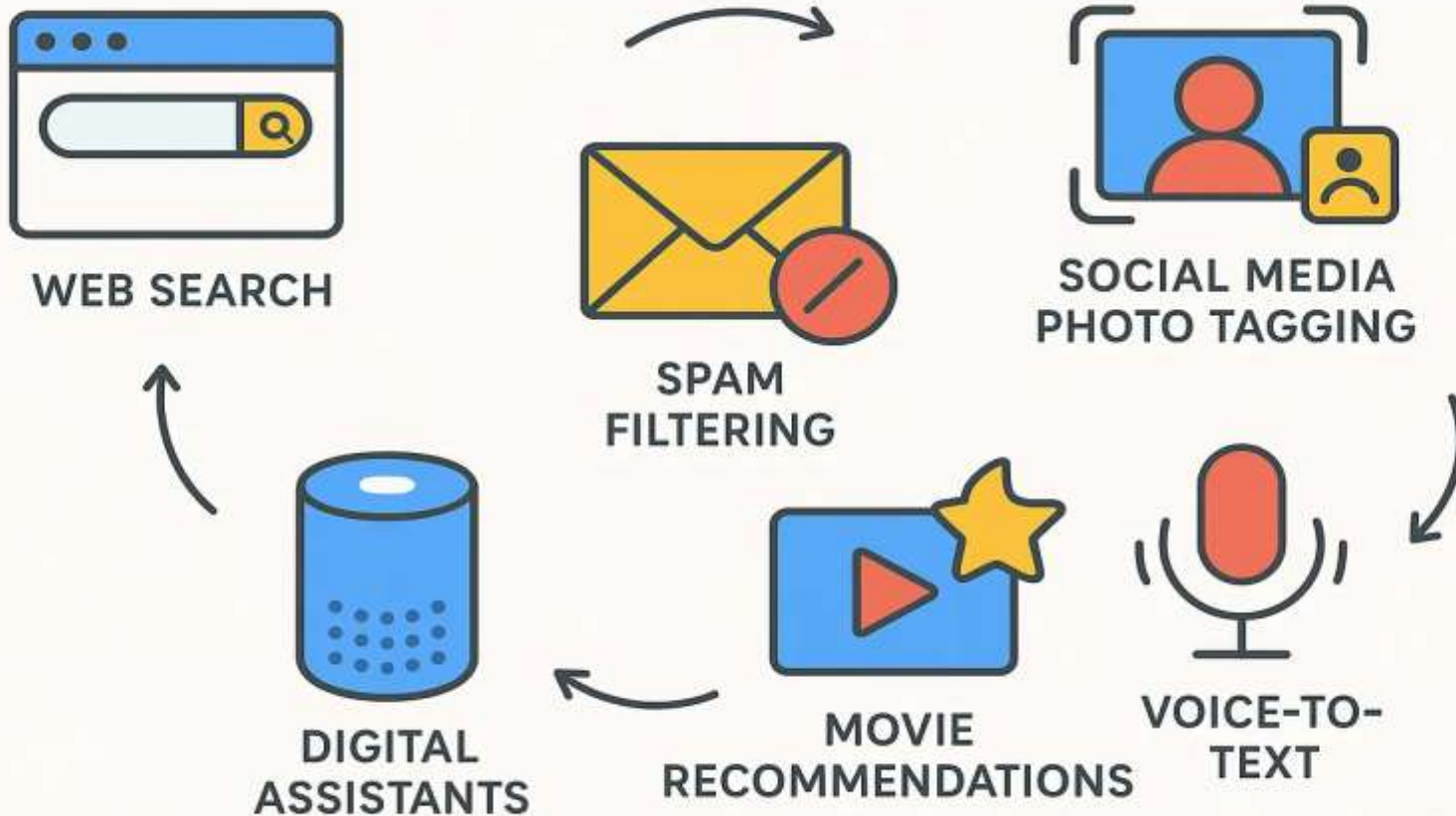Ch 2.1

Machine Learning: Definition and Applications

Content

- What machine learning means
- How machines learn from data
- Why machine learning is important
- Types of machine learning
- Common applications of machine learning
- The impact of machine learning on different fields
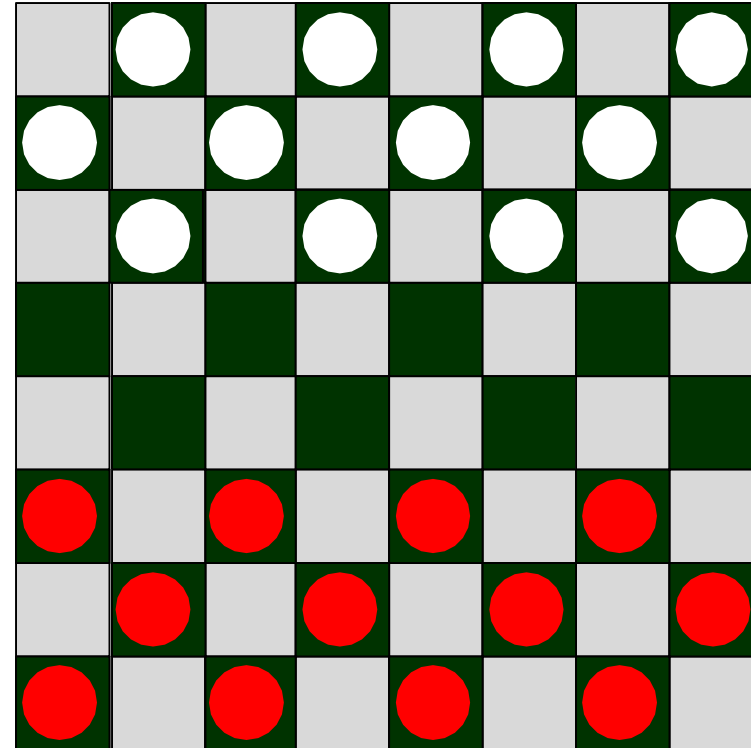- Key ideas and conclusion

Unvelling the Magic of ML

EVERYDAY USES OF
MACHINE LEARNING

WEB SEARCH

SPAM FILTERING

SOCIAL MEDIA PHOTO TAGGING

DIGITAL ASSISTANTS

MOVIE RECOMMENDATIONS

VOICE-TO-TEXT

Definition of Machine learning

"Field of study that gives computers the ability to learn without being explicitly programmed."

Arthur Samuel (1959)

The Impact of Learning Volume

- The more chances a learning algorithm has to practice, the better it becomes.

- Samuel's checkers program improved because it played a very large number of games against itself.

- He programmed the computer to play **thousands of self-play games**, learning from each outcome.

- Over time, the program became stronger and eventually outperformed Samuel himself.

Question

If the checkers program had been allowed to play only ten games (instead of tens of thousands) against itself, a much smaller number of games, how would this have affected its performance?

○ Would have made it better

○ Would have made it worse

What is Machine Learning?

Machine learning is a field of AI that lets computers learn from data and improve performance without being explicitly programmed

Computer (with Machine Learning)

Uses Algorithms

Learns from Data

No Explicit Programming
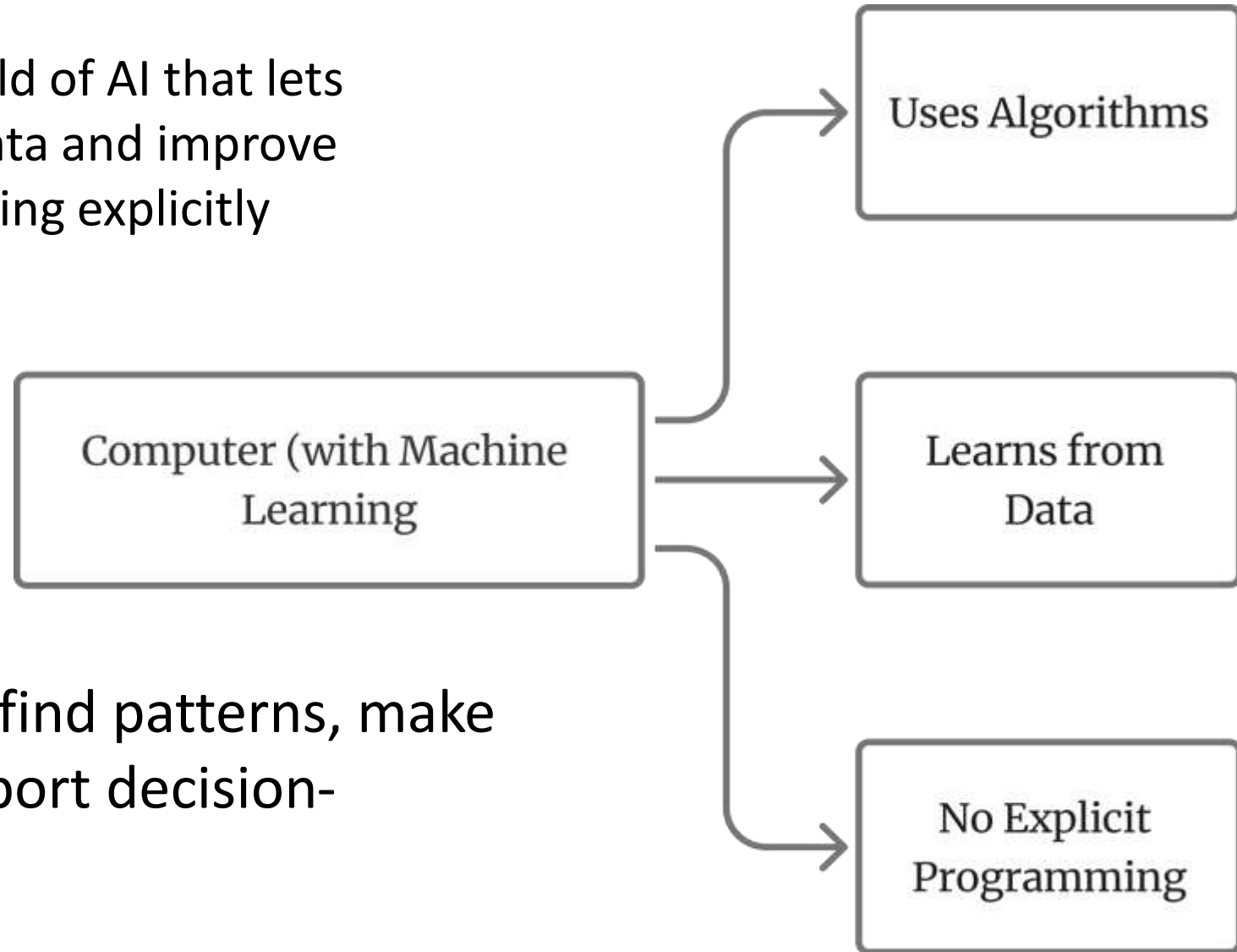
It uses algorithms to find patterns, make predictions, and support decision-making.

The Significance of Machine Learning:

- Many real-world tasks are too complex to code with fixed rules.

- Machine learning replaces manual programming by learning patterns automatically from data.

- This makes it a powerful approach for building intelligent systems.

Machine learning does what coding can't—it learns the rules instead of needing them written.

Examples of tasks that are hard to program

- Web searches,
- Speech recognition,
- Medical diagnosis from x-rays,
- Developing self-driving cars.
- Speech recognition,
- Computer vision for google maps street view images,
- Advertising.
- Large scale agriculture
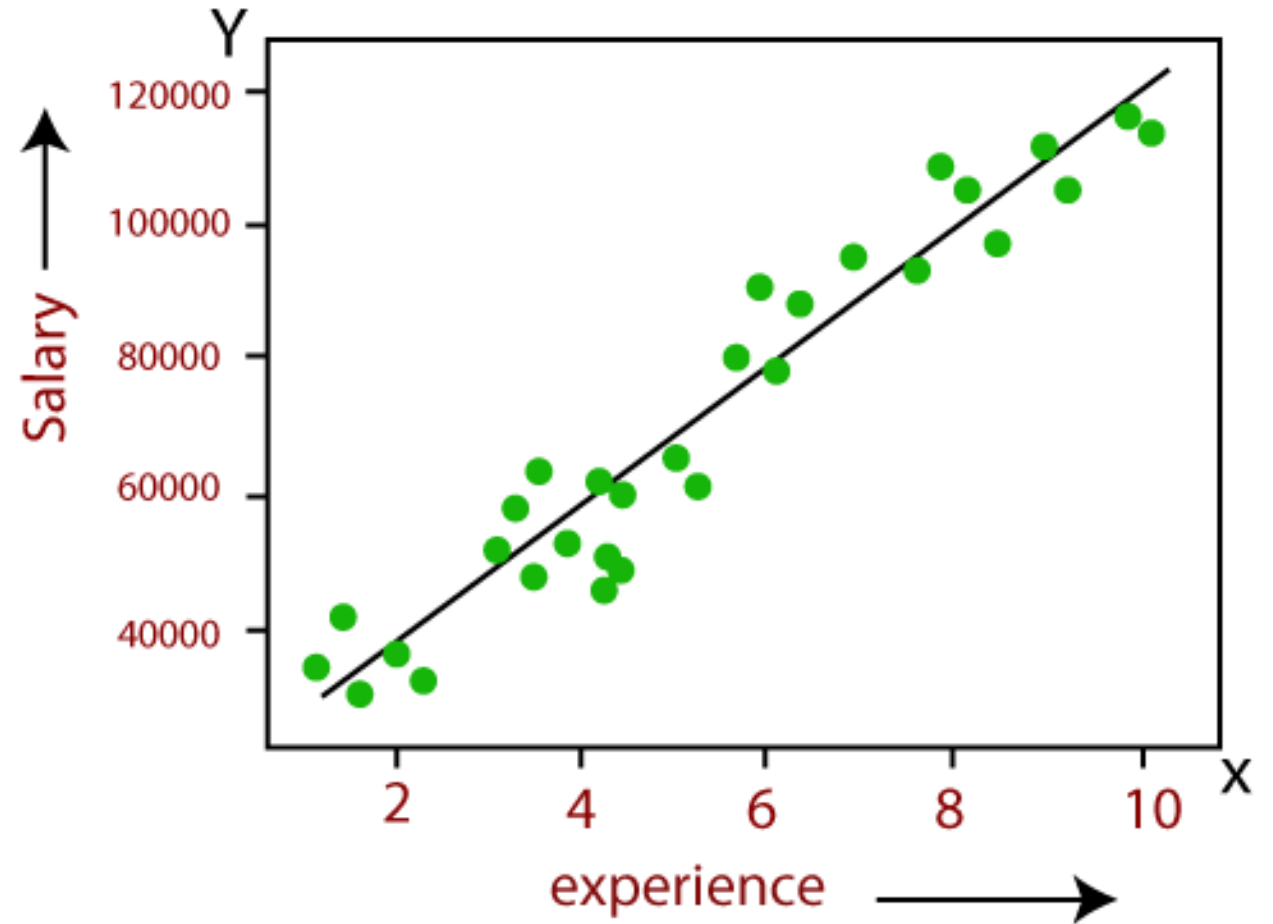
→ The solution of all of these tasks is machine learning

Types of Machine Learning

- Supervised Learning

- Unsupervised Learning

- Reinforcement Learning

Unsupervised Learning
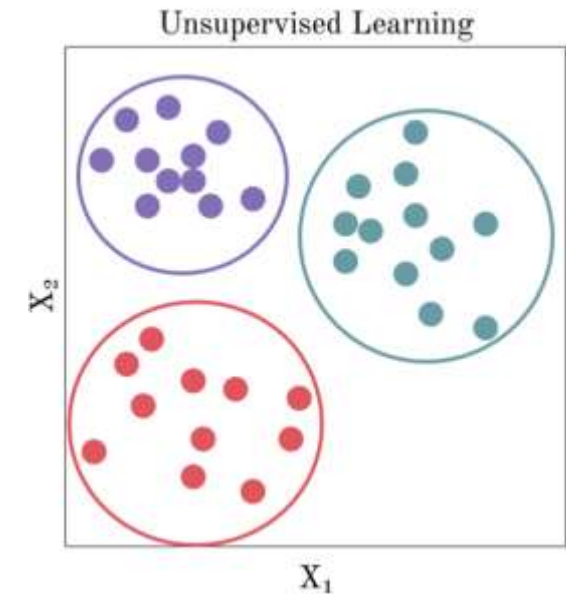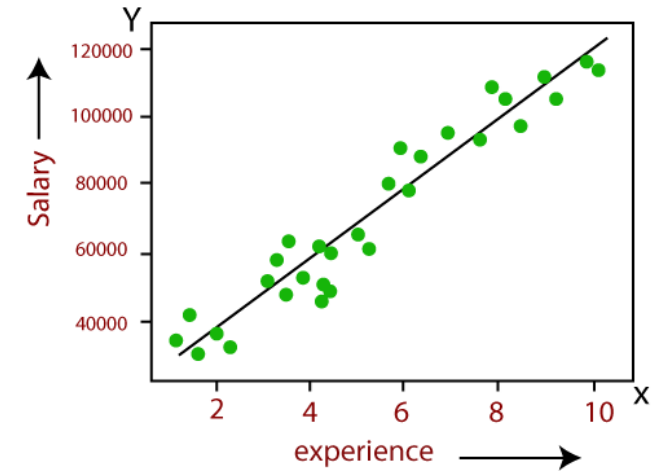
Supervised Learning

| Experience (years)	Salary (USD)
2	40,000
3	48,000
4	55,000
5	62,000
6	70,000
7	78,000
8	90,000
9	105,000
10	118,000

Supervised learning trains a model using labeled examples—like experience paired with salary—so it can learn the relationship and predict salaries for new experience values.

Unsupervised Learnin

Unsupervised learning, on the other hand, focuses on finding inherent structures or patterns within data without the assistance of labeled information.

For instance, it can group customers with similar purchasing behaviors in e-commerce, helping businesses offer more targeted recommendations.

Unsupervised Learning
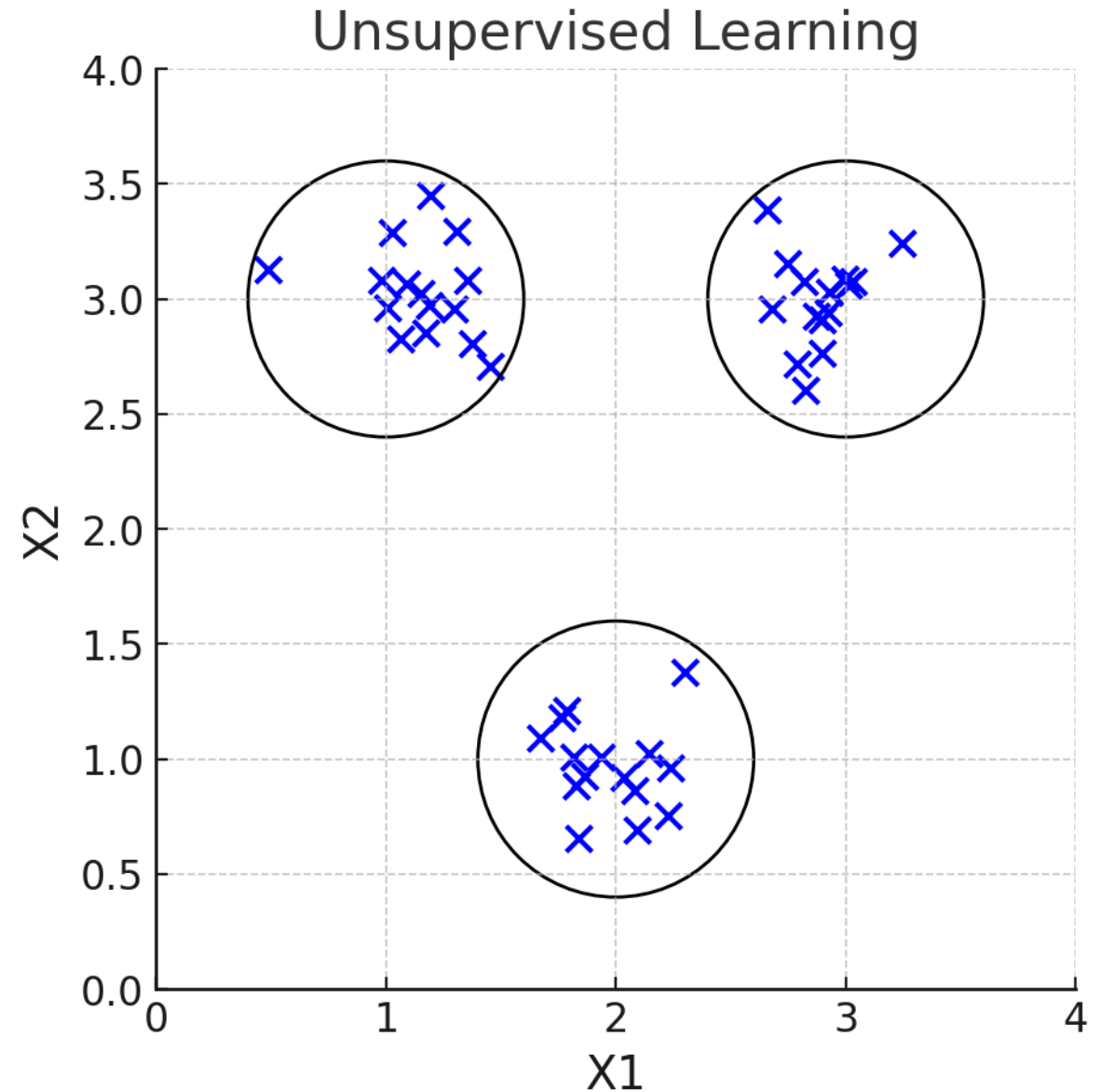
Reinforcement Learning

Reinforcement learning involves training agents to make a sequence of decisions in a dynamic environment.

It's like teaching a robot to navigate a complex maze or a game character to make optimal moves. The agent learns by receiving rewards or penalties for its actions, gradually improving its decision-making process.

Applications of Machine Learning

- Image and Speech Recognition

  Examples: Facial recognition, voice assistants

- Natural Language Processing (NLP)

  Examples: Chatbots, language translation, sentiment analysis

- Recommendation Systems

  Examples: Product recommendations, movie suggestions

- Autonomous Vehicles

  Examples: Self-driving cars, autonomous drones

- Healthcare and Medical Diagnosing

  Examples: Disease detection, personalized treatment, drug discovery

Unlocking Value of Machine Learning:

- AI and ML are expected to add **$13 trillion USD** in value by 2030.

- Rapid global growth driven by **generative AI** and automation.

- ML is expanding beyond software into **healthcare, finance, retail, energy, and transportation**.

- Countries and companies are investing heavily in AI adoption.

- Demand for ML talent is rising fast—making now the best time to learn ML.

Conclusion

Machine learning is not just a buzzword but a transformative technology with applications in numerous domains.

It empowers computers to handle complex tasks, make accurate predictions, and unlock the potential of data-driven decision-making. As we continue to advance in this field, the possibilities are endless.