
```

That `install.packages` command may additionally install over 100 more packages.


## Lessons and Assignments

| Lecture Date | Topic | Assignment | Reading assignment (before next class) |
|---|---|---|---|
| 19-Jan | Intro to R and RStudio | R4DS:<br>5.2.4: Exercises 1, 3<br>5.3.1: Exercise 1<br>5.5.2: Exercises 2, 5<br>(Due 1/26) | R4DS: Sections 1, 5, 6, 7, 8 |
| 26-Jan | Analytic Workflow & Visualization | R4DS:<br>3.2.4: Exercise 5<br>3.3.1: Exercise 2<br>3.6.1: Exercise 1<br>4.4: Practice 3<br>(Due 2/6) | R4DS: Sections 2,3,4<br>FES: Chapters 1 & 3 |
| 2-Feb | Modeling – Introduction & Data Usage | | R4DS: Sections 9-13 |
| 9-Feb | Modeling - Feature Engineering | | R4DS: Sections 14-16 |
| 16-Feb | Modeling – Resampling & Grid Search | Credit Modeling Project (due 3/9) | R4DS: Sections 17-21 |
| 23-Feb | Regression in R | | R4DS: Sections 22-25 |
| 2-Mar | Classification in R | | |