Introduction to Machine Learning

What is Machine Learning (ML)?

Machine Learning is a way of teaching computers to learn from data and improve over time without being explicitly programmed. Instead of following fixed rules, the computer adjusts itself using examples and experience. ML is a subset of Artificial Intelligence (AI) — AI is the broader field, and ML is one of its main tools.

How Does It Work?

ML uses algorithms — mathematical models or procedures that act as building blocks. These algorithms analyze data, learn patterns, and make predictions or decisions. Unlike normal programs that only store and retrieve data, ML systems learn and improve automatically with more data.

Why Do We Need Machine Learning?

Earlier systems used manually crafted if–else rules for decision-making. Example: a spam filter that flags an email as spam if it contains certain blacklisted words. **Disadvantages:** 1. Domain-Specific: Each new task requires writing new rules from scratch. 2. High Human Effort: Requires deep understanding and detailed logic for every decision.

Need for Learning from Data

Modern applications involve huge amounts of data — it’s impossible to manually design rules for every scenario. ML allows systems to automatically learn from data and adapt to new situations.

Example: Face Detection

Detecting faces in images was extremely difficult using manual rules because: - Computers interpret images as pixels, not as “faces” like humans do. - Writing exact rules for what a “face” looks like in pixel form is nearly impossible. With ML, the system can learn to recognize faces by being shown many example images of faces.

Conclusion

Machine Learning helps computers: - Learn from examples instead of rules - Adapt and improve over time - Handle complex, data-driven tasks like face detection, spam filtering, and more