1

Introduction to ML/DL

Basics of Machine Learning

1.1
What is **Machine Learning?**

An intuitive understanding of Machine Learning (ML)

- ML is branch of Computer Science
- It focuses on the use of data and algorithms to imitate the way humans learn

How do humans learn?

- Humans see data, lots of data
- Over a long period of time, a ton of data is processed
- Humans start to form bits and pieces of rules based on their observations to understand things
- Example:
  - 4 legged furniture?
    - If I can sit on it: It’s a chair
    - If I can lie down on it: It’s a bed

Computers learn in the same way

- Provide a computer lots of data
- Select a learning algorithm for it to use
- It will form its own rules to solve the problem

Purpose

- Machine Learning is an important field of data science
- There is too much data in the world for humans to process
- Machines Learning to do our task **is the future**

Industrial Scale of Data:
400 hours of video are uploaded every minute on Youtube (Source)

- **192,200 hours** of video in 8 hours
- YouTube wants to ensure the videos have no offensive content
- Human labor is not as efficient at this scale
- **Solution**:
  - Teach a computer what counts as offensive
  - The computer automatically flags content

1.2
What is **Deep Learning?**

Machine Learning vs Deep Learning

- *Classical* Machine Learning is dependent on human intervention
- Human experts determine the set of features to learn
- Can do supervised learning

- *Deep* Machine Learning can work with or without human intervention
- Human experts could determine the set of features to learn but not required
- Can do supervised & unsupervised learning

Artificial Intelligence vs Machine Learning vs Deep Learning

- AI (Artificial Intelligence) - is an umbrella term for software that mimics human cognition to perform complex tasks
- ML (Machine Learning) - sub-field of AI that uses algorithms trained on data to produce adaptable models to perform tasks
- DL (Deep Learning) - subset of machine learning that uses layers of Neural Networks to do the most complex ML tasks

1.3
How do Machines **Learn?**

All Machine Learning tasks has 3 general steps

1. Decision: ML algorithms are used to either make a **prediction** or **classify** a given data input. The data may or may not be labeled
2. Error Function: A function is responsible to evaluate the prediction of a model with it's true label
3. Optimization: Models are adjusted to reduce discrepancy between a known example and the model estimate

Types of Learning

Machines can be taught with 3 different methods:

1. Supervised Learning
2. Unsupervised Learning
3. Reinforcement Learning

Supervised Learning

This is the most popular method to train algorithms.

- A **labeled dataset** is used to train algorithms
- The **algorithm learns patterns from labeled data** during training and predict outcomes for new, unseen data
- Can be used to learn **classification** or **regression**
- Trained models **aim to generalize**, by avoiding overfitting/ underfitting (cont. next slide)

- **Generalization**: Model should generalize by learning the *underlying patterns* in the data, rather than *memorizing* the data exactly
- **Overfitting**: Occurs when a model fits the training data too closely and can only train well but test poorly. *Model has memorized data*
- **Underfitting**: Occurs when the model is too simple and has not captured the underlying pattern. *Model did not learn*

Example of models that are used during **supervised learning**:

- Neural Networks
- Naive Bayes
- Random Forest
- Gradient Boosting
- And many more!

Unsupervised Learning

- An **unlabeled dataset** is used to train algorithms
- Used often to uncover hidden patterns or data grouping **without human intervention**
- Ideal for:
  - Exploratory data analysis
  - Image and Pattern Recognition

Example of models that are used during **unsupervised learning**:

- Neural Networks
- K-means clustering
- Principal Component Analysis (PCA)
- Singular Value Decomposition (SVD)

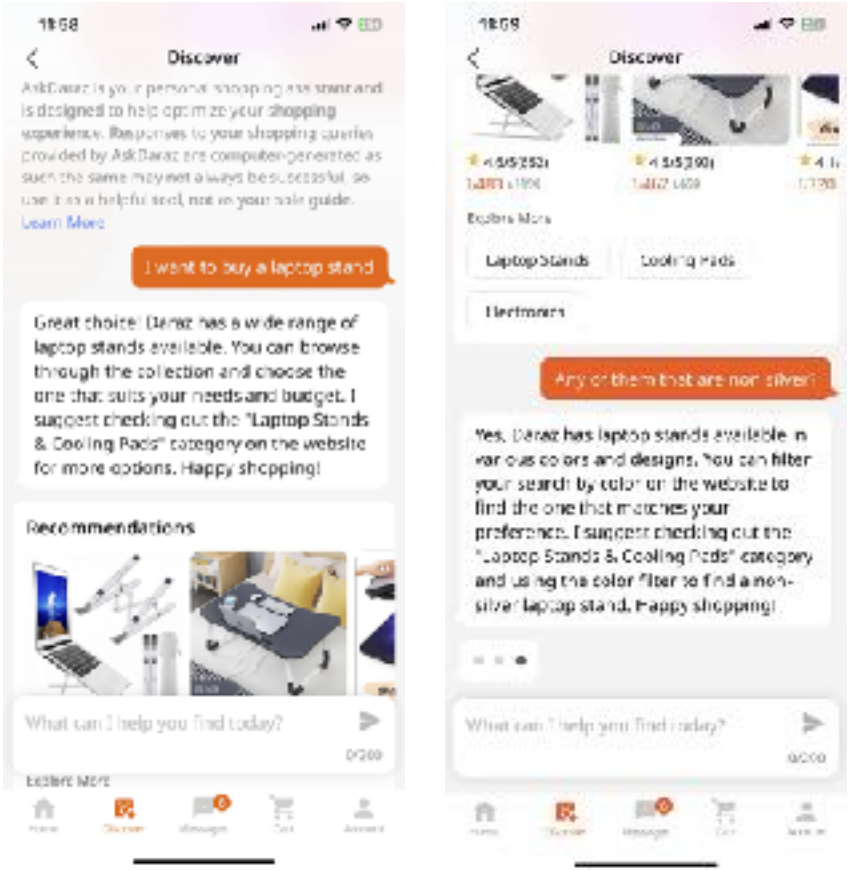
1.4
AI is already everywhere

Speech Recognition

- A lot of programs allow users to speak instead of typing
- This increases a program's accessibility to the differently abled
- Also allows for a more natural interaction with computers
- Examples:
  - Google Assistant
  - Speech-to-Text keyboards

Customer Service

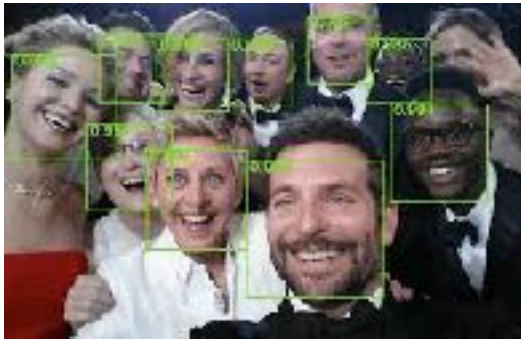
- The advent of ChatGPT and other chatbots have led to creation of customer service chatbots
- Daraz has rolled out their own chatbot to help you search for items



1.4. AI is all around us. Read more: IBM: The use-cases of AI

Computer Vision

- Everytime you take a picture, AI is used to determine the best way to tune color, exposure and lighting
  - MKBHD talks about this with examples
- When the picture is taken, AI is used to tag faces in the picture for various reasons



Recommendation Engines

- Using past customer data, AI models can help recommend content that customer likes to consume
- TikTok, Youtube, Instagram, Facebook, etc. perfected the craft
- Advertisement platforms are built with the promise of connecting the right ads to the right user

Fraud Detection

- Banks and other financial institutions use AI to spot suspicious transaction
- This is to protect their customers from malicious intent
- Email services also detect and delete fraudulent emails from entering your inbox

END.