Module 1:
Introduction to Machine Learning

Overview

Faculty Introduction

Ekpe Okorafor, PhD

AFFILIATIONS:

- Accenture - Applied Artificial Intelligence
- African University of Science & Technology
- Nigerian British University

RESEARCH INTERESTS:

- Generative AI
- Machine Learning
- Big Data & Advanced Analytics
- Knowledge Graph
- Information Assurance and Cybersecurity

FUN & INTERESTS

- Drawing & Painting
- Hiking
- Soccer
- DJ & Dancing

Introduction to Machine Learning

Modules for this topic

1. Overview: What is Machine learning
2. Categories of Machine Learning
3. Machine Learning Application Development Approach
4. *Building Classification Model*
5. Recommender Systems
6. *Building a Recommender Engine*

Introduction to Machine Learning

Learning Objectives

Upon successful completion of this topic, you will be able to:

- Define machine learning

- Describe the categories of machine learning

- Decide when to leverage Machine learning

- Build a simple classifier model

- Discuss approaches to ML application development

- Differentiate between the ML approaches and motivations

- Build a simple recommender engine in R

Module 1

Overview: What is Machine Learning?

Introduction to Machine Learning

Introduction to Machine Learning
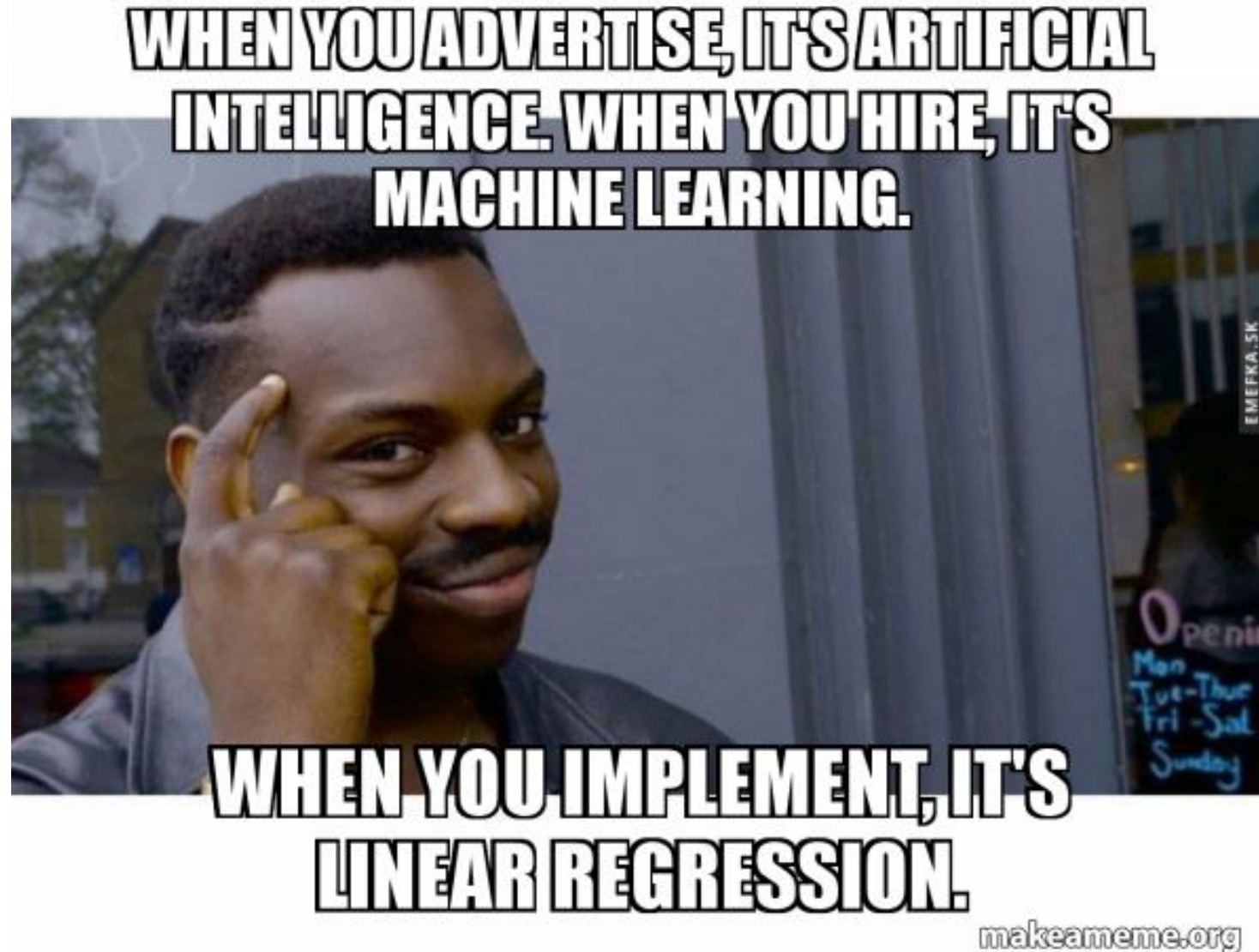
Why Do We Want Machines To Learn?

- Lucia wants to buy a car
  - New car = $20,000
  - 1 yr old (used) = $19,000
  - 2 yr old (used) = $18,000 and so on

- Pattern -> car price depends on its age and drops $1,000 every year but won't get lower than $10,000.

- Lucia invented *regression*

- **Problem:** There are so many other factors, e.g., options, technical condition, seasonal demand spikes, etc.

- **Challenge:** Lucia can't keep all that data in her head while calculating the price.

- **Solution:** Provide the machine some data and ask it to find all hidden patterns related to price.
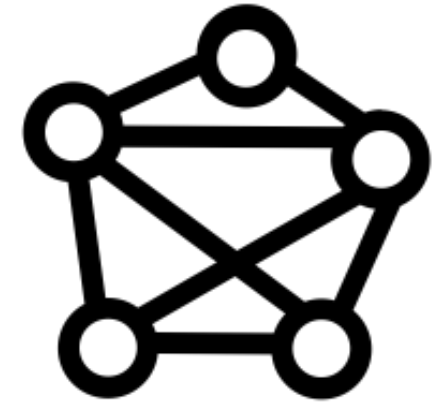
Introduction to Machine Learning

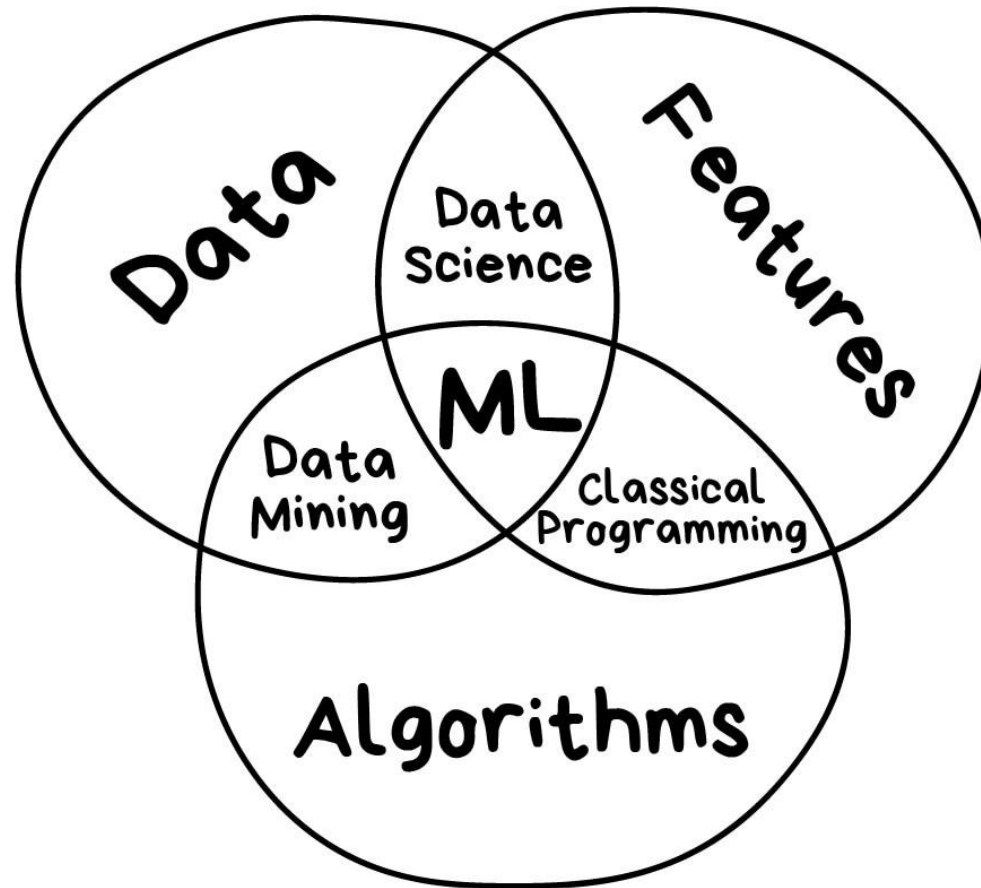# What is What is Machine Learning?

Data

Features

Algorithms

"Machine learning is the field of study that gives computers the ability to learn without being explicitly programmed. – Arthur L. Samuel, AI Pioneer, 1959

Introduction to Machine Learning

What is Machine Learning?

"Machine learning is the field of study that gives computers the ability to learn without being explicitly programmed. – Arthur L. Samuel, AI Pioneer, 1959

What is Machine Learning?

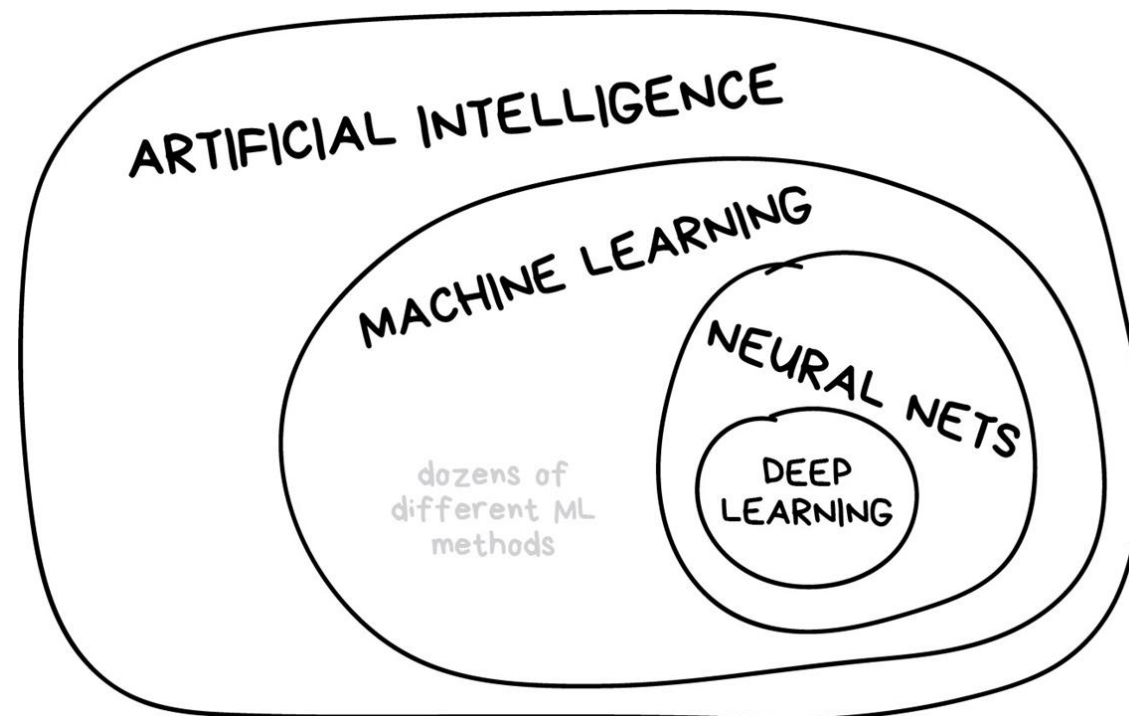- Artificial Intelligence (AI) is a branch or Computer Science that uses algorithms and techniques to mimic human intelligence

- Machine Learning (ML) is one of several AI techniques for sophisticated cognitive tasks

Introduction to Machine Learning

Machine Learning

Machine Learning is a particularly interesting technique because it represents a paradigm shift within AI

Traditional AI techniques

Data → ⚙️ → Output
Logic →

- **Static** – hard-coded set of steps and scenarios
- **Rule Based** – expert knowledge
- **No generalization** – handling special cases is difficult

Machine Learning

Data → ⚙️ → Logic
Output →

- **Dynamic** – evolves with data, finds new patterns
- **Data driven** – discovers knowledge
- **Generalization** – adapts to new situations and special cases

Introduction to Machine Learning

Machine Learning - Example

Example - Excelling at playing the game of chess

Symbolic AI	Mathematical/Statistical AI	Machine Learning Approach
"Let us sit down with the world's best chess player, Ekpe Okorafor, and put his knowledge into a computer program"	"Let us simulate all the different possible moves and the associated outcomes at each single step and go with the most likely to win"	**"Let us show millions of examples or real life and simulated games (won and lost) to the program, and let it learn from experience"**

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Machine Learning – When to use

Machine learning is particularly good at solving 2 types of problems where other AI techniques fail

Tasks programmers can't describe

Complex multidimensional problems that can't be solved by numerical reasoning

Handwriting

Weather Forecasting

Health Care Outcomes

Cognitive Reasoning

Network Intrusion

Movie Recommendation

Introduction to Machine Learning
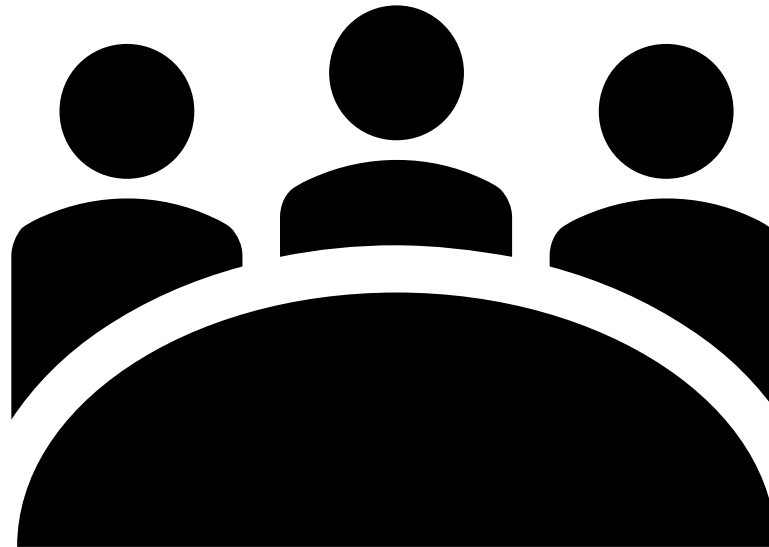
Applications of Machine Learning

- Email spam detection

- Face detection and matching (e.g., iPhone X, Windows laptops, etc.)

- Web search (e.g., DuckDuckGo, Bing, Baidu, Google)

- Sports predictions

- Post oce (e.g., sorting letters by zip codes)

- ATMs (e.g., reading checks)

- Credit card fraud

- Stock predictions

- Smart assistants (Apple Siri, Amazon Alexa, . . .)

- Product recommendations (e.g., Walmart, Netflix, Amazon)

- Self-driving cars (e.g., Uber, Tesla)

- Language translation (Google translate)

- Sentiment analysis

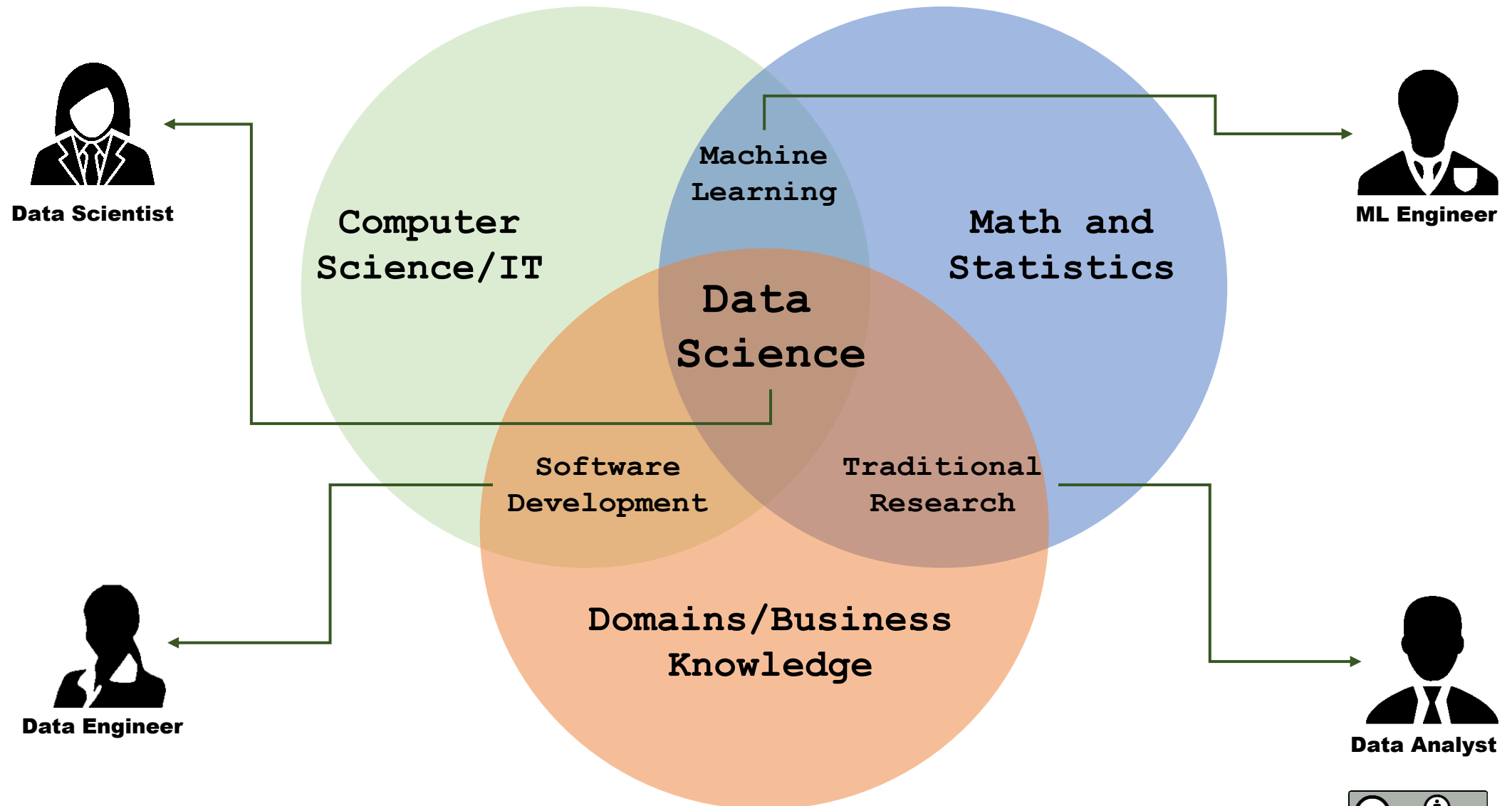- Drug design

- Medical diagnoses

- ……

Exercise

As a first exercise, think about how machine learning could be applied in these problem areas or tasks listed in the previous slide:

- What is the desired outcome?

- What could the dataset look like?

- Is this a supervised or unsupervised problem, and what algorithms would you use? (Supervised and unsupervised learning will be introduced next)

- How would you measure success?

- What are potential challenges or pitfalls?

Class Discussion

Introduction to Machine Learning

The World of Data

Machine Learning

Computer Science/IT

Math and Statistics

Data Science

Software Development

Traditional Research

Domains/Business Knowledge

Data Scientist

ML Engineer

Data Engineer

Data Analyst

Introduction to Machine Learning

Summary

- We now have an overview and a good definition for Machine Learning
- We have seen some examples where ML can be leveraged