IBM **SkillsBuild**

INTRODUCTION TO ARTIFICIAL INTELLIGENCE

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Introduction to artificial intelligence

Module 1: What is artificial intelligence?

Artificial Intelligence (AI): When machines learn patterns and make predictions. It does not replace human decisions but helps improve them.

Augmented Intelligence: Augmented Intelligence is a branch of AI that focuses on enhancing human intelligence by providing insights, recommendations, or automation while keeping human decision-making in control.

Key Differences Between AI and Augmented Intelligence:

Feature	Artificial Intelligence (AI)	Augmented Intelligence
Purpose	Automates tasks and decision-making	Enhances human intelligence and decision-making
Decision-Making	AI can make decisions on its own	Final decisions are made by humans with AI assistance
Risk	Potential for bias and lack of human oversight	Reduces risk by keeping human judgment in control
Focus	Replacing human actions	Supporting and improving human actions

Examples:

Situation	Artificial Intelligence (AI)	Augmented Intelligence
Driving a Car	A fully self-driving car that drives without a human.	A car with a smart assistant that helps the driver but still needs human control.
Doctor's Diagnosis	A machine that examines medical scans and decides on a diagnosis without a doctor.	A machine that helps a doctor by suggesting possible diagnoses, but the doctor makes the final decision.
Customer Service	A chatbot that talks to customers and solves their problems without human help.	A chatbot that suggests replies, but a human check and sends them.

Study Case: Imagine you are given the job to sort items in the meat department at a grocery store. You realize that there are dozens of products and very little time to sort them manually. How could you use **artificial intelligence**, **machine learning**, and **deep learning** to help with your work?

1-Artificial Intelligence (AI) – Basic Smart System:

- **A barcode scanner can read labels and tell me where to place each product.**
- **AI can track inventory and tell me when items need restocking.**
- **AI-powered cameras can recognize different types of meat and sort them automatically.**

2-Machine Learning (ML) – Learning from Experience:

- **It can learn to recognize different meat products by looking at their packaging, weight, or labels.**
- **It can predict which meats sell faster and suggest better shelf placement.**
- **It can help organize the store based on customer buying habits.**

3-Deep Learning (DL) – Advanced Smart Vision:

- **A camera with deep learning can see and sort meat based on its color, texture, or packaging.**
- **A robotic arm can pick up and place meat in the right sections.**
- **DL can even detect spoiled or damaged meat by looking at images.**

How It All Works Together

1-AI controls the system and helps with decisions.

2-ML learns from past sorting mistakes to improve accuracy.

3-DL allows machines to see, understand, and sort items like a human.

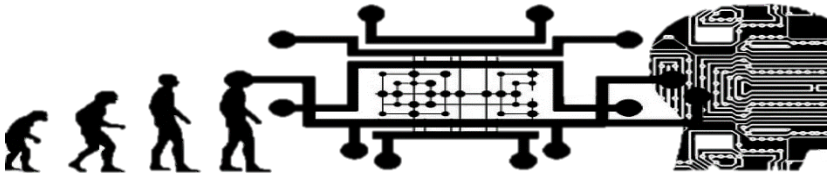
How do AI services calculate? and, what do they do with those calculations?

AI services calculation	
Analysis	**Prediction**
AI services can process huge amounts of data quickly. They use math to analyze, sort, and organize information in ways that would have been impossible just a few years ago.	**AI services can analyze data to make predictions. They can look at patterns and say, "Based on this information, this is likely to happen."**

How is AI evolving:

Computer scientists have identified three levels of AI based on predicted growth in its ability to analyze data and make predictions. They call these levels:

1) **Narrow AI**
2) **Broad AI**
3) **General AI**



1- Narrow AI: Narrow AI refers to artificial intelligence that is designed for a specific task. It can perform one job very well but cannot think or function beyond that task.

Example: Siri and Alexa – Voice assistants that can answer questions but do not truly "think."

Key Point: Narrow AI is task-focused and cannot think beyond its programmed function.

2-Broad AI (Expanding AI): Broad AI is a concept where AI can handle multiple tasks across different areas but still lacks human-like reasoning. It is more advanced than Narrow AI but not as flexible as General AI.

Examples: AI systems that can understand multiple languages, analyze data, and provide recommendations.

Key Point: Broad AI is more capable than Narrow AI but still lacks true independent thinking.

3-General AI (Artificial General Intelligence): General AI is an AI system that can think, learn, and solve problems like a human across different areas, not just one specific task. This type of AI does not exist yet but is the goal of AI research.

Examples (Theoretical): A robot that can learn new skills on its own without needing new programming.

Key Point: General AI would have human-like intelligence and could adapt to any situation.

Module 2: Structured, semi-structured, or unstructured data

What is data:

Data is raw information that can come in many forms. It includes facts, statistics, opinions, or any recorded content. This could be voices, photos, names, or even moves.

Data can be organized into the following three types.

1. **Structured data**
2. **Unstructured data**
3. **Semi-structured data**

1- Structured data: Structured data is highly organized information that is stored in a clear format, such as tables or spreadsheets.

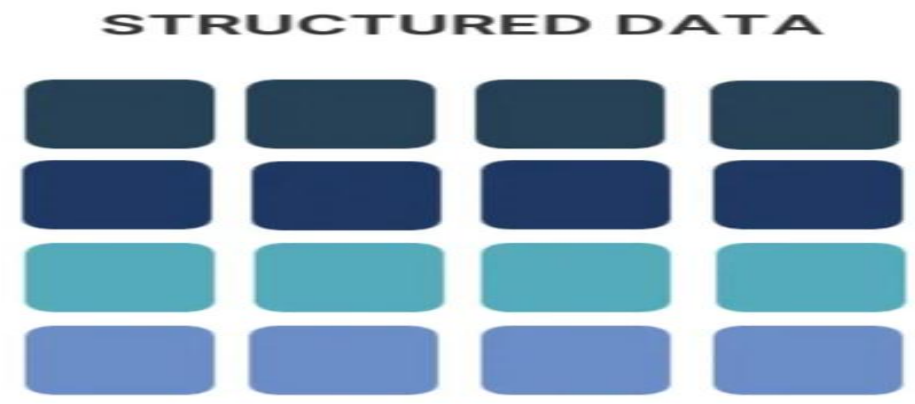
It is quantitative and easy to search, sort, and analyze.

Examples:

- **Names and addresses**
- **Dates and times**
- **Credit card numbers**

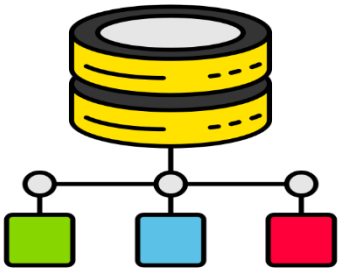
Key Point:

- **Organized Format: Stored in rows and columns (like spreadsheets and databases).**
- **Easy to Search & Analyze: Can be quickly filtered and processed.**
- **Quantitative Data: Mostly numbers and categorized information.**



2- Unstructured data: **Unstructured data, also called dark data, is qualitative information that does not follow a fixed format and cannot be easily processed using traditional data tools. It lacks organization and requires advanced methods like AI and machine learning to analyze.**

Examples:



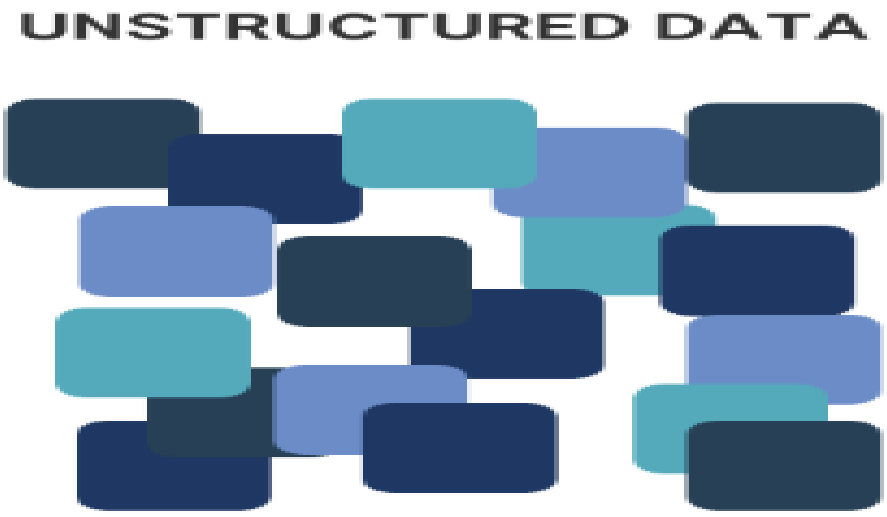
- **Images and videos**
- **Texts and emails**
- **Medical records**

Key Point:

- **No Fixed Structure: Does not follow rows and columns like structured data.**
- **Difficult to Process: Needs advanced tools like AI for analysis.**
- **Mostly Qualitative – Includes words, images, and other non-numerical data.**
- **Found Everywhere – Used in social media, healthcare, business insights, and more.**

Since unstructured data holds valuable insights, businesses and researchers are developing AI-powered tools to extract meaningful information from it.

Experts estimate that about 80% of all the data in today's world is unstructured.



3- Semi-structured data: **Semi-structured data is the middle ground between structured and unstructured data. It does not follow a strict format like structured data but contains some organization through metadata, making it easier to catalog, search, and analyze than unstructured data.**

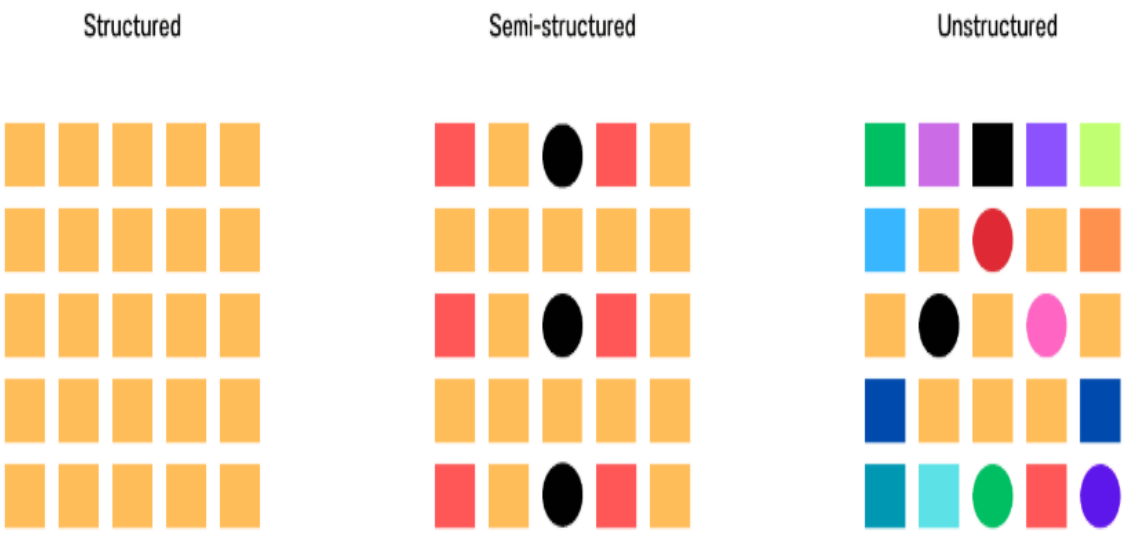
Examples:

- **A video on social media (the video itself is unstructured, but hashtags, captions, and location tags provide structure).**
- **Emails (the text is unstructured, but the sender, recipient, and date fields provide structure).**
- **JSON and XML files (contain structured tags but flexible data inside).**

Key Point:

- **Bridge Between Data Types: Has elements of both structured and unstructured data.**
- **More Complex Than Structured Data: But easier to analyze than unstructured data.**
- **Uses Metadata: Helps categorize and organize information.**

Semi-structured data is valuable because it provides flexibility while still allowing for better organization and analysis compared to fully unstructured data.

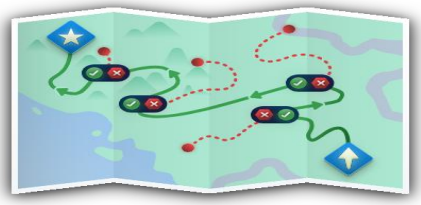


Module 3: Is machine learning the answer to the unstructured data problem?

How AI and Machine Learning Solve Dark Data Problems:

AI can handle dark data without relying on traditional programming instructions. Instead, it uses machine learning to analyze complex, unstructured information much faster than a standard computer.

To understand this, let's take the example of a navigation system trying to find the best route through a busy city. This is a dark data problem because it involves not just a street map but also constantly changing factors like *weather*, *traffic*, and *accidents*.



Two Ways to Solve the Problem:

1- Traditional Rule-Based System (Programmed Instructions):

- **A basic navigation system follows predefined rules based on a fixed street map.**
- **It calculates distances and suggests a route, but it cannot adjust dynamically to new events like traffic congestion.**

2- AI-Powered Machine Learning System:

- **A smart navigation system learns from past traffic patterns and real-time data (e.g., live traffic reports, weather updates).**
- **It continuously updates the best route based on new conditions.**
- **Over time, it improves predictions and suggests faster routes even before a problem occurs.**

Machine learning solves dark data problems by adapting in real time, recognizing patterns, and making smarter, data-driven decisions—something traditional programmed systems cannot do efficiently.

Machine learning uses probabilistic calculation

There are two other ways to contrast classical and machine learning systems. One is deterministic and the other is probabilistic.

1-Deterministic Systems:

- **Follow fixed, pre-programmed rules and a large database of possible outcomes.**
- **Use binary logic: answers are either YES (1) or NO (0), true or false.**
- **Example: A traditional GPS finds a predefined best route and follows it without adjusting for real-time traffic.**

2-Probabilistic Systems:

- **Instead of fixed rules, they analyze and compare possibilities in real-time.**
- **Work with confidence levels rather than binary decisions.**
- **Example: A modern AI-powered GPS does not say, "This is the fastest route." Instead, it says, "I am 84% sure this route is the fastest based on current traffic conditions."**

Key Differences

Feature	Deterministic System	Probabilistic System
Decision Type	**Fixed "YES" or "NO"**	**Confidence-based (e.g., 84% sure)**
Flexibility	**Follows preset rules**	**Adjusts based on new data**
Example	**Old GPS picks a single route**	**AI GPS suggests multiple routes with estimated times**
Nature	**Binary (0 or 1)**	**Analog (gradual changes like waves)**

Why It Matters?

Machine learning systems are more adaptive and can adjust to real-world changes, making them better at handling complex, unpredictable situations like traffic, weather, or business forecasts.

Module 4: Three common methods of machine learning

Machine learning solves problems in three ways:

1. **Supervised learning**
2. **Unsupervised learning**
3. **Reinforcement learning**

1-Supervised learning: Supervised learning is a type of machine learning where an AI model learns by studying labeled data—meaning data that has both input (features) and correct output (labels). This helps AI make accurate predictions.

How Supervised Learning Works:

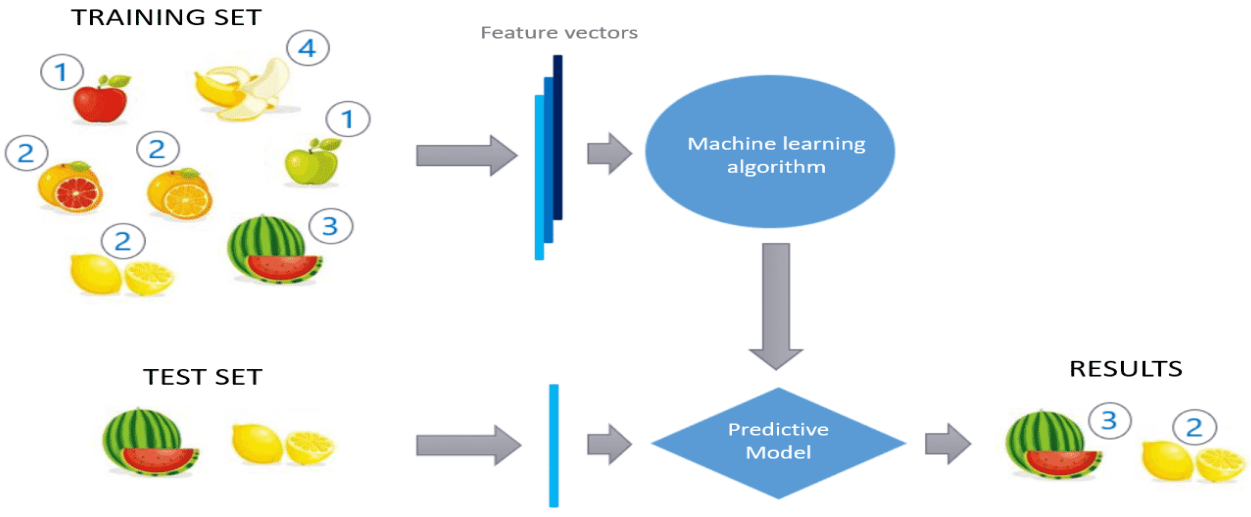
To train a supervised learning model, you need to provide:

1- **Features: Key characteristics of the data (e.g., size, color, shape).**

2- **Labels – The correct category or answer for each data point (e.g., "apple" or "banana").**

Example:

Teaching an AI to recognize fruits—**Features**: Shape, color, weight. **Labels**: Apple, banana, orange. The AI learns from labeled examples to predict a new fruit's name based on similar features.



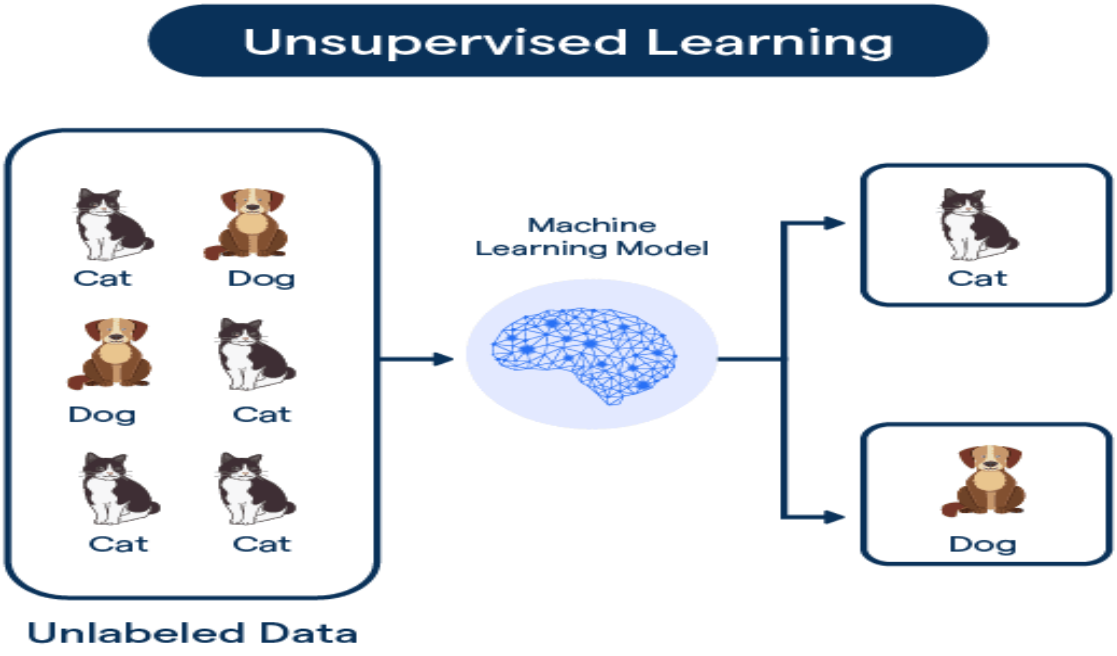
2-Unsupervised learning: **Unsupervised learning is a type of machine learning where an AI model is given a large amount of data but no labels or predefined answers. Instead of being told what the data is, the AI finds patterns and groups similar data on its own.**

How Unsupervised learning works:

1- **A person provides lots of raw data (e.g., images, articles, or numbers).**
2- **The machine analyzes the data and finds patterns or clusters without human guidance.**
3- **When given a new piece of data, the AI can categorize it based on what it has learned.**

Example:

An AI analyzes many photos and articles about dogs without labels, grouping similar features like fur type, ear shape, and size. When shown a new dog photo, it identifies it as part of the same group with reasonable accuracy.



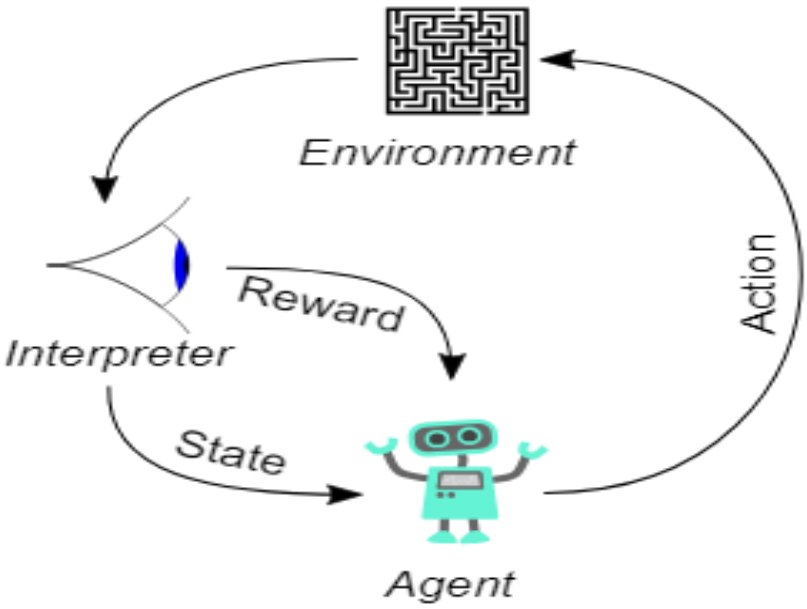
3- Reinforcement learning: Reinforcement learning is a type of machine learning where an AI learns through trial and error rather than from labeled data. It continuously adjusts its behavior based on rewards and punishments to find the best solution for a given task.

How Reinforcement learning works:

1- **The AI (called an agent) starts with no knowledge.**
2- **It tries different actions and observes the results.**
3- **It gets a reward for correct actions and a penalty for mistakes.**
4- **Over time, the AI learns the best way to complete the task efficiently.**

Example:

Imagine teaching a robot to walk—When it takes a good step, it earns a reward (positive reinforcement). If it falls, it receives a penalty (negative reinforcement). Over time, by trial and error, the robot learns to balance and walk efficiently.



The end, Thank you!!