

## Applications in Different Sectors

- Retail Sector
  - ML helps predict product demand, optimize stock levels, and personalize recommendations on platforms like Amazon and Flipkart.
  - Targeted marketing and customer profiling enhance user engagement and increase sales.
- Banking and Finance
  - ML is used for credit risk assessment, loan sanctioning, fraud detection, and investment strategies.
  - Helps automate decision-making processes and personalize financial products.
- Transportation
  - Applications include dynamic pricing, demand forecasting, route optimization, and driver dispatching (examples: Ola, Uber).
  - Predictive analytics improve operational efficiency and customer satisfaction.
- Manufacturing
  - Automation using ML-driven robotic arms in assembly lines increases productivity and quality control.
  - Predictive maintenance anticipates machine failures, reducing downtime and repair cost.
- Consumer Internet
  - Platforms like YouTube and social media use ML for content recommendation, sentiment analysis, and personalized experiences.
  - Sentiment analysis on review sites (e.g., IMDb) helps understand user opinions and improve services.

### Key Insights

- ML is deeply integrated into both B2C (business to customer) and B2B (business to business) environments, fuelling profits and innovation.
- It influences multiple facets of modern life, from e-commerce and banking to transportation and entertainment, often in ways users may not directly realize.
- The technology continues to evolve and proliferate, driving smarter and more adaptive systems across sectors.

## Machine Learning Development Life Cycle (MLDLC)

### Key Steps in the Machine Learning Life Cycle

1. Gathering Data
  - Collect relevant data required for solving the problem; quality and quantity of data are essential.
2. Data Preparation
  - Clean, preprocess, and format data to handle missing values, duplicates, and inconsistencies for better model training.
3. Data Wrangling
  - Explore and transform data, including feature engineering and selection, to highlight important aspects for the model.
4. Analyse Data (Exploratory Data Analysis - EDA)
  - Use statistical and visualization techniques to understand data distribution, relationships, and patterns.
5. Train the Model
  - Use appropriate algorithms with training data to build models that learn data patterns.
6. Test the Model
  - Evaluate model performance on test data to assess accuracy and generalization ability.
7. Deployment
  - Integrate the trained model into a production environment where it can make predictions on new data.
8. Beta Testing and Optimization (Additional Steps)
  - Conduct beta testing with real users to gather feedback, refine the model, optimize parameters, and improve performance.

### Four key data science and machine learning job roles:

Data Engineer, Data Analyst, Data Scientist, and Machine Learning Engineer

#### Data Engineer

- Responsible for collecting, organizing, and preparing data for analysis and use by others.
- Works on building and maintaining data pipelines, databases, and data warehouses.
- Requires strong software and database knowledge, familiarity with data architecture, and programming skills.
- Critical role for ensuring high-quality data availability for ML models and analytics.

#### Data Analyst

- Entry-level role focused on translating numerical and raw data into understandable reports and insights.
- Proficient in tools like Excel, SQL, and programming basics (e.g., Python).
- Works closely with business teams to analyze past data trends and assist in decision making.
- Can progress toward data engineering or data science roles with experience.

#### Data Scientist

- Senior role that builds predictive models using advanced techniques like machine learning, clustering, and neural networks.
- Develops actionable business insights by analyzing data and collaborating with analysts and engineers.
- Requires deep expertise in statistics, ML algorithms, and strong programming skills.
- Often responsible for end-to-end data product development including model deployment.

#### Machine Learning Engineer

- Focuses on taking machine learning models created by data scientists and productionizing them.
- Works on model optimization, integration into applications/websites, and model maintenance.
- Requires expertise in both software engineering and ML, bridging gaps between data science and software development teams.

#### Summary Comparison

| Role           | Focus                                    | Skills Required                         | Seniority           |
|----------------|------------------------------------------|-----------------------------------------|---------------------|
| Data Engineer  | Data infrastructure and pipelines        | Software dev, databases, big data tools | Junior to Mid-Level |
| Data Analyst   | Data cleaning, reporting, basic insights | Excel, SQL, basic programming           | Entry-Level         |
| Data Scientist | Advanced modeling, analytics, insights   | ML, statistics, programming             | Senior              |
| ML Engineer    | Model deployment and engineering         | Software engineering, ML, system design | Mid-Level to Senior |