**Introduction to machine learning**

Click the image above for a video discussing the difference between machine

learning, AI, and deep learning.

Pre-lecture quiz

Welcome to this course on classical machine learning for beginners! Whether you're

completely new to this topic, or an experienced ML practitioner looking to brush up on an

area, we're happy to have you join us! We want to create a friendly launching spot for your

ML study and would be happy to evaluate, respond to, and incorporate your feedback.

Click the image above for a video: MIT's John Guttag introduces machine learning

Getting started with machine learning

Before starting with this curriculum, you need to have your computer set up and ready to

run notebooks locally.

Configure your machine with these videos. Use the following links to learn how to

install Python in your system and setup a text editor for development.

Learn Python. It's also recommended to have a basic understanding of Python, a

programming language useful for data scientists that we use in this course.

Learn Node.js and JavaScript. We also use JavaScript a few times in this course

when building web apps, so you will need to have node and npm installed, as well as

Visual Studio Code available for both Python and JavaScript development.

Create a GitHub account. Since you found us here on GitHub, you might already

have an account, but if not, create one and then fork this curriculum to use on your

own. (Feel free to give us a star, too )

Explore Scikit-learn. Familiarize yourself with Scikit-learn, a set of ML libraries that

we reference in these lessons.

What is machine learning?

The term 'machine learning' is one of the most popular and frequently used terms of today.

There is a nontrivial possibility that you have heard this term at least once if you have some

sort of familiarity with technology, no matter what domain you work in. The mechanics of

machine learning, however, are a mystery to most people. For a machine learning beginner,

the subject can sometimes feel overwhelming. Therefore, it is important to understand

what machine learning actually is, and to learn about it step by step, through practical

examples.

The hype curve

Google Trends shows the recent 'hype curve' of the term 'machine learning'

A mysterious universe

We live in a universe full of fascinating mysteries. Great scientists such as Stephen

Hawking, Albert Einstein, and many more have devoted their lives to searching for

meaningful information that uncovers the mysteries of the world around us. This is the

human condition of learning: a human child learns new things and uncovers the structure

of their world year by year as they grow to adulthood.

The child's brain

A child's brain and senses perceive the facts of their surroundings and gradually learn the

hidden patterns of life which help the child to craft logical rules to identify learned patterns.

The learning process of the human brain makes humans the most sophisticated living

creature of this world. Learning continuously by discovering hidden patterns and then

innovating on those patterns enables us to make ourselves better and better throughout

our lifetime. This learning capacity and evolving capability is related to a concept called

brain plasticity. Superficially, we can draw some motivational similarities between the

learning process of the human brain and the concepts of machine learning.

The human brain

The human brain perceives things from the real world, processes the perceived

information, makes rational decisions, and performs certain actions based on

circumstances. This is what we called behaving intelligently. When we program a facsimile

of the intelligent behavioral process to a machine, it is called artificial intelligence (AI).

Some terminology

Although the terms can be confused, machine learning (ML) is an important subset of

artificial intelligence. ML is concerned with using specialized algorithms to uncover

meaningful information and find hidden patterns from perceived data to corroborate

the rational decision-making process.

AI, ML, Deep Learning

A diagram showing the relationships between AI, ML, deep learning, and data

science. Infographic by Jen Looper inspired by this graphic

Concepts to cover

In this curriculum, we are going to cover only the core concepts of machine learning that a

beginner must know. We cover what we call 'classical machine learning' primarily using

Scikit-learn, an excellent library many students use to learn the basics. To understand

broader concepts of artificial intelligence or deep learning, a strong fundamental

knowledge of machine learning is indispensable, and so we would like to offer it here.

In this course you will learn:

core concepts of machine learning

the history of ML

ML and fairness

regression ML techniques

classification ML techniques

clustering ML techniques

natural language processing ML techniques

time series forecasting ML techniques

reinforcement learning

real-world applications for ML

What we will not cover

deep learning

neural networks

AI

To make for a better learning experience, we will avoid the complexities of neural networks,

'deep learning' - many-layered model-building using neural networks - and AI, which we

will discuss in a different curriculum. We also will offer a forthcoming data science

curriculum to focus on that aspect of this larger field.

Why study machine learning?

Machine learning, from a systems perspective, is defined as the creation of automated

systems that can learn hidden patterns from data to aid in making intelligent decisions.

This motivation is loosely inspired by how the human brain learns certain things based on

the data it perceives from the outside world.

Think for a minute why a business would want to try to use machine learning strategies

vs. creating a hard-coded rules-based engine.

Applications of machine learning

Applications of machine learning are now almost everywhere, and are as ubiquitous as the

data that is flowing around our societies, generated by our smart phones, connected

devices, and other systems. Considering the immense potential of state-of-the-art

machine learning algorithms, researchers have been exploring their capability to solve

multi-dimensional and multi-disciplinary real-life problems with great positive outcomes.

Examples of applied ML

You can use machine learning in many ways:

To predict the likelihood of disease from a patient's medical history or reports.

To leverage weather data to predict weather events.

To understand the sentiment of a text.

To detect fake news to stop the spread of propaganda.

Finance, economics, earth science, space exploration, biomedical engineering, cognitive

science, and even fields in the humanities have adapted machine learning to solve the

arduous, data-processing heavy problems of their domain.

Conclusion

Machine learning automates the process of pattern-discovery by finding meaningful

insights from real-world or generated data. It has proven itself to be highly valuable in

business, health, and financial applications, among others.

In the near future, understanding the basics of machine learning is going to be a must for

people from any domain due to its widespread adoption.

Challenge

Sketch, on paper or using an online app like Excalidraw, your understanding of the

differences between AI, ML, deep learning, and data science. Add some ideas of problems

that each of these techniques are good at solving.