

# 1. Basic Terminology in Artificial Intelligence

\* Think about the most intelligent person you know. What about this person leads you to describe him or her this way?

\* Solns:

Machine capability lags behind human intelligence

## AI Vs. AII

\* Artificial Intelligence, also known as AI, Technical experts in the field of AI prefer to use the term Artificial General Intelligence (AII). to refer to mlc's with human-level or higher intelligence, capable of abstracting concepts from limited experience & transferring knowledge to domains.

\* AII is also called "strong AI"  
\* Weak AI or Narrow AI differentiate which refers to systems designed for one specific task & whose capabilities are not easily transferable to other systems.

\* Deep Blue - chess - 1997 beat world champion  
AlphaGo - Go - 2016

\* Today's are "weak or narrow AI"

\* Intelligent Prgms can defeat human in specific tasks, but they can't apply that expertise to other tasks, such as driving cars or creating arts.

\* AI is also unclear. Approaches that work well for solving narrow pblms do not generalize well to tasks such as abstract reasoning, concept formulation & strategic planning - capabilities that even human toddlers possess but our computers do not.

Modern AI Techniques  
Statistics and Data Mining

\* collection, analysis, description, visualization & drawing of inferences from data.

1. Descriptive statistics

↳ visualizes the basic features of the data being studied

2. Inferential statistics

↳ Draw conclusions that apply to more than just the data being studied.

3. Data Mining - automation of exploratory statistical analysis on large-scale DB.

Goal of DM is to extract patterns & knowledge from large-scale datasets so that they can be reshaped into a more understandable structure for later analysis

## Symbolic and Expert Systems

- \* It are Programs that use human-understandable symbols to represent problems & reasoning.
- \* Rule-based expert systems
- \* Production - rules [if-then stmts]
- \* Drawback due to the limited no. of experts

## Machine Learning

- \* Machine Learning enables computers to learn without being explicitly programmed.
- \* It is a field in Computer Science that builds on top of computational statistics & data mining.
  1. Supervised Learning
    - Eg: Email Spam Detection.

The model is trained on labeled data [Spam vs. non-spam emails] to classify new email as spam or not spam based on their content

### 2. Unsupervised Learning

Eg: Customer Segmentation.

Analyzing purchasing patterns of customers without any predefined labels to group them based on similarities

### 3. Semi-Supervised Learning

Eg: Photo Tagging

When you upload photos to social media of the platform suggests tags for people based on previous tagged images

### 4. Reinforcement Learning

Eg: Autonomous Driving

Teaching a self-driving car to navigate roads by rewarding it for making correct maneuvers (staying in the lane, obeying traffic rules) and penalizing for incorrect actions

### 1. Supervised Learning -

The algorithm learns from labeled training data, where each input has a corresponding output label.

The goal is to learn a mapping function that can predict the output for new, unseen inputs accurately

### 2. Unsupervised Learning

The algorithm deals with unlabeled data & aims to find patterns or intrinsic structures within the data without explicit output labels

clustering, dimensionality reduction, and association mining are examples of unsupervised learning

### 3. Semi-Supervised Learning

This combines elements of both supervised and unsupervised learning

It involves a small amount of labeled data with a larger amount of unlabeled data to train models.

It aims to utilize the available labeled & unlabeled data to improve learning accuracy

### 4. Reinforcement Learning

This type involves an agent learning to make decisions by interacting to make decisions by interacting with an environment

It receives feedback in the form of rewards or penalties, enabling the agent to learn the optimal behavior or strategy to maximize cumulative reward over time

## Deep Learning

\* It is a subset of ML that involves training ANN (Artificial Neural Networks) with multiple layers to learn & make intelligent decisions from data

\* These NN (Neural Networks) can automatically discover patterns from raw data, making them highly effective for complex tasks like image & speech recognition, natural language processing & more.

### Advantages:

#### 1. Highly Effective

Capable of learning intricate patterns in data

#### 2. Feature Extraction

Can automatically learn relevant features from raw data

#### 3. Scalability

Scales well with large amounts of data

### Disadvantages:

#### 1. Data Hunger

Requires a massive amount of data for effective training

#### 2. Computationally Intensive

Training deep learning models can be resource-intensive

#### 3. Interpretability

Understanding why a model makes a specific decision can be challenging due to its complexity.

Eg. DL in action is in autonomous vehicles.

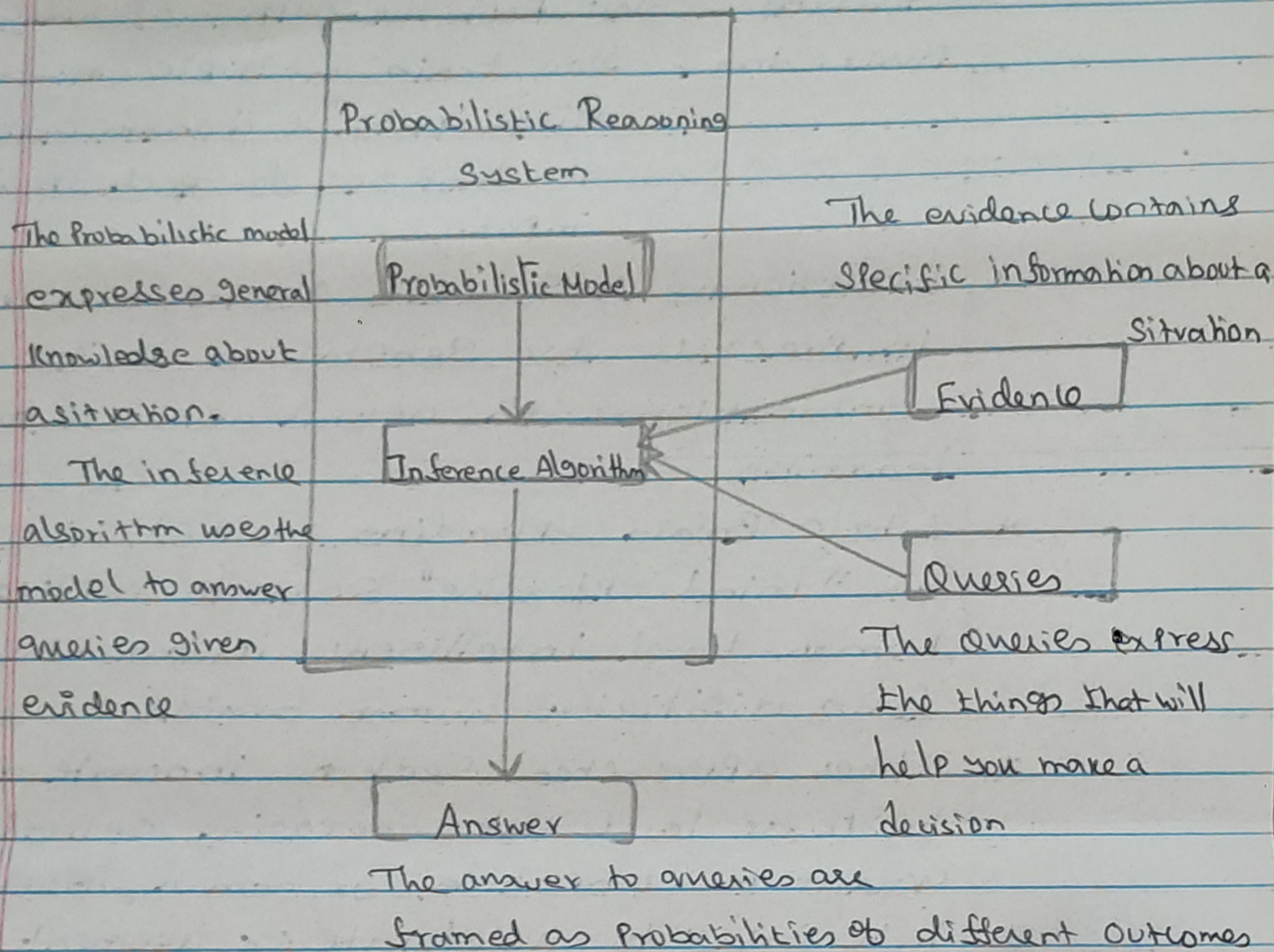
• DL models process real-time data from

cameras, LiDAR, and other sensors to detect objects, pedestrians, traffic signs, & lanes.

- \* These models analyze the environment & make split-second decisions, contributing to the vehicle's ability to navigate safely on the road.

### Probabilistic Programming

- \* It enable us to create learning systems that make decisions in the face of uncertainty by making inferences from prior knowledge.
- \* It have been used successfully in applications such as medical imaging, machine perception, financial predictions, & econometric & atmospheric forecasting
- \* Practical probabilistic programming, a model is first created to capture knowledge of a target domain in quantitative, probabilistic terms. Once trained, the model is then applied to specific evidence to generate an answer to a more specific query in a process called inference



## Other AI Approaches

There are 4 broad categories of ensembling

1. Bagging
2. Boosting
3. Stacking
4. Bucketing

**Bagging** - Training the same algorithm on different subsets of the data & includes popular algorithms

**Boosting** - Training a sequence of models, where each model prioritizes learning from the examples that the previous model failed on.

Stacking - You pool the output of many models

Bucketing - You train multiple models for a given problem & dynamically choose the best one for each specific ~~output~~ input.

\* Evolutionary & Genetic algorithms are used in practice for generative design & in combination with neural networks to improve learning.

\* Whole Brain Uploading (WBE), also known as "mind uploading" seek to replicate human-level intelligence in machines by fully digitizing human brains.

\* Other approaches seek to innovate at the hardware level by leveraging optical computing, quantum computing, or human-machine interfaces to accelerate or augment current methods