Introduction

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Chapter 1

Introduction

1.1 Machine Learning

- Performing a Task
- With Experience
- Improving Performance

1.2 Artificial Intelligence (AI)

Definition 1.2.1: Artificial Intelligence

The science and engineering of making intelligent machines, especially intelligent computer programs.

1.3 Deep Learning vs Machine Learning

1.3.1 Machine Learning

- Subfield of AI focused on algorithms that learn from data.
- Works well with structured data.
- Simpler models.
- Requires manual feature extraction and selection.
- Involves predictive modelling, clustering, and classification.
- Feature extraction and application are done separately.

1.3.2 Deep Learning

- Subfield of ML using neural networks with many layers.
- Works well with large amounts of unstructured data.
- Complex models with multiple layers.
- Automatically extracts features from raw data.
- Involves image and speech recognition, natural language processing, and recommendation systems.
- Feature extraction and application are done together by the neural network.

1.4 Supervised Learning

Definition 1.4.1: Supervised Learning

A subfield of Machine Learning where labelled datasets are used to train algorithms that classify data or predict outcomes.

1.4.1 Terminology

Definition 1.4.2: Feature / Input Feature / Independent Variable / X

A feature is an individual measurable property or characteristic of a phenomenon being observed.

Definition 1.4.3: Label / Dependent Variable / Y

The output / target variable that we are trying to predict.

Definition 1.4.4: Classification

Involves predicting a categorical label.

Definition 1.4.5: Regression

Involves predicting a quantitative continuous label.

1.4.2 Supervised Learning Pipeline

1. Determine the type of training dataset.
2. Gather the labelled training data.
3. Split the training dataset into training dataset, test dataset.
4. Determine the most suitable algorithm for the model.
5. Execute the algorithm on the training dataset.
6. Evaluate the accuracy of the model by providing the test set.

Definition 1.4.6: Independent Identical Distribution (IID)

1.4.3 Math

For a model:

$$h(x) = \theta_0 + \theta_1 x$$

Where $h(x)$ is he hypothesis, The θ are our parameters, and x is an input feature.

$$h(x) = \boldsymbol{\theta} \cdot \mathbf{x}$$

Where $x_0 = 1$, where the number of elements in $\boldsymbol{\theta}$ and $\mathbf{x}$ is $n + 1$ or

$$h(x) = \sum_{i=0}^{n} \theta_i x_i$$

Where $x_0 = 1$, For multiple input features.

For the training set $\left(X^i, Y^i\right)$, represents the i-th input and the i-th label