# Professional Prep Academy

## “Ready to Go” Courses

100% online; Supported by our expert mentors.

## Contents

# Health Sciences

## Mystery Case

Duration: 1 week
Prerequisites: none

Mystery Case is a unique learning experience in which students play the role of general medical residents working at a fictional hospital. They report to Dr. Sophia Campbell, a fictional doctor in the scenario, and are asked to "meet" a young patient who has some unusual symptoms. Their job is to work with Dr. Campbell to diagnose and treat the patient.

Working in teams, students develop problem-solving and critical thinking skills as they complete their work. They will develop a differential diagnosis, analyze medical test results, and try to deduce which disease is affecting their patient. These medical practices are meant to be challenging, but with help of a facilitator, will be readily accessible to students and will help learners determine if they would potentially enjoy a career in the medical field.

Course content is all housed on a course website. On the first day, the instructor will give students a tour of the site and help them use it. The instructor will also facilitate group discussions, provide help proactively and as students request it. Students will work in a combination of full cohort discussions and breakout team rooms. This is not a lecture-based course. Instead, students are immersed on day one in a realistic medical-mystery story, and they learn by doing as they work to solve the mystery case. Learning resources on relevant content are available on the course website, and student teams will do research and prepare team assignments.

During their work, students:

- Meet the patient and take a first pass at developing a differential diagnosis.
- Interpret test results and analyze their differential diagnosis again.
- Maintain a personal glossary of medical terminology.
- Continue to investigate the differential diagnosis with this patient, examining additional
- test results and using this evidence to further revise their differential.
- Examine the final round of test results and apply what they have learned to the differential diagnosis.
- React to a twist in the case.
- Develop a discharge summary for the patient.
- Conclude and reflect on their experiences in the course.

This course was developed under a grant from the Ewing Marion Kauffman Foundation.

## Think Like a Physician (Internal Medicine)

Duration: 2 weeks
Prerequisites: none

Explore Medical Careers: Think Like a Physician is an immersive, learning-by-doing course. Learners will play the role of a general medical resident working at Lincoln Regional Medical Center under the supervision of a physician. Their first patient of the day comes in complaining of several acute symptoms. Learners will work in teams, where their job is to ethically diagnose, treat and cure the patient's illness. They will also discuss ethical issues surrounding the patient's case.

Week 1:

- Students will be introduced to the course and the learning objectives. Together with the facilitator, students will create a set of classroom expectations and a list of what they hope to gain from the course.
- Task 1: Students will develop a differential diagnosis for their patient, Frank McGrath. Students will use a medical archive provided in the course to narrow down the potential causes for Mr. McGraths illness.
- Ethics Committee Request 1: Students will evaluate their first medical ethics dilemma: evaluating patients with certain conditions for transplant eligibility.
- Task 2: Students will confirm their diagnosis with a series of tests and medical images.
- Task 3: Students will learn to think like a physician and explain the diagnosis to Mr. McGrath.
- Ethics Committee Request 2: Students will discuss the ethics underlying treatment for terminal patients.
- Task 4: Students will continue to learn to think like a physician by explaining the treatment process to Mr. McGrath. :

Week 2:

- Task 5: Students will review the criteria for organ donation.
- Ethics Committee Request 3: Students will evaluate a series of ethical dilemmas associated with live organ donors.
- Task 6: Students will explain a surgical procedure and the associated risks to their patients.
- Task 7: Students will discuss the post-operative plan to their patient.
- Task 8: Conclusion and Reflection

The week will be organized as follows each day: students will meet as a large group over Zoom and will do some work in team break-out rooms. A knowledgeable mentor will always be available to provide help, advice, and feedback on students' work; the mentor will also facilitate

regular group discussions. On some days, outside individual work will be needed. The course has no prerequisites.

This course was developed under a grant from the Ewing Marion Kauffman Foundation.

## Medical Detective

Duration: 1 week
Prerequisites: none

Medical Detective is an immersive, learning-by-doing course. Students will play the role of junior investigator working on the case of a woman who has died from a gunshot wound.

Note that the mature and sometimes graphic nature of the subject matter in this rotation may be disturbing for sensitive students.

As part of their work, students will consider evidence to determine whether a crime was a homicide or suicide, closely examining crime scene photographs to conduct their analysis. (In some cases, these images have been slightly modified to make them less disturbing.) Students will also prepare expert testimony and testify in court.

The student's job is to follow a death investigation from start to finish and determine whether a woman's death was a suicide (she killed herself) or a homicide (her husband killed her). If her husband does get charged with murder, it's possible that the student could be called into court to testify, so they need to keep good records of what their findings and of all the of evidence collected.

The course comprises the following tasks:

- Introduction: Students will be introduced to the course and the learning objectives. Together with the facilitator, students will create a set of classroom expectations and a list of what they hope to gain from the course.
- Task 1: Students will begin their investigation by reviewing a wide variety of evidence.
- Task 2: Students will learn to draw a diagram of the crime scene, a very useful tool for testimony in court.
- Task 3: Students will review autopsy and ballistics findings to help uncover what took place on the night of the incident.
- Task 4: Students will come to a conclusion about what happened in Lawson case.
- Task 5: Students will prepare a testimony using the evidence provided in the course.
- Task 6: Students will testify "in court" and debate what they believed happened based on the evidence.
- Task 7: Wrap up the Lawson case.

The week will be organized as follows each day: students will meet as a large group over Zoom and will do some work in team break-out rooms. A knowledgeable mentor will always be available to provide help, advice, and feedback on students' work; the mentor will also facilitate regular group discussions. The course has no prerequisites.

This course was developed under a grant from the Ewing Marion Kauffman Foundation

# Entrepreneurship and Business

## The Idea Workshop

Duration: 2 weeks
Prerequisites: none

The Idea Workshop provides a unique opportunity for students to explore what it's like to be an entrepreneur beginning a new venture. Working in small teams, students will go through the process of envisioning an exciting product or service and a business model for taking it to market twice during the course -- the first time in a problem area we suggest and the second time in an area chosen by each student team.

Students will develop the skills of working in teams, principled brainstorming, defining a product or service, formulating a business model, and pitching their ideas to others. This is a challenging process, but students will be supported by knowledgeable mentors. The experience will help students to decide if entrepreneurship is a potential career path for them.

Course content is all housed on a course website. On the first day, the mentors will give students a tour of the site and help them use it. The mentors will also facilitate group discussions, and will be readily available to provide help and advice as students request it. Students will work in a combination of full class discussions and breakout team rooms. This is not a lecture-based course. Instead, students are immersed from day one in a realistic situation, and they learn by doing as they work individually and together. Learning resources and detailed guidance are available on the course website.

Each week of the course will be organized as follows:

- Monday: brainstorm a product idea (2 hours)
- Tuesday: formulate a business model (2 hours)
- Wednesday: create a pitch for your product (2 hours)
- Thursday: present your pitch and debrief (2 hours)

## Product Definition

Duration: 8 weeks
Prerequisites: The Idea Workshop

In the Idea Workshop, you generated a promising idea for a product and a high-level business model for your proposed business. Now it is time to flesh out your idea into a realistic, compelling product vision and to refine your business vision for bringing it to market.

While you have envisioned a problem your product will address, you have yet to engage real users and customers to gain a deep understanding of their needs. This is a crucial step in developing a successful product - one that truly helps people do important things they need (or want) to do.

In this course, you will learn skills and procedures for user- and customer-centered product design. You will learn interviewing, analysis, and modeling techniques to identify needs and to define the "whole product" required to provide a complete solution from a user's/customer's point of view. You will also learn how to analyze the competitive landscape and to plan a first release of your product.

Working with your project team, you will create a Product Vision Document that includes:

- A thorough explanation of the problem your product addresses
- A compelling description of how the intended user will benefit from your product; and
- A refined business vision for your product.

In order to create your Product Vision Document, you will engage in a process called "Rapid Contextual Design," which includes:

- Conducting Contextual Inquiry interviews in which users tell stories of frustrating experiences to get at the "breakdowns" that occur when trying to accomplish things that matter to them.
- Analyzing those stories with the aid of affinity diagrams (and perhaps other models) that help identify recurring themes.
- Generating descriptions of prototypical users and context scenarios that illustrate how they will use your envisioned product to better achieve their goals.
- Validating through user and customer "storyboard interviews" that your product vision addresses their needs.
- Formulating the features of your product needed to achieve those goals.

To further refine your vision, you will also conduct a competitive analysis and envision the first release of your product (a "minimum viable product" or a traditional first release).

What You Will Learn in this Course

As a result of successfully completing this course, you will be able to:

- Conduct Contextual Inquiry interviews to gain an understanding of user problems and needs.
- Analyze customer needs by reviewing and interpreting user interviews, creating an affinity diagram, and defining one or more personas.
- Use the information so obtained to create context scenarios and a storyboard.
- Validate a product idea with potential users.
- Define requirements for a proposed product in the form of user stories.
- Conduct an in-depth competitive analysis.
- Define the "whole product" and refine a business vision based on the results of the product definition process.
- Develop proposals for a minimum viable product and a traditional first release.

## Think Like an Investor

Duration: 1 week
Prerequisites: The Idea Workshop

In order to better understand what makes a business attractive to potential investors, you will evaluate the viability of a series of business opportunities playing the role of an angel investor. You will learn to look at an opportunity through the critical eyes of a professional investor, gaining key insights into what differentiates a great idea with a sound, investment-gaining plan from "just another idea that couldn't attract investors." You'll emerge with a framework for understanding how potential investors think and what information they look for when deciding whether or not to invest in a business.

You will watch a series of videos of entrepreneurs pitching their early-stage businesses to potential angel investors. In addition to seeing the pitches, you will also hear questions from the investors and the entrepreneur's answers. Each video will stop before the investors make a decision regarding the business. You and your team will analyze the information you have received and make a carefully reasoned case, supported by evidence, regarding whether to invest or not. After submitting your thoughts to your mentor, you will see the decision the investors made and hear a follow-up discussion.

Through this process you will learn how investors analyze a pitch and the information they need to make a decision and, thus, you will learn how to make a more effective pitch for your own business idea when you have the opportunity.

## Write a Business Plan

Duration: 8 weeks
Prerequisites: none

You and your co-founders will develop a complete business plan for your new venture. You will elaborate your business model and create a complete set of projected financials for your company including revenues and expenses. You will then write an updated version of your earlier "Kawasaki 10/20/30 pitch" to hone your ability to persuasively articulate the value of your venture in preparation for writing your formal business plan. After writing your business plan, you will formulate an "elevator pitch," which concludes the module.

Many people think that a business plan is useful only for seeking investment. While this is an important purpose, there are many others including the development of an in-depth blueprint for your business and projections that will serve as a yardstick to measure your progress. Beyond these, the exercise of formally writing a business plan will cause you to think more completely and more deeply about your business, maximizing the potential for success.

You will begin by developing a financial model for your new venture. Then you will develop a "10/20/30 pitch," much like the one that you produced during the Idea Workshop, only this time doing it with more care, subjecting every aspect of your business substantially more thought and analysis. After you are happy with your pitch, you will write a formal business plan, section by section, submitting each to your mentor for feedback, and revising in light of that feedback. Finally, you will develop a short "elevator" pitch that you can give extemporaneously when asked about your business.

## Business Essentials

Duration: 8 weeks
Prerequisites: none

In this course you will learn the practical business skills and principles necessary for participating effectively in the management of a successful company. This course will equip you with skills in financial management and planning, marketing strategy and communications, project planning, employee hiring, and executive and investor presentations. By working through a series of realistic tasks, you will gain a deeper understanding of the elements of a successful business and the role each business function plays in achieving this goal, as well as acquiring key business skills that will be immediately applicable in the real world. This course is targeted primarily at educated professionals with limited background in business who want to learn the basics of successfully operating and expanding a business.

You are a business consultant for Austin Consulting, a boutique consulting firm that specializes in helping companies transform from small, struggling businesses to serious, financially successful companies. You and your team have been assigned to a new client, First String Fine Instruments, a large and successful Austin-based manufacturer of fine stringed instruments. Last year, First String acquired Clayborn Cases, a small, private company that specializes in handcrafting custom guitar cases for high-end guitars. First String has turned Clayborn into an autonomous division and has installed one of its up-and-coming executives as the division head. Clayborn began operations nearly 40 years ago when William "Bud" Clayborn, a fiberglass craftsman who worked making boats, began making the cases in his suburban Austin backyard for his friends' expensive guitars. Because of his high-quality craftsmanship and the fact that Bud treated customers like friends, the company grew each year to the point where it had a steady six-month backlog of orders. Now that First String owns the company, First String's management is looking to increase Clayborn's sales volume and profitability, and possibly expand its operations to keep up with growing demand. However, management is unsure of how best to achieve these goals.

You and your team are tasked with working with First String's management to analyze Clayborn's current financial situation, customer base, and market share to determine how best

to strengthen - and possibly expand - the division. Your work must help First String reach its goals of increasing sales and profits, producing a solid cash flow, protecting and promoting the brand, attracting investors, and positioning Clayborn as an elite and coveted product that is a leader in this niche industry.

As a result of successfully completing this course, you will be able to:

- Analyze financial statements to assess a company's financial condition and performance.
- Identify problems that underlie a company's subpar financial performance.
- Develop marketing goals and strategies in order to meet a sales target.
- Evaluate a logo, create a product fact sheet and news release, and outline a social-media campaign.
- Create a project plan that includes a statement of work, project schedule, resource forecast and allocation, and budget.
- Communicate findings and recommendations to management through brief executive presentations.
- Analyze and define a company's business vision and model to create a pitch to the Board of Directors for expanding the business.

# Software Development

## Introduction to Website Development

Duration: 6 weeks
Prerequisites: none

In this course, you are an independent contractor who develops custom websites for small organizations. The Northside Youth Soccer League (NYSL) has hired you to develop a website for their soccer teams. You will work on this website on your own and will learn to use modern HTML and CSS to produce an attractive, informative multi-page website based on the client's requirements.

To do this, you'll work through a series of tasks designed by experts in programming and web development to help you create a robust and useful website, and to reflect real challenges that arise during the website development process.

Website Development is the process of creating a website. The web development process comprises the skills of:

- Gathering the information to display on the website.
- Deciding on a look and feel for the website.
- Coding the web pages using HTML and CSS.
- Validating that the HTML and CSS coding is correct and follows industry standards.
- Testing that the web pages work as specified, on multiple browsers.

## Introduction to JavaScript Development

Duration: 6 weeks
Prerequisites: Introduction to Website Development

In this course, you are a developer at Code of the Web, a small software shop that creates custom JavaScript-based web applications. Transparent Government in Fact (TGIF), a non-partisan non-profit organization working to increase the public's involvement in government, has hired you to develop a Congressional tracking web site for them. You will work on this web application using modern JavaScript technologies, including AJAX, JSON, and RESTful APIs.
To do this, you'll work through a series of tasks designed by experts in programming and web app development to help you create a robust and useful web application.

Web application development is the process of creating a web site that acts like an application program. Web applications collect, manipulate, calculate and display data, using the same programming constructs as apps you download and install. But unlike apps, there is nothing to install. The code is run within your browser, using data collected on demand from web services.

In addition to learning to program in JavaScript, you will learn to use the following key technologies and organizing frameworks:

- JavaScript and sophisticated JavaScript libraries, such as jQuery and AngularJS
- AJAX (Asynchronous JavaScript and XML) to communicate directly with web services from a web page
- JSON (JavaScript Object Notation) to encode complex data in a portable compact human-readable format
- RESTful (Representational State Transfer) APIs (Application Program Interfaces) to standardize the messages used to get JSON objects with AJAX calls

## Mobile Web Application Development

Duration: 8 weeks
Prerequisites: Introduction to Website Development and Introduction to JavaScript Development

In this course, you are an independent developer the Northside Youth Soccer League (NYSL) has hired to create an app to give their players and parents easy on-the-go access to the league's game schedules. To avoid the hassles of native apps, they would like this to be a mobile web app. You will design and develop the mobile web app, and will add features to the app that are specific to mobile devices, such as location-based features so parents can see where they are in relation to the soccer field.

To do this, you'll work through a series of tasks designed by experts in programming and mobile web app development to help you create a robust and useful mobile web application.

Mobile Web Application Development is the process of creating or updating web-based applications or websites to be optimally viewable and functional within a mobile device's browser. You will learn the skills of:

- Using new features in HTML5, CSS3, and JavaScript to make the mobile web app look and feel like a native mobile application.
- Creating a responsive design that works for various screen sizes and rotations.
- Taking advantage of specific capabilities of smartphones such as location-awareness.

## Java 1 and 2

Duration: 10 weeks *each*
Prerequisites: Introduction to Website Development and Introduction to JavaScript Development

In this course, your team of developers has been contacted by a board game company looking to use their brand recognition to market online games with a retro touch. In particular, they want your team to create a multi-player online version of a Salvo-like game engine. Salvo was a pencil and paper game that was the basis for the popular Battleship game. The basic idea involves guessing where other players have hidden objects. This can be varied to create many different kinds of games with different user interfaces.

Your job will be to create a front-end web application that game players interact with, and a back-end game server to manage the games, scoring, and player profiles. You will use the jQuery JavaScript library for the front-end client, and the Spring Boot framework for the Java-based RESTful web server.
In Part One of the course, you will implement the core architecture:

- A small Java back-end server to store Salvo game data, and send that data to client apps via a RESTful API.
- A front-end browser-based game interface that graphically shows players the state of the game, including ships they've placed, damage sustained, and scores.

In Part Two of the course, you will implement game play:

- Players can create new games and join games that others have created.
- When a game has both players, players can place their ships on their grids.
- When ships have been placed, players can begin trading salvos (shots) and seeing the results (hits, sinks, and misses).
- When all of a player's ships have been sunk, the game ends and the winner is added to the leaderboard.

Web servers are the backbone of the Internet. When you use web apps or many mobile apps, they use web servers so that you can save data, communicate with other users, retrieve information, and perform many more activities that need computational power, persistent data storage, and network bandwidth.

Web servers can be implemented in many languages. Java is particularly common for large web sites. In recent years, with the arrival of Java 8, there has been an explosion of tools for Java web services. (A side-benefit of learning Java is that it is the primary language used to develop native Android apps.)

Web server development typically involves writing front-end code that runs on mobile apps and web pages, and back-end code that runs on the web server.

In this course, you'll learn how to develop a modern web application using HTML, CSS, and JavaScript to handle all the user interface presentation aspects, and a Java RESTful web service to handle multi-user access and communication, store persistent data and implement complex business logic. More specifically, you'll learn how to:

- Use JavaScript and the jQuery library to
    - send and retrieve data from a web service using AJAX

- construct HTML displays using templates
- Use Java and the Spring Boot suite of tools to
  - implement a RESTful API to both the database and application services
  - apply modern-day Java programming concepts, such as lambdas, streams, and dependency injection
- Use JavaScript Object Notation (JSON) data structures to
  - communicate between your application's JavaScript front-end and Java back-end
  - implement the "model" in a model-view-controller

# Cybersecurity

## Cyber Sleuth 1: Insider Threat?

Duration: 2 weeks
Prerequisites: none

The field of Information Security deals with the ever-growing volume of threats to businesses and government entities. While hardening computer and network infrastructure with patching, firewalls, and intrusion protection systems is important, those tools will probably never stop the threats completely. Adept individuals are needed to monitor the security tools, watching for, analyzing, and responding to threats that bypass the automated protections.

Cyber Sleuth 1 gives students an opportunity to begin learning cybersecurity skills by investigating the activities of an employee who was doing something suspicious on the internet while at work. No prior knowledge of networking or network administration is assumed – just curiosity, basic computer literacy, and a willingness to explore a variety of data. Any laptop or desktop computer with a good internet connection will suffice.

Students will work with two tools used by cybersecurity professionals, NetworkMiner and Wireshark; these will both be accessed from a virtual machine in an Amazon Web Services private cloud (an "Amazon Workspace") for which each student will be given a personal account. Our hands-on learning curriculum is designed to give students just enough technical mastery to complete their investigation with the help of mentor-directed activities.

For two weeks, students will meet as a group for an hour each day where they will participate in individual and group activities. They will then work individually on a daily homework assignment with additional support as needed from a mentor.

Guidance and additional resources will be available in a course website which will be introduced to students on the first day of class. All coursework will be completed in their personal Amazon Workspace which provides each student with a Windows 10 virtual machine to which they will connect remotely after installing an Amazon Workspaces client on their personal computer.

A brief syllabus for Cyber Sleuth 1:
Day 1. Orientation: Enter your virtual environment
Day 2. Get started with NetworkMiner
Day 3. View user activities on the internet
Day 4. Close your preliminary investigation
Day 5. Present/discuss preliminary hypotheses
Day 6. Get started with Wireshark

Day 7. View user activities at the packet level
Day 8. View host-to-host conversations
Day 9. Present/discuss final reports
Day 10. Reflect/discuss this investigation

## Cyber Sleuth 2: Exploit a Vulnerable Website

Duration: 2 weeks
Prerequisite: Cyber Sleuth 1

Cyber Sleuth 2 gives students an opportunity to exploit a vulnerability on a web server in order to access password files on that server. They will then crack the webmaster's password in order to access the server with all the webmaster's privileges. Once they have privileged access, students will locate the server's vulnerability and patch the source of the problem so no one else can break into the server. Since students will learn skills that can be used both legally (authorized pentesting) and illegally (unauthorized computer access), we will cover the legal issues associated with this material and emphasize our own zero-tolerance course policy regarding illegal behaviors. *We also note that the specific vulnerability that the students exploit is very old and is rarely seen on web servers anymore. No prior programming experienced is required.*

Students will work with two tools used by cyber security professionals, Burp Suite and John the Ripper; these will both be accessed from a virtual machine in an Amazon Web Services private cloud (an "Amazon Workspace") for which each student will be given a prepaid personal account. Our hands-on learning curriculum is designed to give students just enough technical mastery to complete their assignments with the help of mentor-directed activities.

For two weeks, students will meet as a group for an hour each day where they will participate in individual and group activities. They will then work individually on a daily homework assignment with help from a mentor as needed.

Guidance and additional resources will be available in a course website which will be introduced to students on the first day of class. All coursework will be completed in their personal Amazon Workspace which provides each student with a Windows 10 virtual machine to which they will connect remotely after installing an Amazon Workspaces client on their personal computer (if they haven't already). Note that the vulnerable webserver for this course will only be accessible from within this private cloud environment.

A brief syllabus for Cyber Sleuth 2:

Day 1. Configure software for a man-in-the-middle attack
Day 2. Access the web server's password files

Day 3. Crack the webmaster's password
Day 4. Password cracking & password security
Day 5. White Hats and Black Hats
Day 6. Navigate the Linux directory tree
Day 7. Edit text files in a command-line environment
Day 8. Tweaking code vs. writing code
Day 9. Hack your classmates
Day 10. Discuss and reflect on your hacker/defender experiences

## Cyber Sleuth 3: Suspicious Network Traffic

Duration: 2 weeks
Prerequisite: Cyber Sleuth 2

During Cyber Sleuth 3, students will sharpen the network traffic analysis they began developing in Cyber Sleuth 1 by analyzing the traffic generated by a complex cyber attack.

Students will analyze network traffic moving in and out of a military aide's personal laptop. Using packet capture (PCAP) files, students determine if it was infected by malware and if so what malware and how the infection occurred. Students then perform an attribution analysis on the actors involved in the attack. (They analyze evidence they find and use open source intelligence about a particular exploit kit to make hypotheses about the attackers' identities.)

Students will learn to:

- Analyze suspicious network traffic in a PCAP using Snort and Wireshark.
- Recognize a cushion redirect in network traffic.
- Recognize the identifying features of a specific exploit kit.
- Recognize a malware payload being transferred to a targeted host
- Perform open source intelligence analysis using resources found on the Web.

Guidance and additional resources will be available in a course website which will be introduced to students on the first day of class. All coursework will be completed in their personal Amazon Workspace which provides each student with a Windows 10 virtual machine to which they will connect remotely after installing an Amazon Workspaces client on their personal computer (if they haven't already).

## Cyber Sleuth 4: Analyze a Remote Intrusion Attempt

Duration: 3 weeks
Prerequisites: Cyber Sleuth 3

During Cyber Sleuth 4, students will transition to learning the skills of log analysis which makes investigation of more complex attacks feasible.

A security operations center analyst has seen evidence of a password cracking attempt within a key network. Students analyze a packet capture file (PCAP) and event logs within a security information and event management system (the Splunk SIEM) to determine if any passwords were compromised and if the network was breached as a result. The student must also identify which tools were used by the attacker and which steps should be taken to safeguard specific hosts in the network from similar cracking attempts in the future.

*OBJECTIVE: Analyze suspicious network traffic in a PCAP using Wireshark.*
*OBJECTIVE: Analyze network and system logs using Splunk*
*OBJECTIVE: Cross-correlate events seen in a PCAP with events seen in logs*
*OBJECTIVE: Recognize a Hydra brute-forcing attack*
*OBJECTIVE: Determine if a brute-forcing attack has been successful*

# Data Analytics and Machine Learning

## Introduction to Data Analytics: Machine Learning and Sentiment Analysis

Duration: 4 weeks
Prerequisites: none

This course is for anyone who would like to begin using techniques of statistical machine learning and sentiment analysis to glean insights from data. Graduates of the course will also become more sophisticated consumers of analytics and will be more sophisticated in interactions with professional data scientists. There are no technical prerequisites.

Nearly all businesses collect data about their operations and examine this data for insight into how to improve their operations. As the amount of data that businesses collect becomes increasingly large, insights from the data can no longer be effectively derived manually. There is a growing trend among companies, organizations, and individuals to exploit data analytics' potential to help them discover and act on the most important patterns contained within the data they collect.

Data analytics has a myriad of business applications and is used increasingly to drive decisions about all aspects of business including spotting sales trends, developing smarter marketing campaigns, predicting customer loyalty, and predicting and protecting against fraud. In fact, data analytics can be applied anywhere in a business or organization where a company is interested in identifying and exploiting predictable outcomes. The skills you will learn are applicable to a wide variety of data analytics projects, and will enable you to start working with business problems that require "supervised learning" (which is learning from labeled examples, e.g., Bob, a customer with these characteristics, left us to do business with a competitor).

Introduction to Data Analytics comprises three projects, which will be completed using the free "community version" of the commercial RapidMiner data analytics tool:

1. Use data analytics methods for performing classification to explore the customer churn data collected from historical sales to draw insights and conclusions about customer behavior.
2. Use machine learning methods for performing regression to predict which potential new products will be the most profitable for the company to add to its sales mix. The inferences you draw from the patterns in the data will help the business make data-driven decisions about sales and marketing activities.
3. Use data analytics methods to explore the sentiment among tweets about the United States Government's response to the COVID-19 pandemic on Twitter using the Twitter API.

Students will learn to:

- Preprocess data for analytics
- Use statistical machine learning to solve classification problems
- Use statistical machine learning to solve regression problems
- Evaluate the quality of machine learning models
- Use natural language processing to perform sentiment analysis.

## Machine Learning with Python

Duration: 16 weeks
Prerequisite: intermediate-level ability to program in Python

Students will be playing the role of a machine learning engineer on the data science team of a large consulting firm that is tasked with a series of machine learning projects to satisfy various client needs:

1. Building a Marketing Profile for Gaining New Customers Using Classification
2. Understanding Climatological Variables and Predicting Local Weather Using Regression
3. Discovering Unknown Relationships in Unlabeled Data
4. Deep Learning for Image Recognition
5. Deep Learning for Time Series Forecasting
6. Building an Automated Trading Model using Reinforcement Learning

Skills students will learn:

- Using Machine Learning to build predictive models from complex data sets
- Preprocessing data for machine learning tasks (e.g., transforming numeric values to nominal values, discretizing data)
- Using Decision Tree Classifiers to investigate classification problems
- Using Neural Networks to investigate regression problems
- Using Ensemble Learning to investigate regression problems
- Using Unsupervised Learning to find common groupings in unlabeled data
- Applying cross-validation methods
- Assessing the predictive performance of models by examining key error metrics
- Identifying where learning methods fail and gain insight into why with error analysis
- Drawing relationships between learner performance and measured features to help understand model performance
- Performing feature selection to investigate the correlation between different features in a dataset
- Using Markov Decision Processes to investigate the most optimal decisions while executing a process given a set
- of predefined goals and/or metrics.
- Using Deep Learning to classify images

- Using LSTMs to efficiently make numerical forecasts
- Using containerization for environment setup and model