Study Guide: Machine Learning

Main Headings

1. Introduction to Artificial Intelligence

2. What is Machine Learning?

3. Characteristics of Machine Learning

4. Applications of Machine Learning

5. Limitations of Machine Learning**

Introduction to Artificial Intelligence

* AI is a research field that focuses on systems that take decisions

* AI formalizes decision processes: interactive (decisions change world state) or passive

* AI distinguishes between agent(s) and the external world: decision variables

* AI aims for systems to exhibit functionally desirable behavior

What is Machine Learning?

* Machine Learning (ML) is about fitting a function $f: x \rightarrow y$ to given data $D = \{(x_i, y_i)\}^n_{i=1}$

* ML method makes a single decision: Decide on the function $f \in H$ in the hypothesis space H

* This "single-decision process" is not interactive; ML0 does not formalize/model/consider how the choice of f changes the world

* "Learning" in ML0 is not an interactive process, but some method to pick f on the basis of the static D

Characteristics of Machine Learning

* Function approximation can be used to help solve AI (interactive decision process) problems

* ML is not magical; it can fail due to noise in the training data, insufficient information, or incorrect labeling

* ML can be used for various tasks, such as image recognition, sentiment classification, and medical diagnosis

Applications of Machine Learning

* Image Recognition: Building a trained/ fixed f into an interacting system based on human expert knowledge

* Sentiment Analysis: Classifying course reviews as positive or negative

* Medical Diagnosis: Diagnosing cancer or not based on gene expressions, X-rays, family histories, etc.**

Limitations of Machine Learning

* Noise in the training data can lead to incorrect results

* Insufficient information can make it impossible to make accurate predictions

* Errors in labeling can lead to incorrect results

* ML is not a replacement for human judgment and expertise

Summary of Key Points

**Q1: What is Machine Learning?

A1: ML is about fitting a function f: x → y to given data $D = \{(x_i, y_i)\}_{i=1}^n$**

**Q2: What are the limitations of Machine Learning?

A2: Noise in training data, insufficient information, and incorrect labeling**

**Q3: What are some applications of Machine Learning?

A3: Image recognition, sentiment analysis, and medical diagnosis**

**Q4: What is the difference between AI and ML?

A4: AI focuses on systems that take optimal/desirable decisions, while ML is about fitting a function to given data**

**Q5: What are some challenges in Machine Learning?

A5: Noise, insufficient information, and incorrect labeling**