Machine Learning

Lecture 1: Introduction to Machine Learning (ML)

COURSE CODE: CSE451

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Course Teacher

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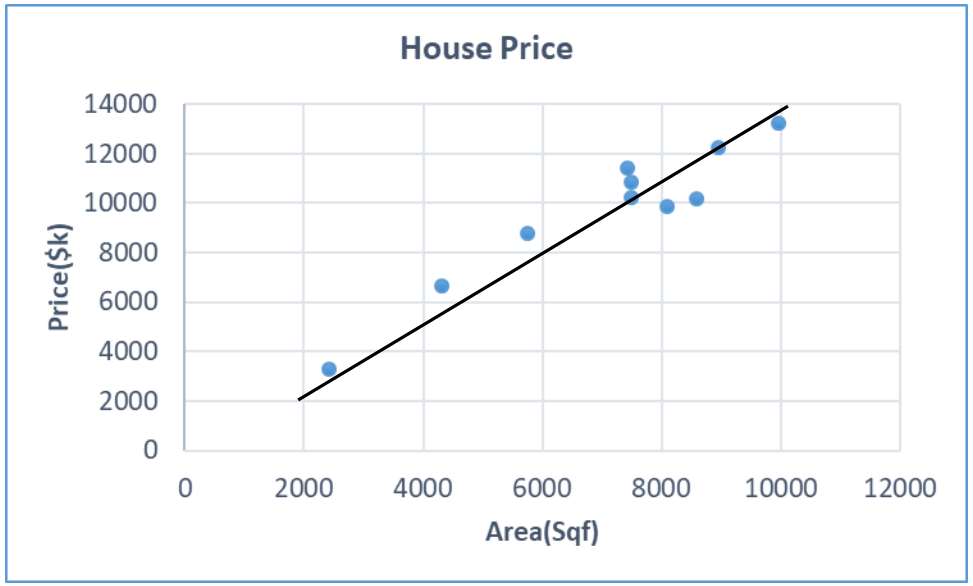
Can You Classify?

Can You Guess House Price?

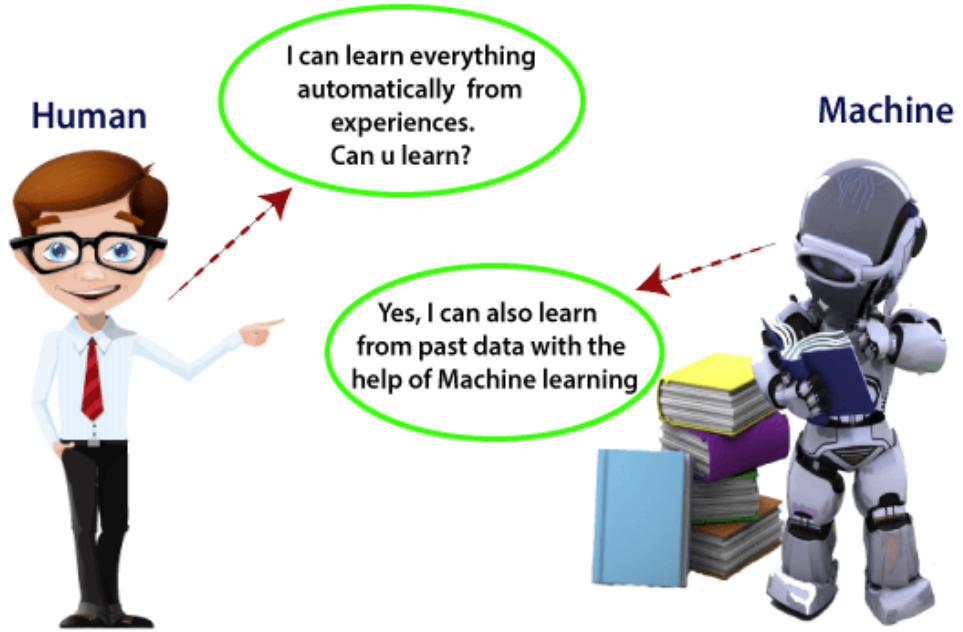
Area (Sqf)	Price ($k)
2420	3300
4305	6680
5750	8800
7420	11410
7500	10215
7500	10850
8100	9870
8580	10150
8960	12250
9960	13250



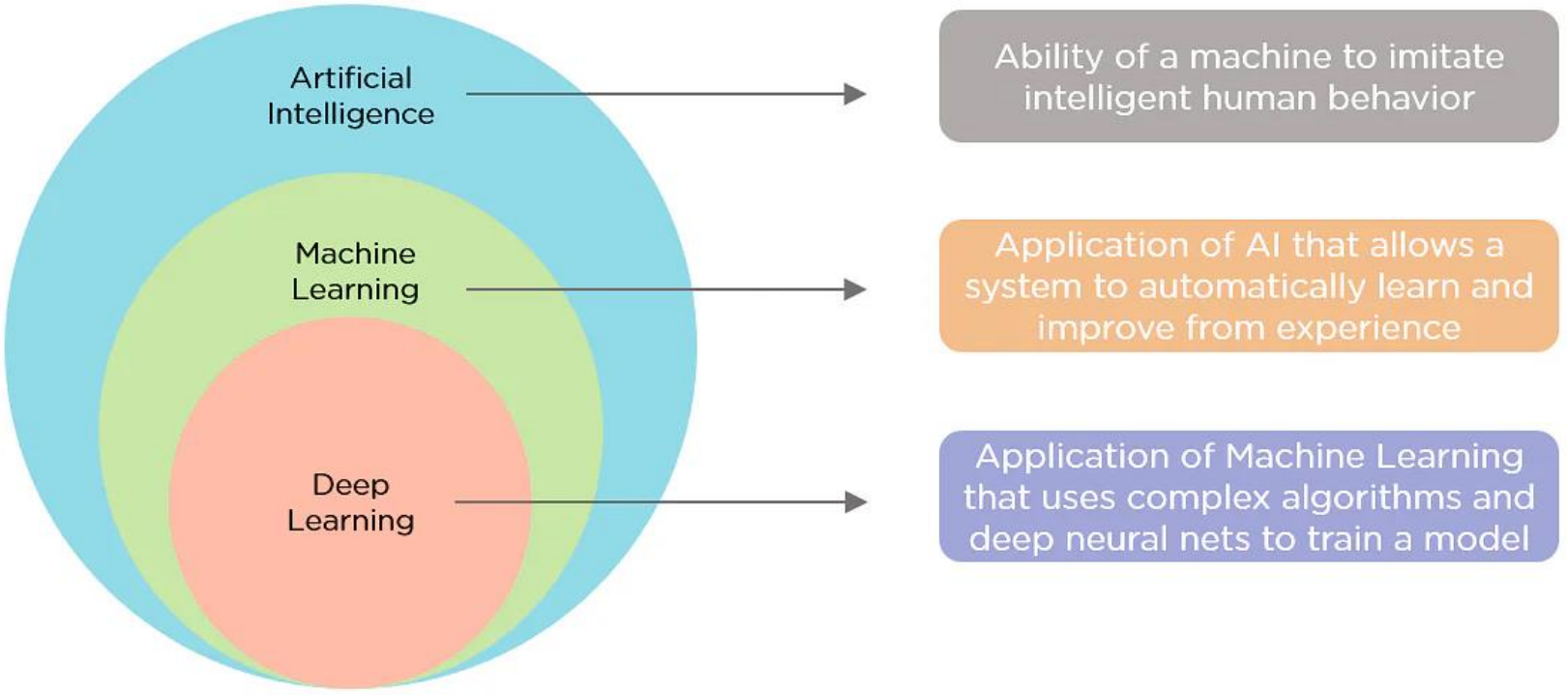
Area (Sqf)	Price ($k)
6550	?

What is Machine Learning (ML)

- Machine learning is about extracting knowledge from data
- Machine Learning is the field of study that enables a system to learn from experience without being explicitly programmed (Arthur Samuel, 1959).

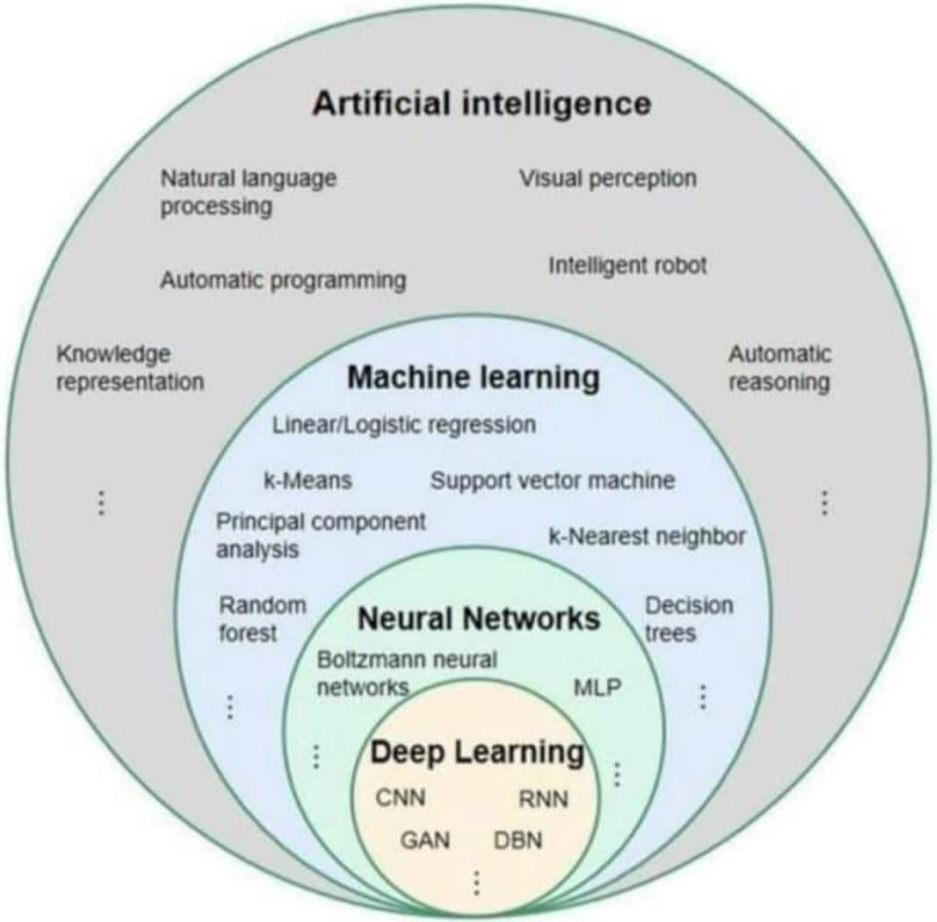


What is AI? AI vs ML



AI vs ML [Link]

Relationship between AI, ML, Neural Networks and DL



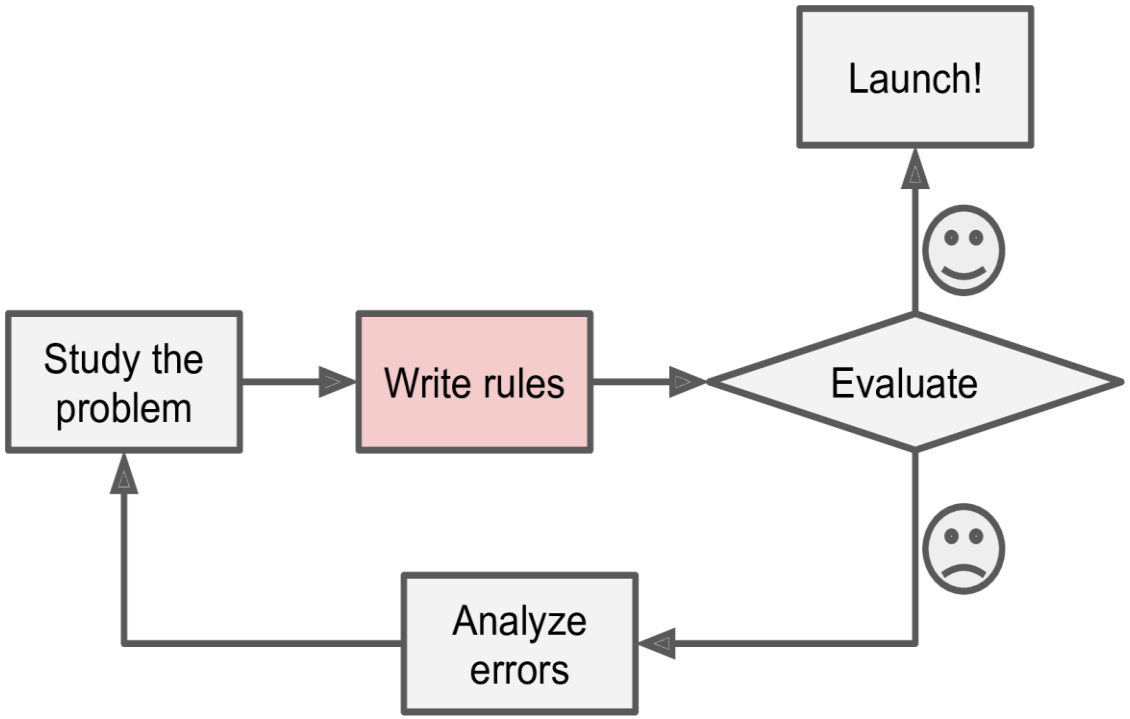
Machine Learning (ML) - A Formal Definition

A computer program is said to learn from experience E with respect to some task T and some performance measure P, if its performance on T, as measured by P, improves with experience E (Tom Mitchell, 1997)

- **Example:** Given some examples of spam emails and some examples of regular emails which are called the training set. You need to do spam filtering for new emails based on the training set.
- In this case, the task T is to flag spam for new emails, the experience E is the training data, and the performance measure P needs to be defined; for example, you can use accuracy and it is often used in classification tasks.

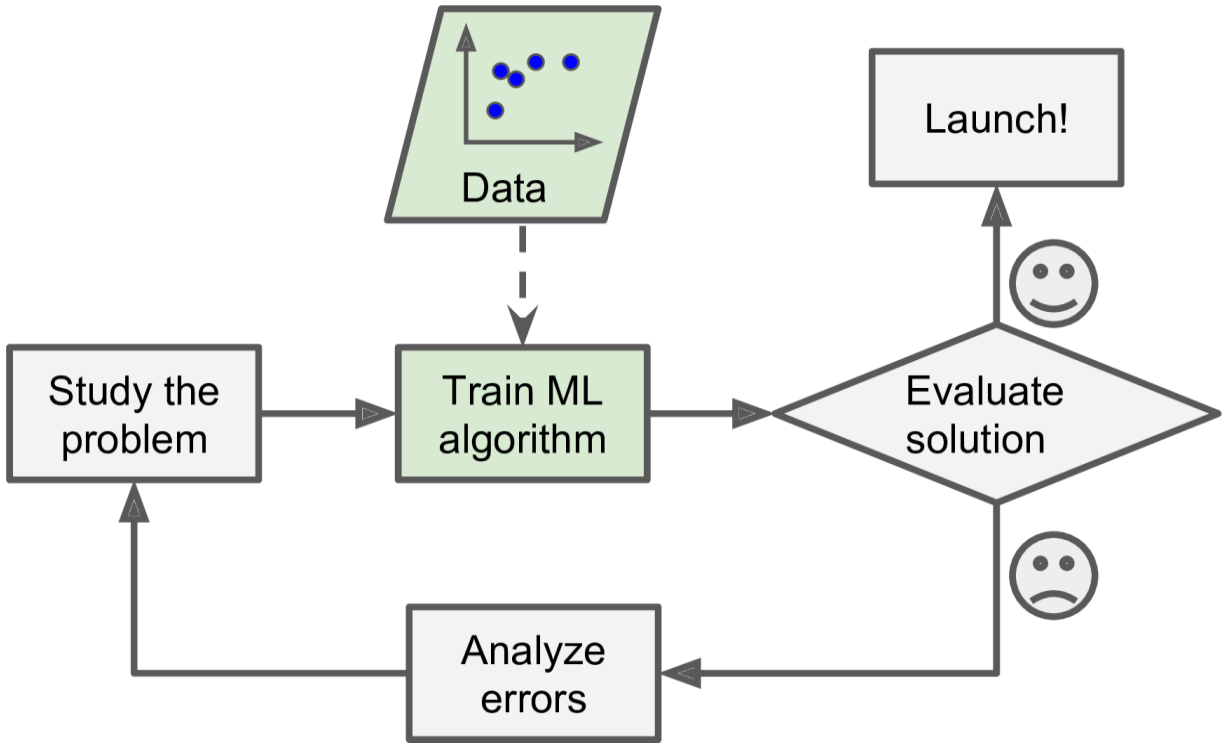
Traditional/ Rule-based Programming

- A programmer code all the rules in consultation with an expert in the industry to solve the problem.
- When the system grows, more rules need to be written.
- Your program will likely become a long list of complex rules—pretty hard to maintain



Machine Learning Approach

- A programmer choose a ML algorithm and train a model from data to solve the problem.
- The system learns how input and output data are correlated and automatically finds patterns or relationships in the data.
- The system adapts in response to new data and experiences to improve efficacy over time.
- The program is much shorter, easier to maintain, and most likely more accurate.



Why and when to use Machine Learning

- **Problems for which existing solutions require a lot of hand-tuning or long lists of rules:** a Machine Learning algorithm can often simplify code and perform better.
- **Complex problems for which there is no good solution at all using a traditional approach:** the best Machine Learning techniques can find a solution.
- **Fluctuating environments:** a Machine Learning system can adapt to new data.
- **Getting insights about complex problems and large amounts of data**.

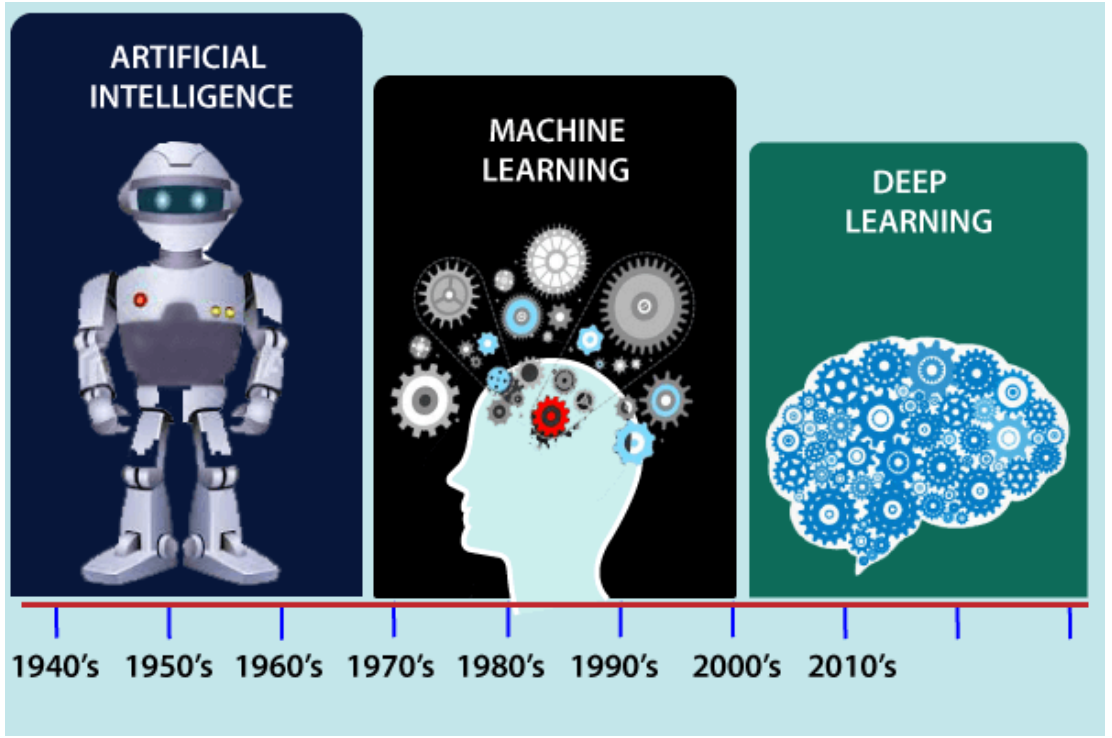
The Goal of Machine Learning

All models are wrong, but some are useful (by George E. P. Box, a British statistician)

- The goal of ML is never to make “perfect” guesses.
- The goal of ML is to make guesses that are good enough to be useful.

History of Machine Learning

- The idea of Machine Learning is not new.
- Machine Learning ideas and research have been around for decades.
- But recently there has been a lot of action and buzz of Machine Learning.

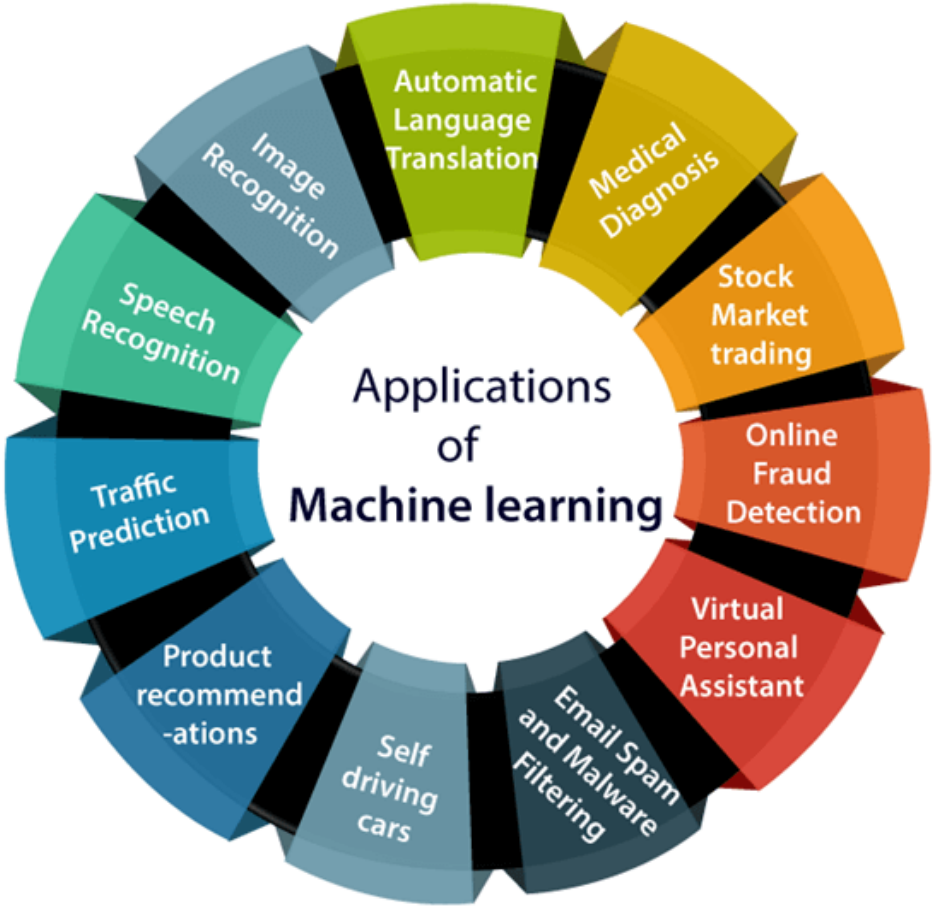


Why is Machine Learning getting so much attention recently?

- **The amount of data generation is increasing significantly with a reduction in the cost of sensors (Force 1)**
- **The cost of storing this data has reduced significantly (Force 2).**
- **The cost of computing has come down significantly (Force 3).**
- **Cloud has democratized compute for the masses (Force 4).**

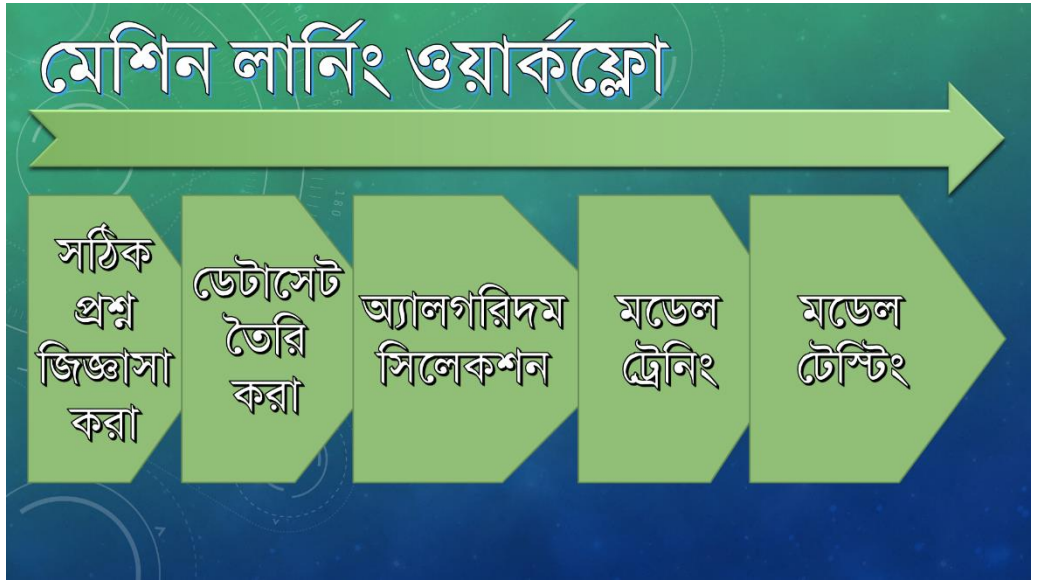
Source: [AnalyticsVidhya]

Some Trending Real-world Applications of Machine Learning



Source: javaTpoint [Link]

Workflow/Steps of Machine Learning



Source: Manas [Link], Medium[Link]

Comprehensive Learning Path of ML/Data Science in Python

Step 1: Setting up your machine (install Anaconda)

Step 2: Learn Python language

Step 3: Learn Regular Expressions in Python

Step 4: Learn Scientific libraries in Python – NumPy, SciPy, Matplotlib and Pandas

Step 5: Effective Data Visualization

Step 6: Learn Scikit-learn and Machine Learning

Step 7: Practice, practice and Practice

Source: AnalyticsVidhya [Link]

Guide to Machine Learning in Python

Step 1: Complete Python course by one week
Introduction to Python by AnalyticsVidhya [Link]

Step 2: Complete another Python course for your hands on practice
Introduction to Python by Datacamp [Link]

Step 3: Complete a basic Machine Learning course
Machine Learning for Everyone by Datacamp [Link]

Step 4: Complete another Machine Learning course
Machine Learning Certification Course for Beginners by AnalyticsVidhya [Link]

Step 5: Keep working on ML and learning

Some Learning Materials in Bangla

1. বাংলায় পাইথন প্রোগ্রামিং বই: সুবীন [Link], মাটিন[Link], Nuhil Mehdy [Link]
2. শূন্য থেকে পাইথন মেশিন লার্নিং [Link], হাতে কলমে মেশিন লার্নিং [Link] by রকিবুল হাসান
3. বাংলায় মেশিন লার্নিং [Link] by মানস কুমার মণ্ডল
4. Python Bangla Tutorial & Data Science Full Course [Link] by STUDY MART at Youtube
5. Youtube, Coursera, Google

Reference Books for ML Course

1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems by Aurélien Géron, O'Reilly (2nd Edition)
2. Introduction to Machine Learning with Python: A Guide for Data Scientists by Andreas C. Müller, Sarah Guido
3. Introduction to Data Mining by Pang-Ning Tan , Michael Steinbach, Vipin Kumar (2nd Edition)
4. The Hundred-Page Machine Learning Book by Andriy Burkov

End of Lecture-1