

Practical Data Science with R

Instructor

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Course Description

R is a very popular open-source programming language for machine learning. Its interactive programming environment and powerful data analysis capabilities make R an ideal tool for machine learning.

This workshop will provide an introduction to the R programming language using RStudio. In addition, we will demonstrate how we can use R to train a series of machine learning models. We'll cover supervised and unsupervised learning in the form of classification, regression, and clustering. Finally, we'll learn how to deploy these models to production to make predictions given new data.

Prerequisites

Please bring your own Windows laptop and complete Lab 0 to install all of the necessary software before the workshop begins.

Module Descriptions

1. **Introduction** – introduce machine learning and the R programming language
2. **Classification** – learn how to predict categorical outcomes
3. **Regression** – learn how predict numeric outcomes
4. **Clustering** – learn how to predict groups of data based on similarity
5. **ML in Practice** – learn how to prepare, optimize, evaluate, and deploy models

Learning Objectives

When students are finished with this workshop, they should understand the following:

Introduction

- What machine learning is, why it is important, and how the machine learning process works
- What R is and why it has become so popular for machine learning
- How to create data types, data structures, subset data tables, and find help on R topics

Classification

- What classification is, how it works, and applications for classification
- What are k-nearest neighbors, decision trees and neural networks
- How to train, test, and make predictions with a decision tree classifier and a neural network

Regression

- What regression is, how it works, and applications for regression
- What are simple linear regression, multiple regression, neural network regression
- How to train, test, and make predictions with linear regression and a neural network

Clustering

- What clustering is, how it works, and applications for clustering
- What are k-Means and hierarchical clustering
- How to group similar data points using k-means and hierarchical clustering algorithms

ML in Practice

- How to prepare data for machine learning
- What are overfitting, underfitting, and regularization
- How to tune hyperparameters to optimize machine learning models
- How to evaluate machine learning model performance
- How to deploy machine learning models into production with R

Course Outline

Introduction

Lecture

- What is machine learning?
- Why is machine learning important?
- How does the machine learning process work?
- What is R?
- Why is R so popular for machine learning?
- R language basics

Lab

- Installation and setup
- Hello World
- Data types
- Data structures
- Data frames
- Miscellaneous topics

Classification

Lecture

- Classification
- Decision tree classifier
- Neural network classifier
- Training and test data sets

Lab

- Predicting categories with k-nearest neighbors
- Predicting categories with a decision tree
- Predicting categories with a neural network

Regression

Lecture

- Regression
- Simple linear regression
- Non-linear regression
- Multiple variable regression

Lab

- Predicting values with simple linear regression
- Predicting values with multiple linear regression
- Predicting values with a neural network

Clustering

Lecture

- Clustering
- k-Means clustering
- Hierarchical clustering

Lab

- Group data with k-means clustering
- Group data with hierarchical clustering

Machine Learning in Practice

Lecture

- Preparing data for machine learning
- Overfitting, underfitting, and regularization
- Tuning hyperparameters to optimize model
- Evaluating model performance
- Deploying ML in production with R

Lab

- Exploring the data
- Preparing the data
- Training models
- Evaluating models
- Deploying models