Johns Hopkins Engineering

Applied Machine Learning for Mechanical Engineers

Introduction to the Course, A

JOHNS HOPKINS
WHITING SCHOOL
of ENGINEERING

Introduction to the Course

- By the end of this lecture, you will be able to:
  - Get to know your instructor.
  - See if the course is appropriate for you or not.
  - See an overview of the course.
  - Get familiar with Google Colab.

WARNING

DO NOT SKIP THIS LECTURE!

https://mediahq.com/wp-content/uploads/2016/02/uncle-sam-we-want-you-1-825x510.jpg

Introduction to the Course

- **Course Instructor**

  - My name is Mohammad H. Rafiei, Ph.D. I am a researcher and instructor at Johns Hopkins University, College of Engineering, and Georgia State University, Department of Computer Science. I am also the founder of MHR Group LLC in Georgia, a data-analytic company, where we work with various domestic and global researchers at different institutions to address persistent challenges in Computer Science, Engineering, and Medicine, using state of the art machine learning and optimization techniques.

  - It is my great pleasure to serve as your instructor, helping students and researchers at JHU to learn machine learning. You can find more information about me at https://ep.jhu.edu/faculty/mohammad-rafiei/.

  - Email: mrafiei1@jhu.edu

Introduction to the Course

- **Course Overview**

Zero to Advanced Machine Learning

  - Why machine learning?
    - Machine learning (ML) is a core technology in developing intelligent systems and has been a focus of substantial research in the past two decades. ML is a tool for predictions, estimations, feature extractions, knowledge discovery, dimensionality reduction, and automation. ML application varies from engineering to medicine.

  - What do we learn in this course?
    - In this course, students will learn some fundamental ML concepts in addition to popular ML and neural network (NN) models. This course includes real-life ML examples, including Mechanical Engineering-related examples, through extensive Python 3 programming and literature reviews, particularly research papers.

Introduction to the Course

- **Course Overview**

  - Why Python?
    - It is free, easy to learn and implement, and have tons of state-of-the-art machine learning libraries!
    - You can run your codes on Google Colab CPUs and GPUs for free! Almost wherever you are in the world, Google will give you free remote access to its computers.
    - You only need to have Gmail (free) and Google Chrome (also free) installed on your operating system!
    - It does not matter what your operating system is.
    - No bulky software is required, just Google Chrome web browser!
    - Almost all the cheapest computers in the market can handle Google Chrome, so no significant computer system is required.
    - You can run your code on JHU MARCC supercomputer.

Introduction to the Course

- **Course Requirements**

  - Calculus, Probability, and Linear Algebra are essential prerequisites for this course.

  - This course requires Python 3 programming skills. However, ***those who are not familiar with Python 3 but are familiar with at least one computational programming language such as MATLAB, C, C++, R, etc., will be given conditional access to the instructor's 3-hour Python 3 tutorial at www.python3h.com.***

    - I will contact you with a guide on how to register for the Python course for free, and it will be within a 3-day limit; and once you register within that 3-day, you will have lifetime free access to the Python course (Udemy restrictions are applied).

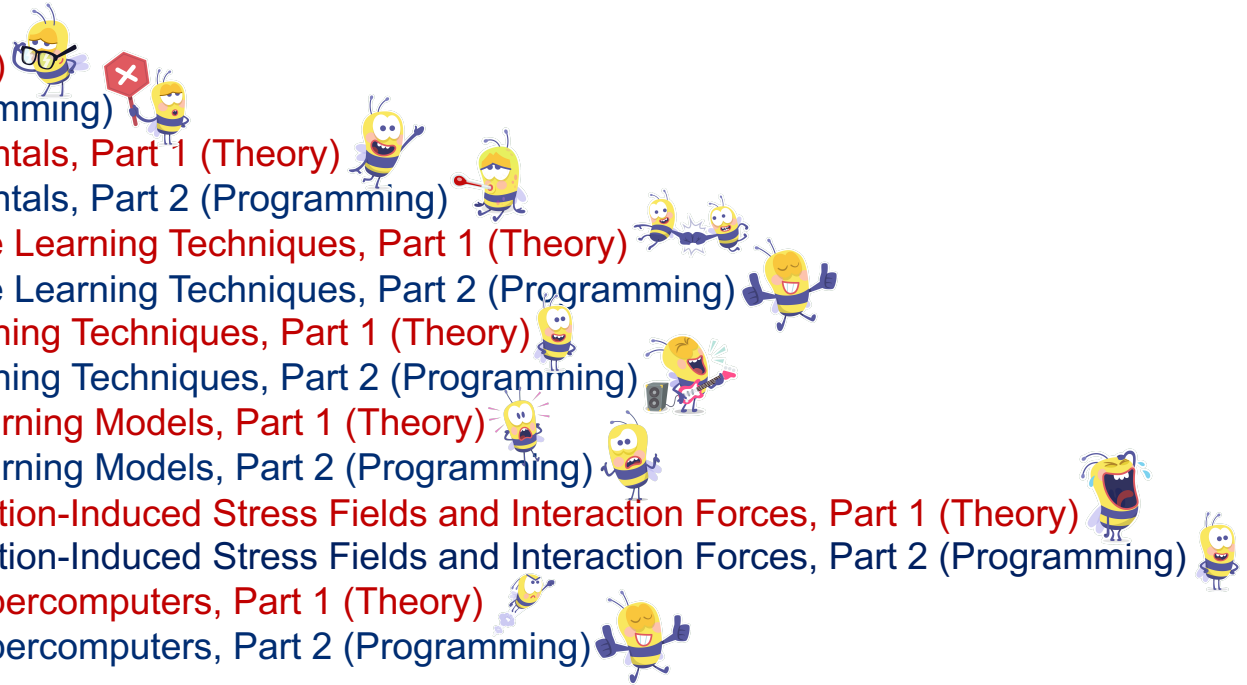
Introduction to the Course

- **Course Contents**
  - 14 modules
  - Odd-numbered modules are about concepts and theories (limited since this is an “applied” machine learning course).
  - Even-numbered modules are all Python programming.

Introduction to the Course

- **Course Contents**

1) Optimization, Part 1 (Theory)
2) Optimization, Part 2 (Programming)
3) Machine Learning Fundamentals, Part 1 (Theory)
4) Machine Learning Fundamentals, Part 2 (Programming)
5) Popular Supervised Machine Learning Techniques, Part 1 (Theory)
6) Popular Supervised Machine Learning Techniques, Part 2 (Programming)
7) Unsupervised Machine Learning Techniques, Part 1 (Theory)
8) Unsupervised Machine Learning Techniques, Part 2 (Programming)
9) Multi-Paradigm Machine Learning Models, Part 1 (Theory)
10) Multi-Paradigm Machine Learning Models, Part 2 (Programming)
11) Machine Learning of Dislocation-Induced Stress Fields and Interaction Forces, Part 1 (Theory)
12) Machine Learning of Dislocation-Induced Stress Fields and Interaction Forces, Part 2 (Programming)
13) Machine Learning Using Supercomputers, Part 1 (Theory)
14) Machine Learning Using Supercomputers, Part 2 (Programming)



Introduction to the Course

- **Course Contents**
  - Data Folder
    - You will have access to a data folder with data (.zip files or .csv files), and you will use these data to practice machine learning in Python
  - Homework
    - Discussions
    - Paper/video/website reading/reviewing/summarizing
    - Develop programming scripts and reports

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Introduction to the Course

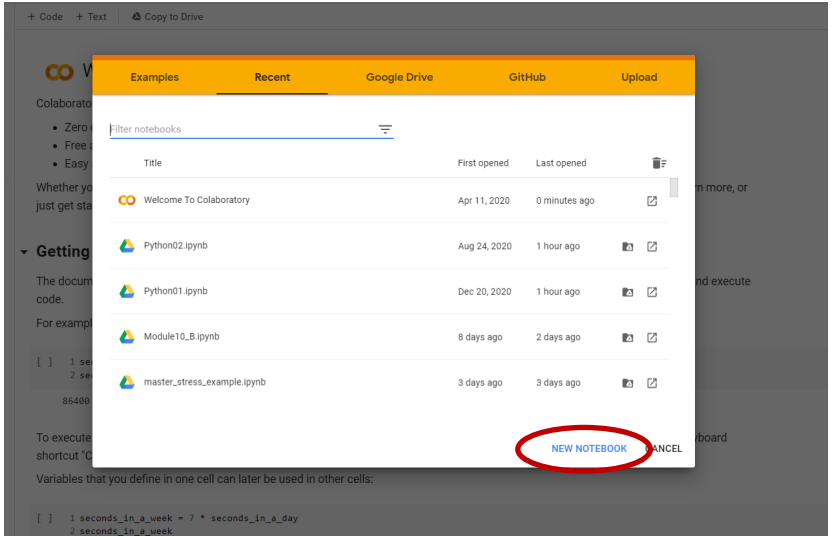
Take A Break!

Introduction to the Course

- **Google Colab**
  - In case you do not have a Gmail or Google Chrome, you can use the following YouTube links to set them up:
    - Google Chrome Installation:
      - Windows: https://www.youtube.com/watch?v=Ew_ReoK1zMc
      - Mac: https://www.youtube.com/watch?v=qa1MBf0dd24
      - Linux (Ubuntu and Mint): https://www.youtube.com/watch?v=SFw-5IcgnQo
    - Gmail:
      - Create Gmail: https://www.youtube.com/watch?v=5zX6DUqJ7xA
      - Sign into Chrome using your Gmail: https://www.youtube.com/watch?v=BbL2nQ1dzuQ

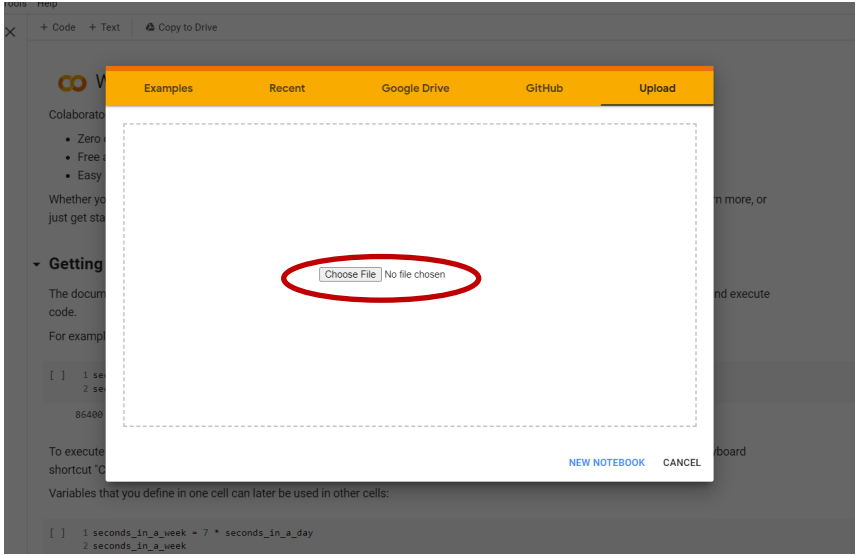
Introduction to the Course

- **Google Colab**
  - Create a Python 3 Google Colab Notebook
    - On your Google Chrome, go to http://colab.research.google.com/
    - On the "Recent" tab, click on "NEW NOTEBOOK“



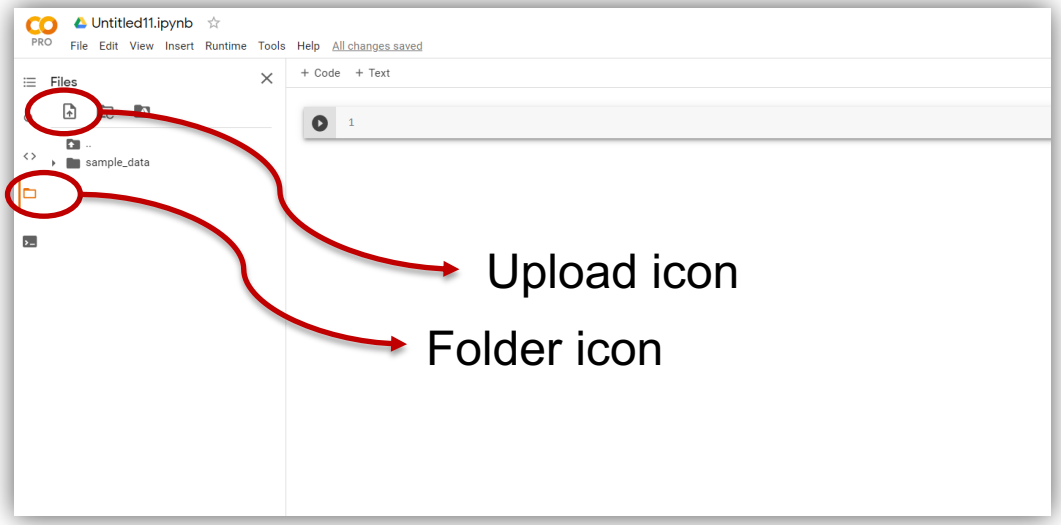
Introduction to the Course

- **Google Colab**
  - Upload a Python 3 Google Colab Notebook
    - On your Google Chrome, go to http://colab.research.google.com/
    - On the “Upload" tab, click on “Choose File“ and salect a “.ipynb” file of your interest (available in programming modules)



Introduction to the Course

- **Google Colab**
  - Upload a file into a Google Colab Environment
    - On a notebook, click on folder icon, click on upload icon, and select your file



Introduction to the Course

- **Google Colab**
  - Let's jump to a preview of my second Lecture in the "Python in 3 Hours" course at www.python3h.com, where we learn how to set up Google Colab and manage our notebook in more details.

Introduction to the Course

- In this lecture, you learned about:
  - Your instructor.
  - The course in general.
  - Google Colab.
- In the next lecture, we will talk about optimization problems.