

# **DSM5012C**

## **Data Analytics Using Tools**

### **Unit No:1 Analytics Foundations**

SEMESTER: 2

PREPARED BY: Ms.Meghna Panara

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# Concept of Data Analytics and Analytical Thinking

## What is Data?

- Raw facts, figures, symbols, or observations.
- Can be numbers, text, images, audio, or video.
- Example: Sales amount, temperature reading, student marks.

## What is Analytics?

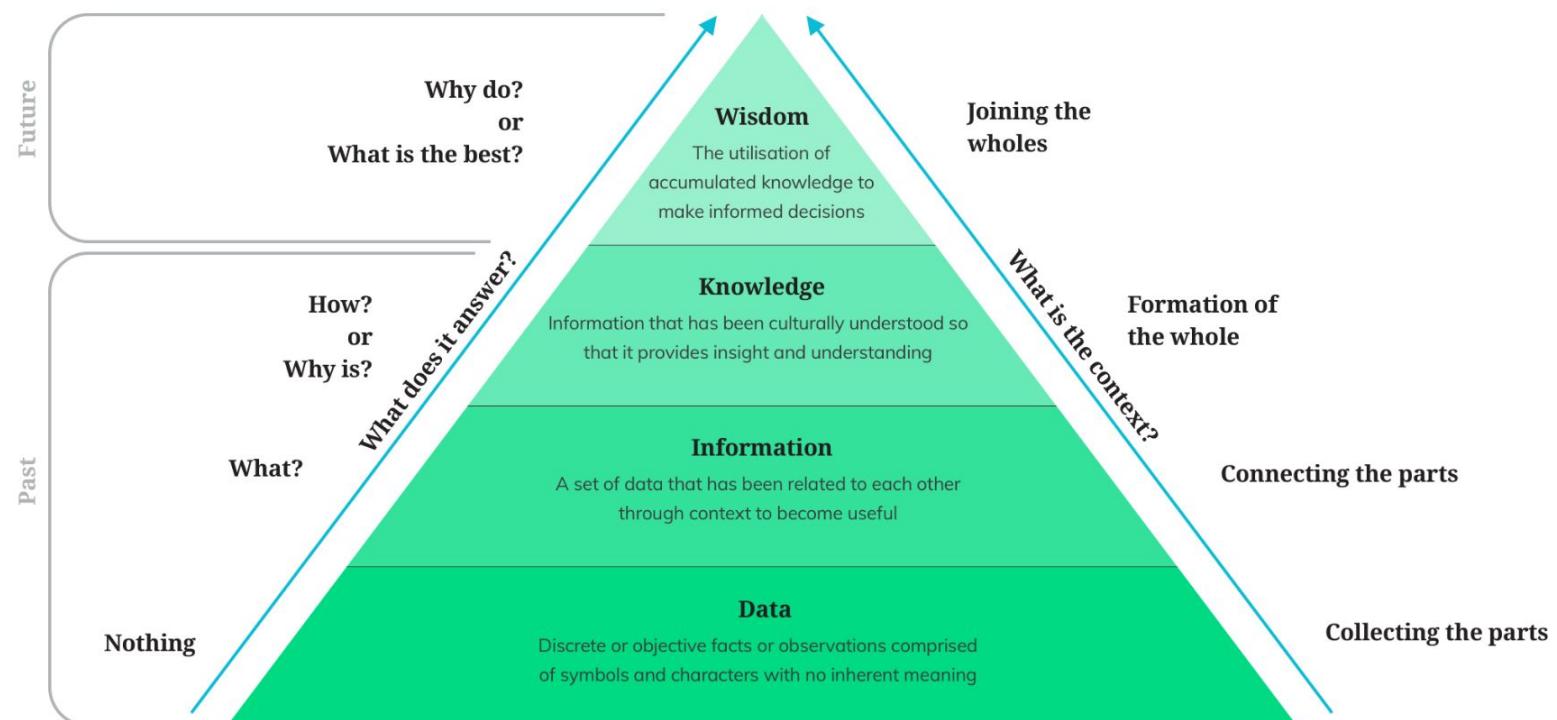
- The systematic computational analysis of data.
- Process of discovering patterns and insights.

## Definition of Data Analytics:

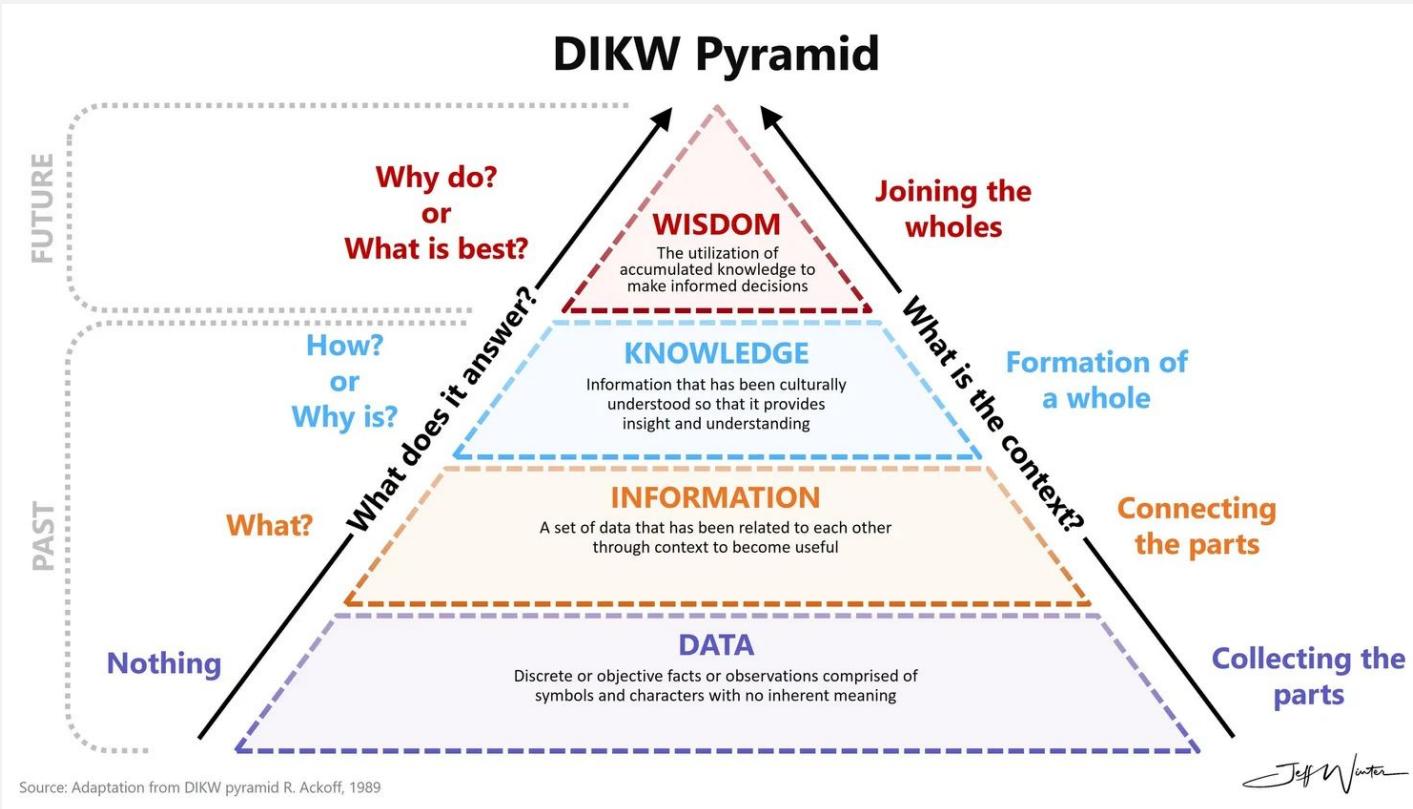
Data Analytics is the process of examining, cleaning, transforming, and modeling data to discover useful information, draw conclusions, and support decision-making.

# Concept of Data Analytics and Analytical Thinking

**Data, information, knowledge and wisdom  
(DIKW) pyramid**



# Concept of Data Analytics and Analytical Thinking



**Data** – Raw facts (e.g., 100, 200, 150)

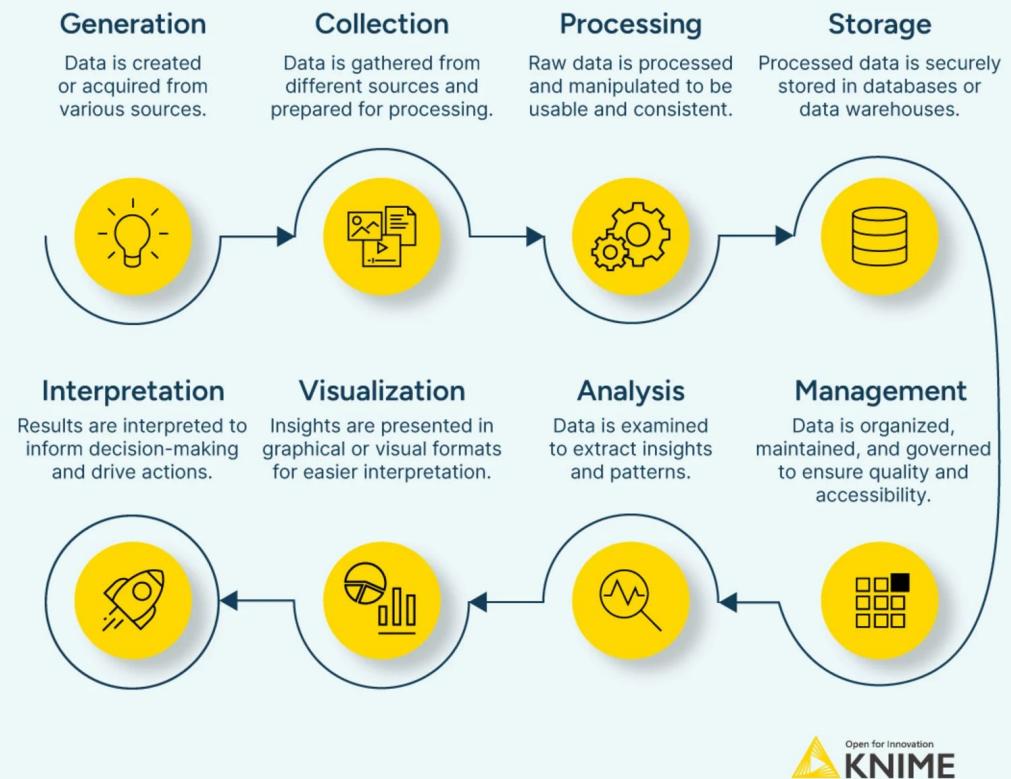
**Information** – Organized data (Monthly Sales Report)

**Knowledge** – Insights (Sales increased in December)

**Decision** – Action (Increase production next month)

# Concept of Data Analytics and Analytical Thinking

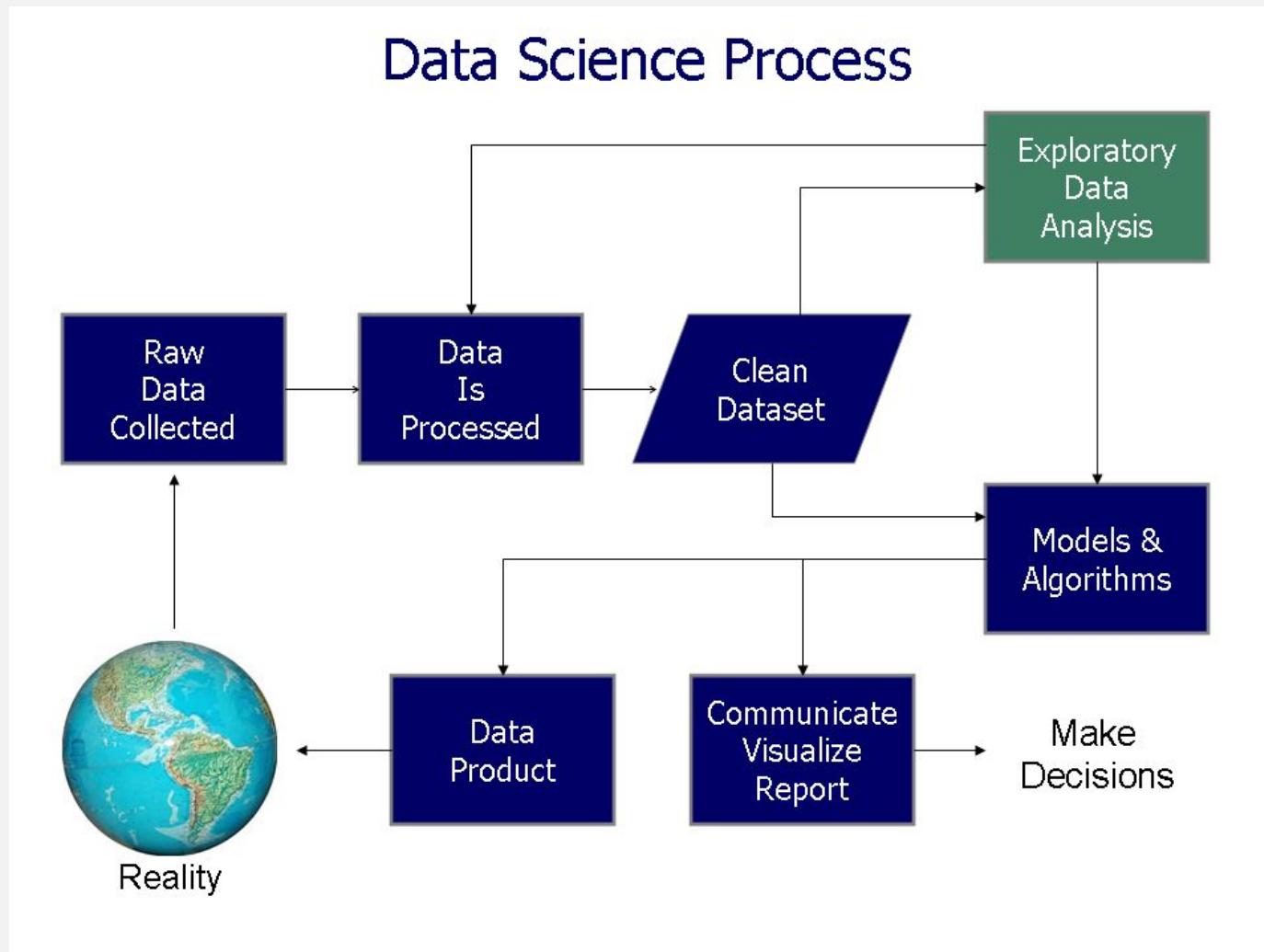
## The Data Lifecycle



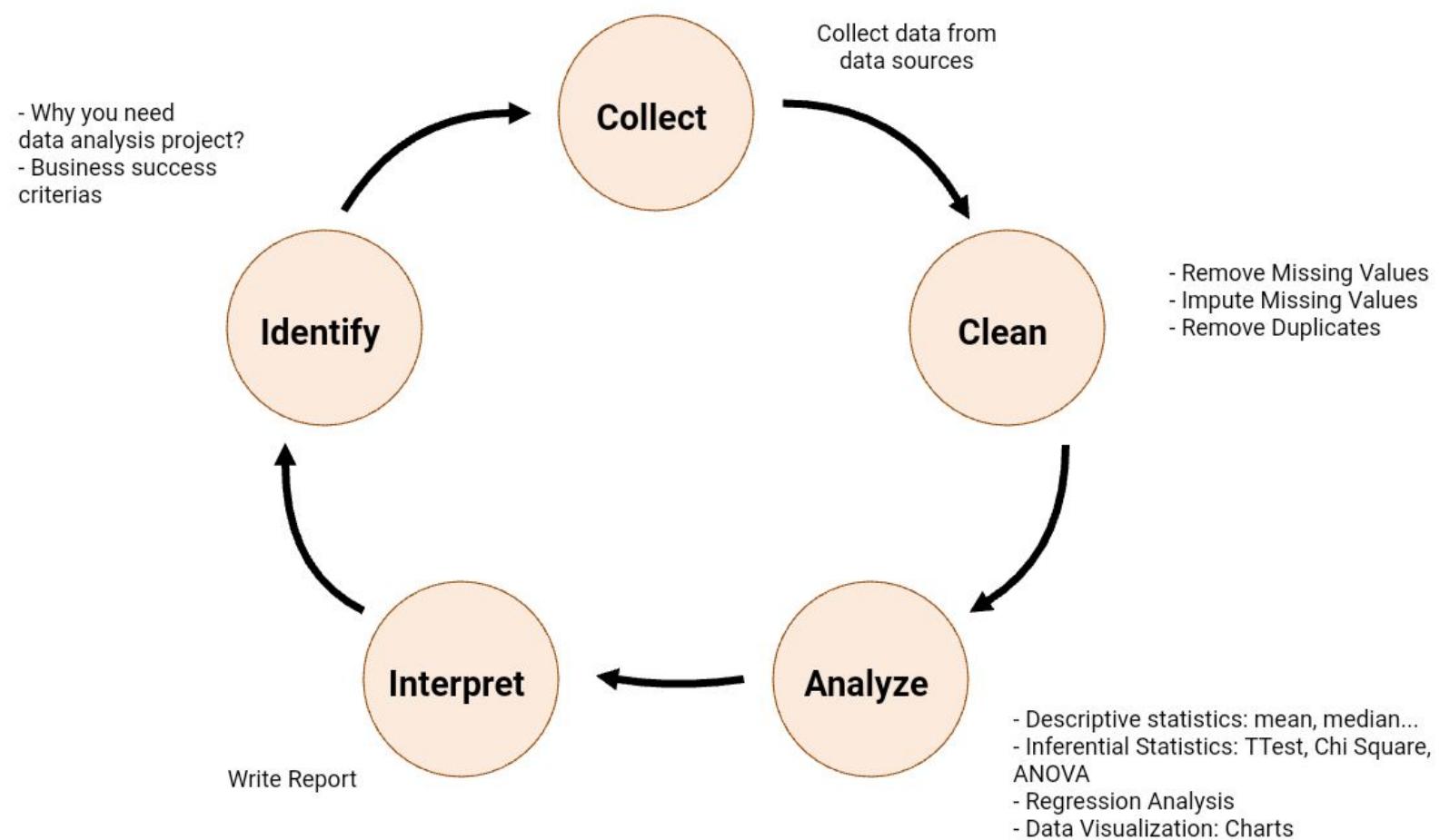
## Key Components:

1. Data Collection
2. Data Cleaning
3. Data Processing
4. Data Analysis
5. Data Visualization
6. Interpretation & Decision Making

# Concept of Data Analytics and Analytical Thinking



# Concept of Data Analytics and Analytical Thinking



# Concept of Data Analytics and Analytical Thinking

## What is Analytical Thinking?

### Definition:

Analytical Thinking is the ability to break complex problems into smaller parts, examine them logically, and make data-driven decisions.

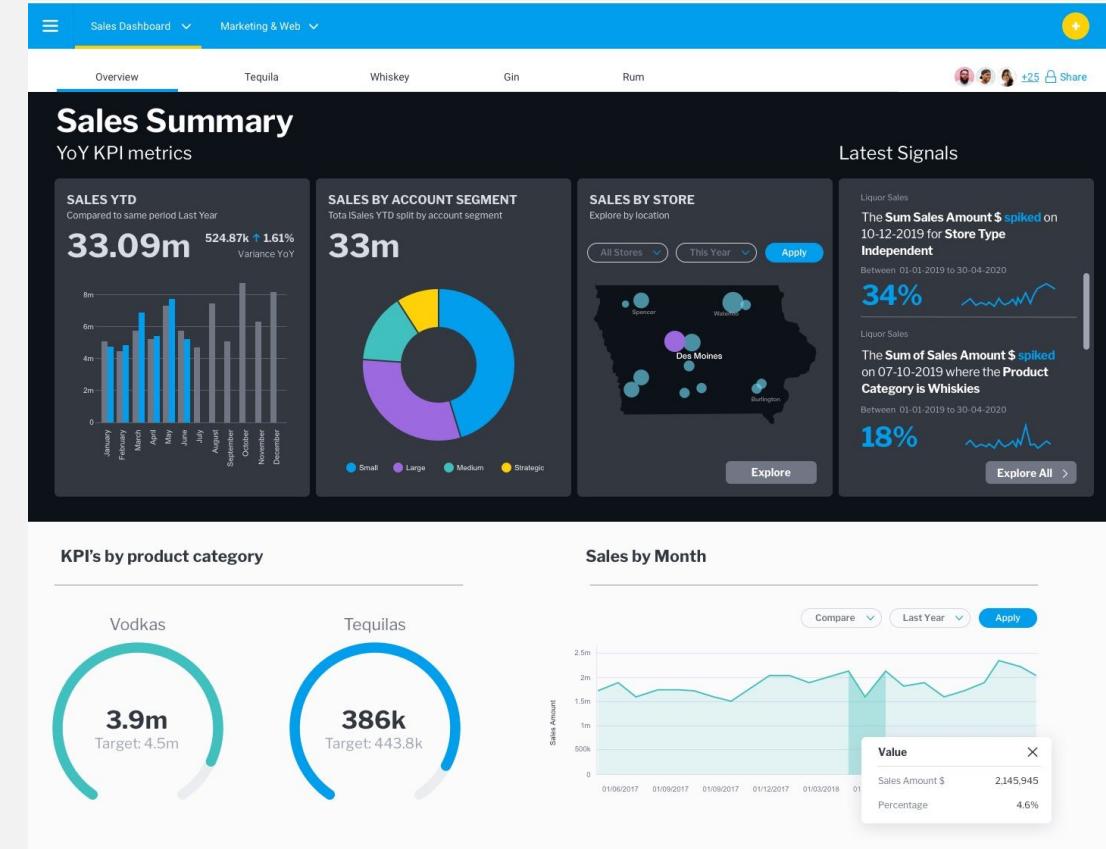
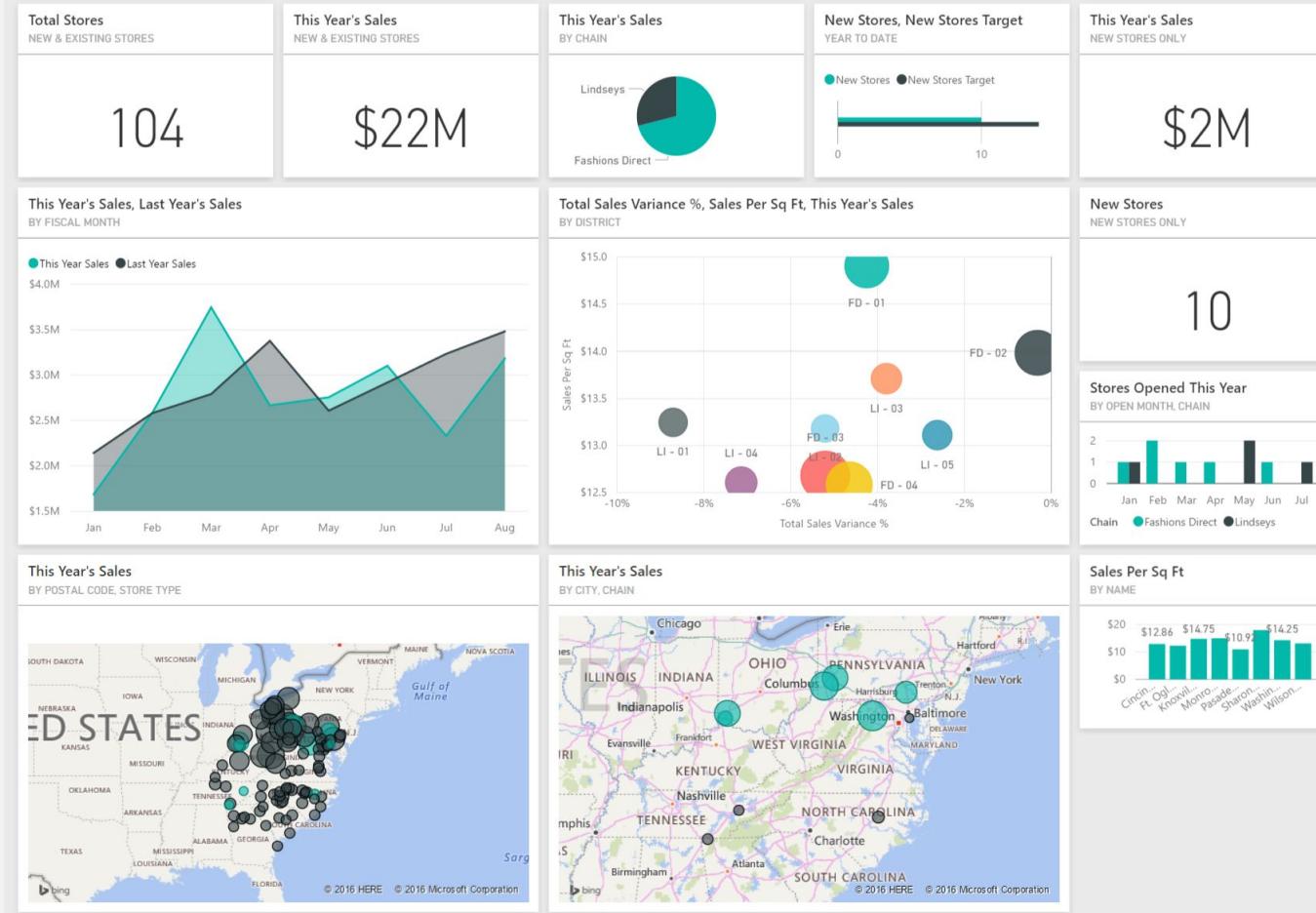
### Key Skills:

- Logical reasoning
- Critical thinking
- Pattern recognition
- Problem-solving
- Data interpretation

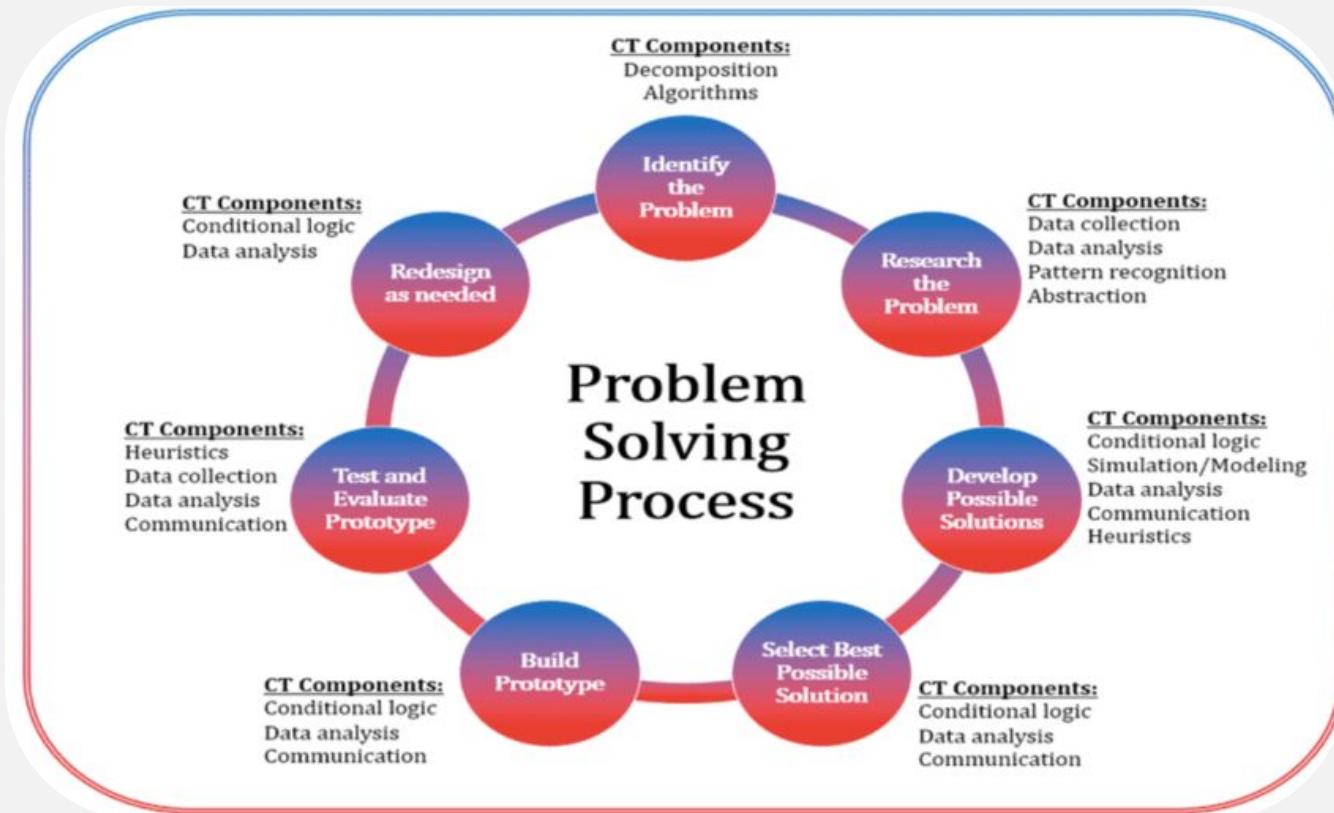
# Concept of Data Analytics and Analytical Thinking

Retail Analysis Sample

Ask a question about your data



# Concept of Data Analytics and Analytical Thinking



## Steps:

1. Identify the Problem
2. Collect Relevant Data
3. Analyze the Data
4. Interpret Results
5. Make Decisions
6. Evaluate Outcomes

# Concept of Data Analytics and Analytical Thinking

## Example of Analytical Thinking in Real Life

### Scenario: Low Sales in a Store

Instead of guessing:

- **✗** “Maybe customers don’t like products.”

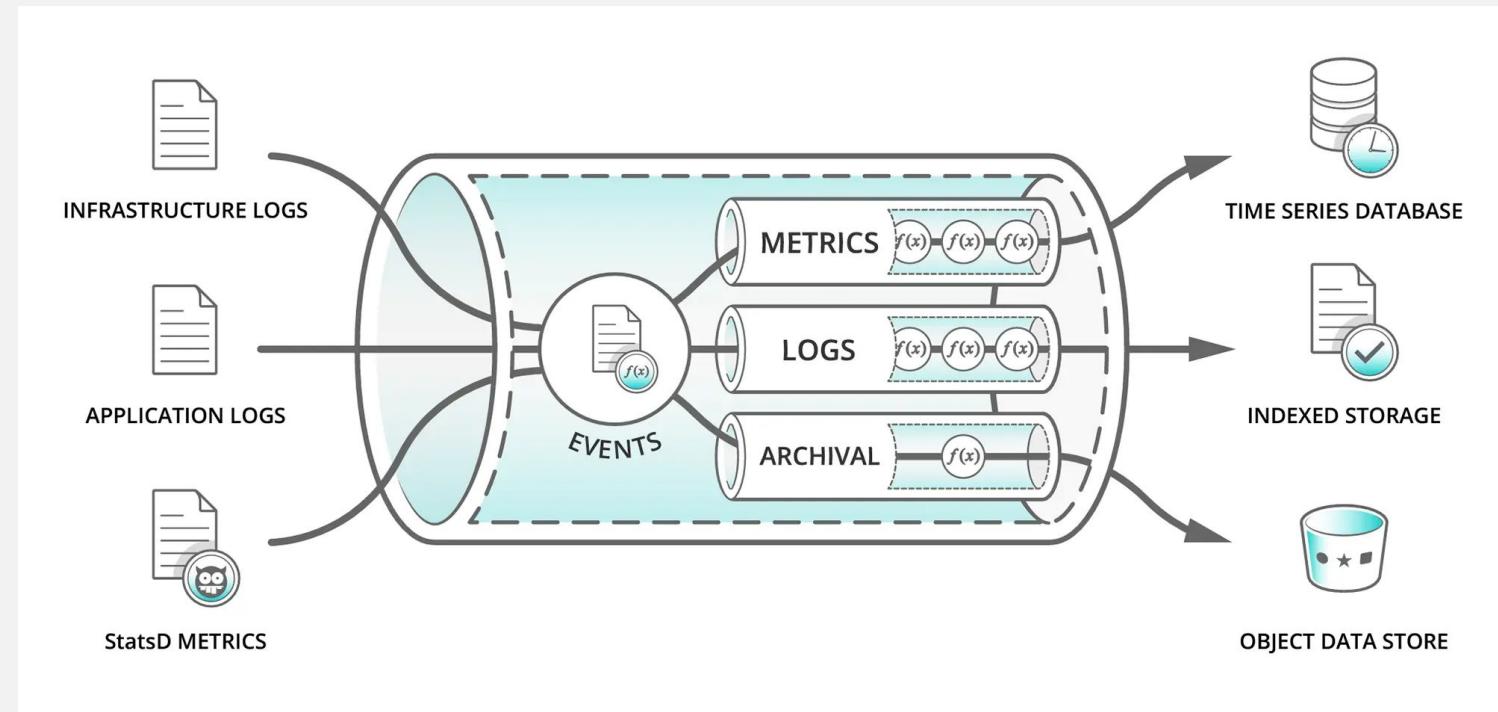
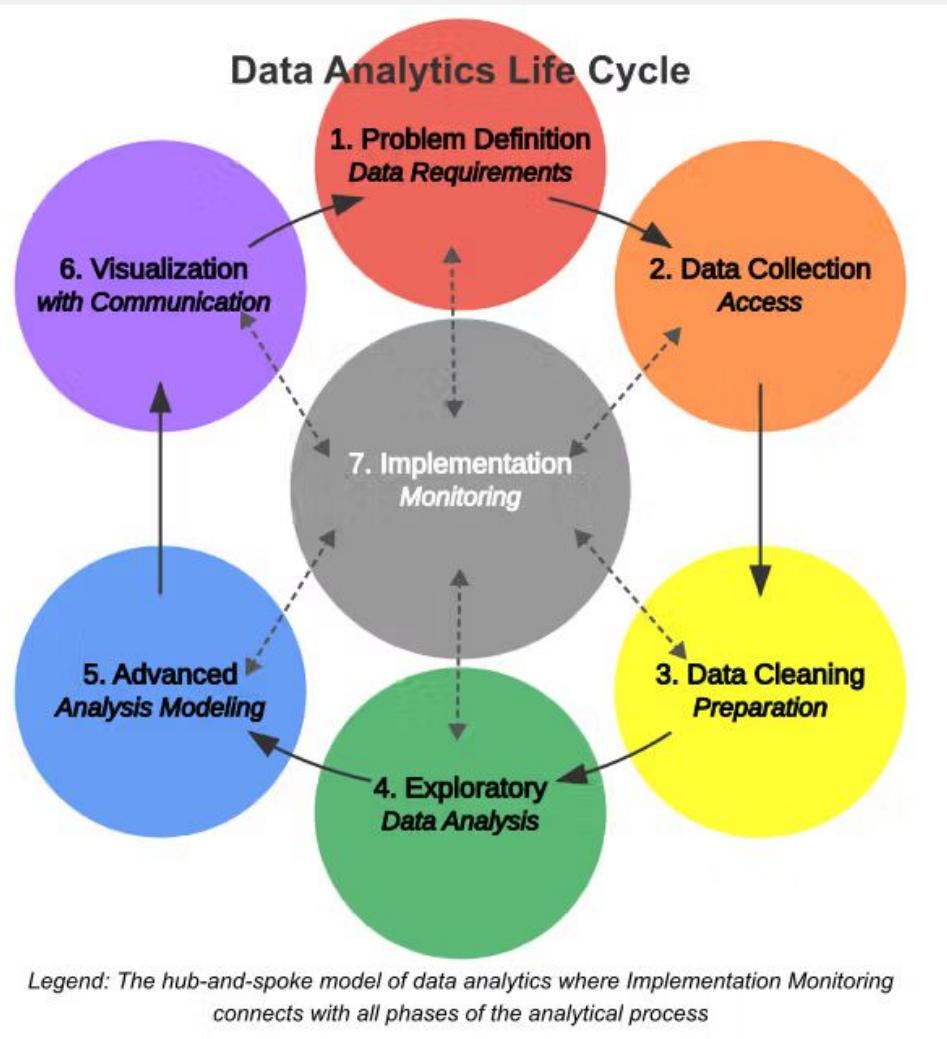
Use Analytical Thinking:

- Check monthly sales data.
- Compare weekdays vs weekends.
- Analyze product categories.
- Study customer feedback.
- Identify root cause (e.g., price increase).

### Characteristics of Analytical Thinker

- Data-driven mindset
- Curious and questioning attitude
- Objective decision-making
- Detail-oriented
- Evidence-based reasoning

# Concept of Data Analytics and Analytical Thinking



# Concept of Data Analytics and Analytical Thinking

## Difference Between Intuition and Analytical Thinking

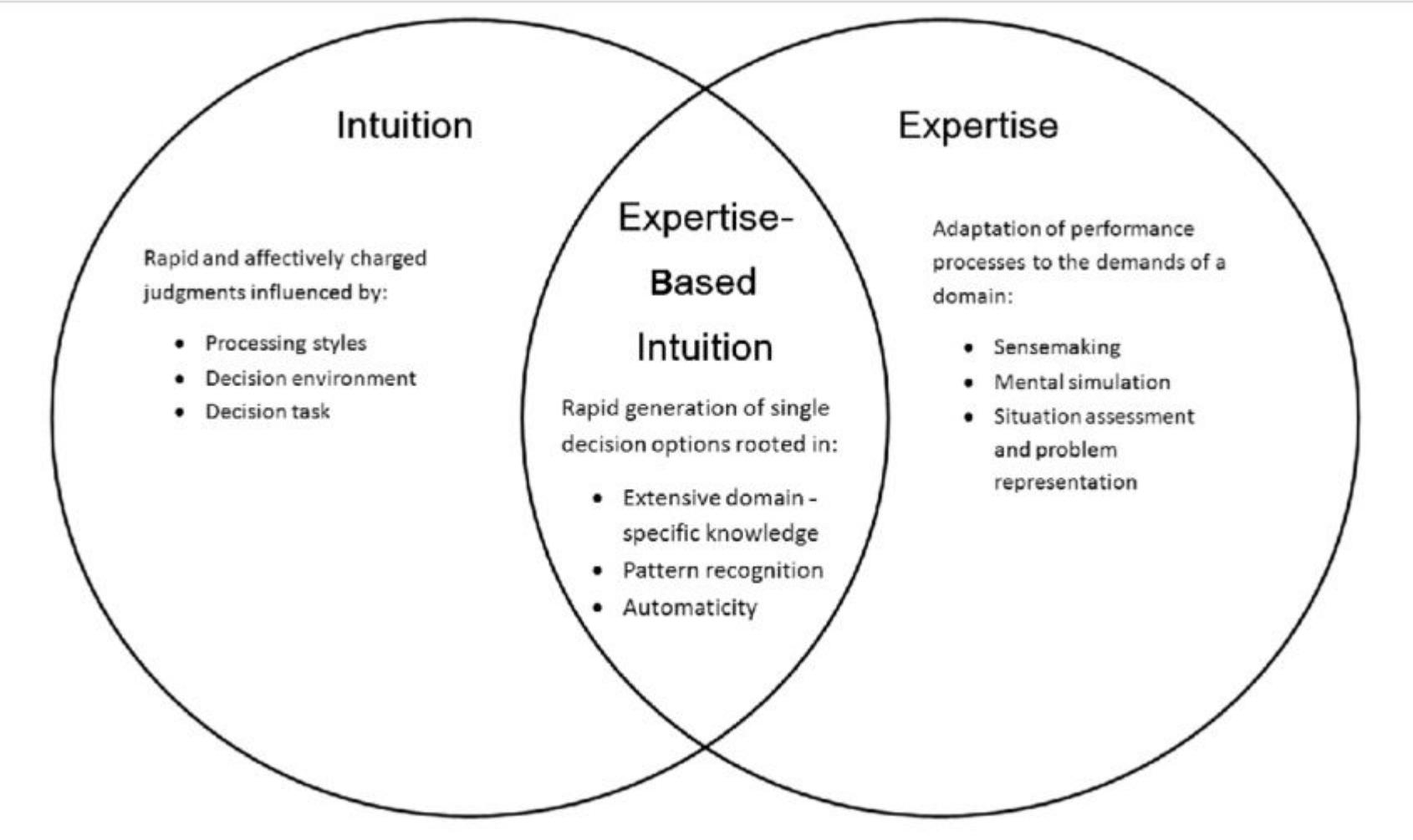
Intuition	Analytical Thinking
Based on feeling	Based on data
Quick decision	Structured decision
Subjective	Objective
Experience-based	Evidence-based

## Tools Used in Data Analytics

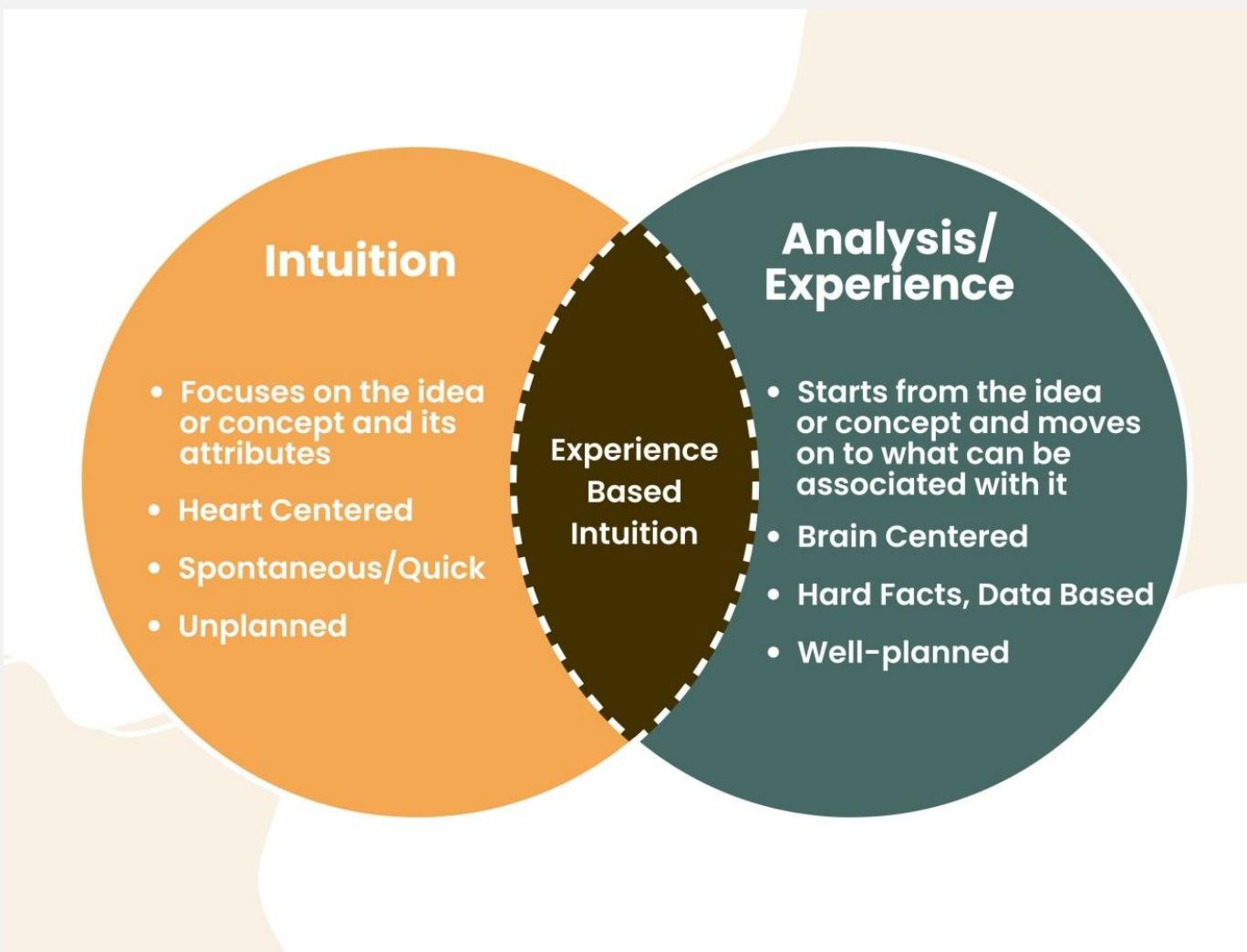
- Excel
- SQL
- Python
- R
- Power BI
- Tableau

These tools help convert raw data into meaningful insights.

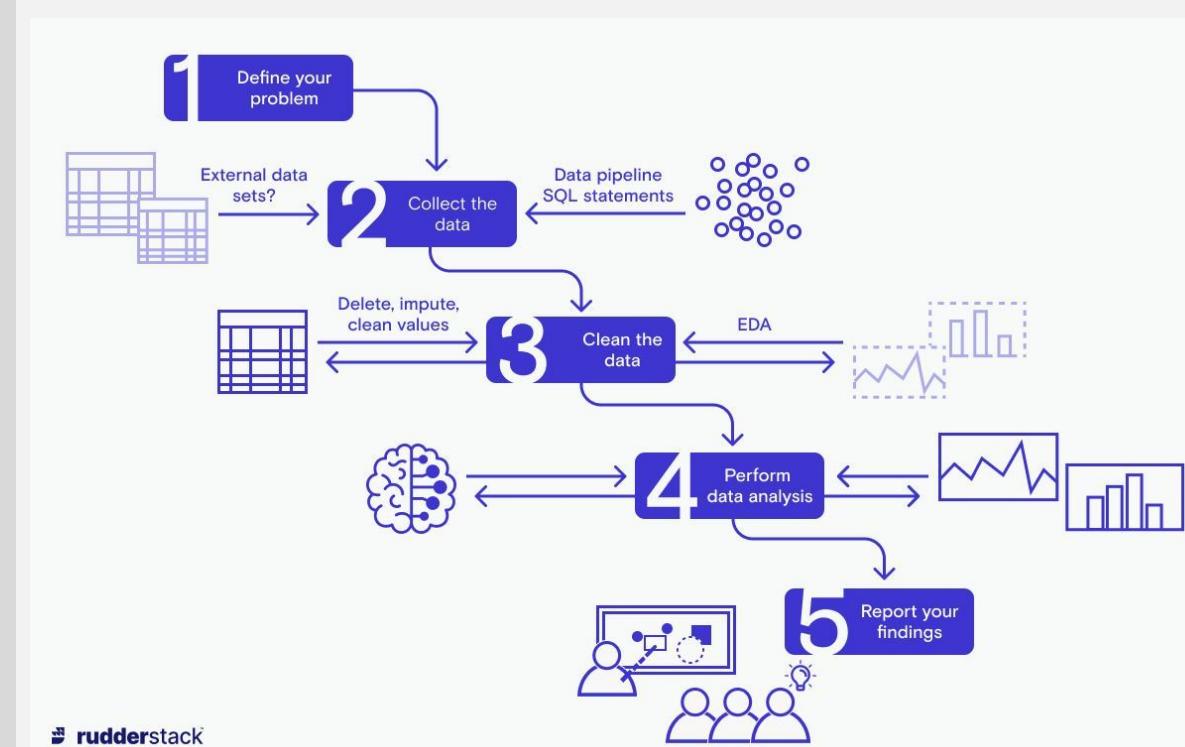
# Concept of Data Analytics and Analytical Thinking



# Concept of Data Analytics and Analytical Thinking



# Concept of Data Analytics and Analytical Thinking



# Concept of Data Analytics and Analytical Thinking

## **Applications of Data Analytics      Benefits of Analytical Thinking in Organizations**

- Healthcare – Disease prediction
  - Banking – Fraud detection
  - Retail – Customer behavior analysis
  - Education – Student performance analysis
  - Manufacturing – Quality control
- Better strategic planning
  - Accurate forecasting
  - Improved efficiency
  - Risk reduction
  - Stronger business growth

# Concept of Data Analytics and Analytical Thinking

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## Benefits of Data Analytics

- Personalised customer experience
- Better decision-making
- Customer retention and loyalty
- Improved work efficiency
- Streamlined operations
- Fraud detection and risk management
- Cost reduction and financial optimisation
- Competitive advantage
- Enhanced security

## 6 Key Components of Data Analytics

-  Data Collection
-  Data Cleaning
-  Data Transformation
-  Data Analysis
-  Data Visualization
-  Decision Making

PHYGITAL<sup>TM</sup>  
INSIGHTS

# Evolution and Scope of Data Analytics in Industry

## Early Era (1960–1990) – Traditional Data Processing

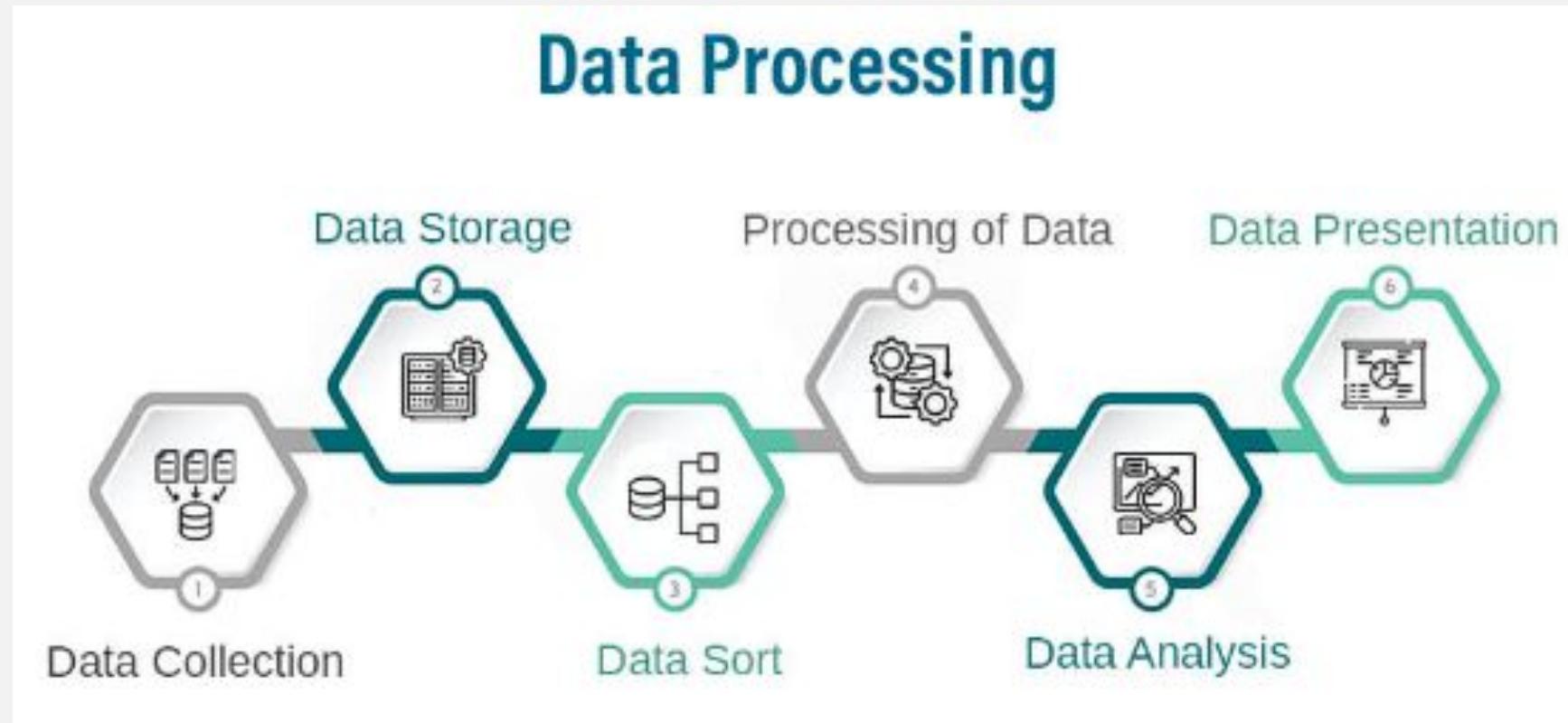


### Characteristics:

- Manual record keeping
- Basic spreadsheets
- Mainframe computers
- Simple reports
- Structured data only

# Evolution and Scope of Data Analytics in Industry

## Early Era (1960–1990) – Traditional Data Processing

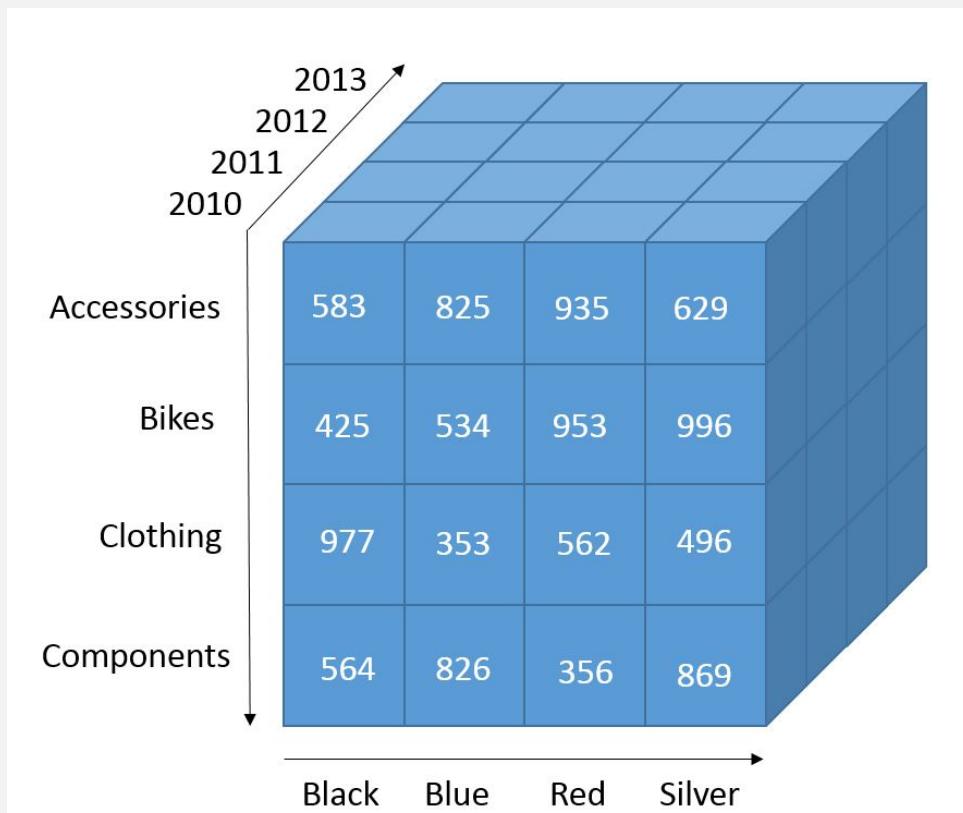
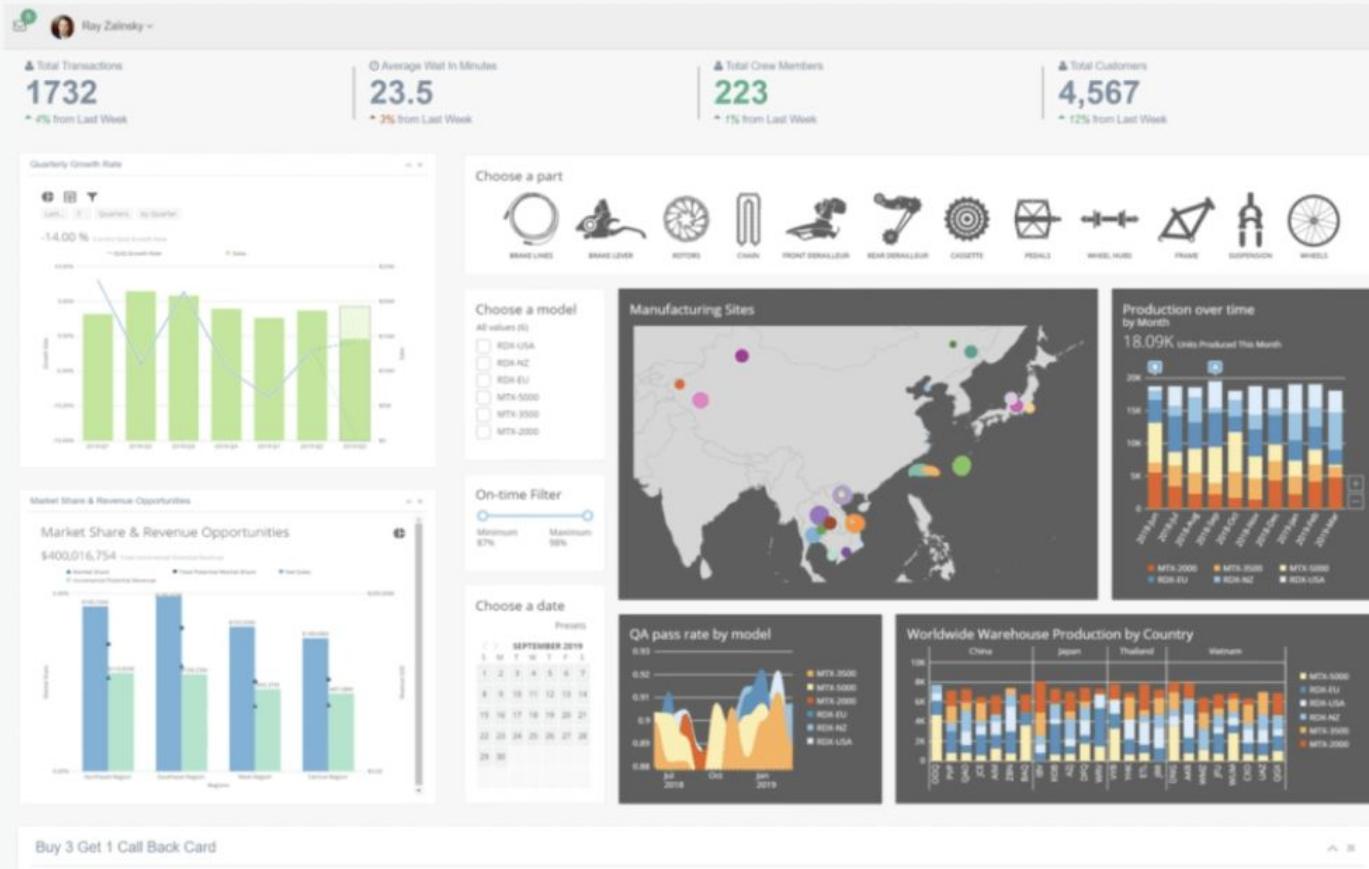


### Focus:

- ✓ Historical reporting
- ✓ Accounting and financial records

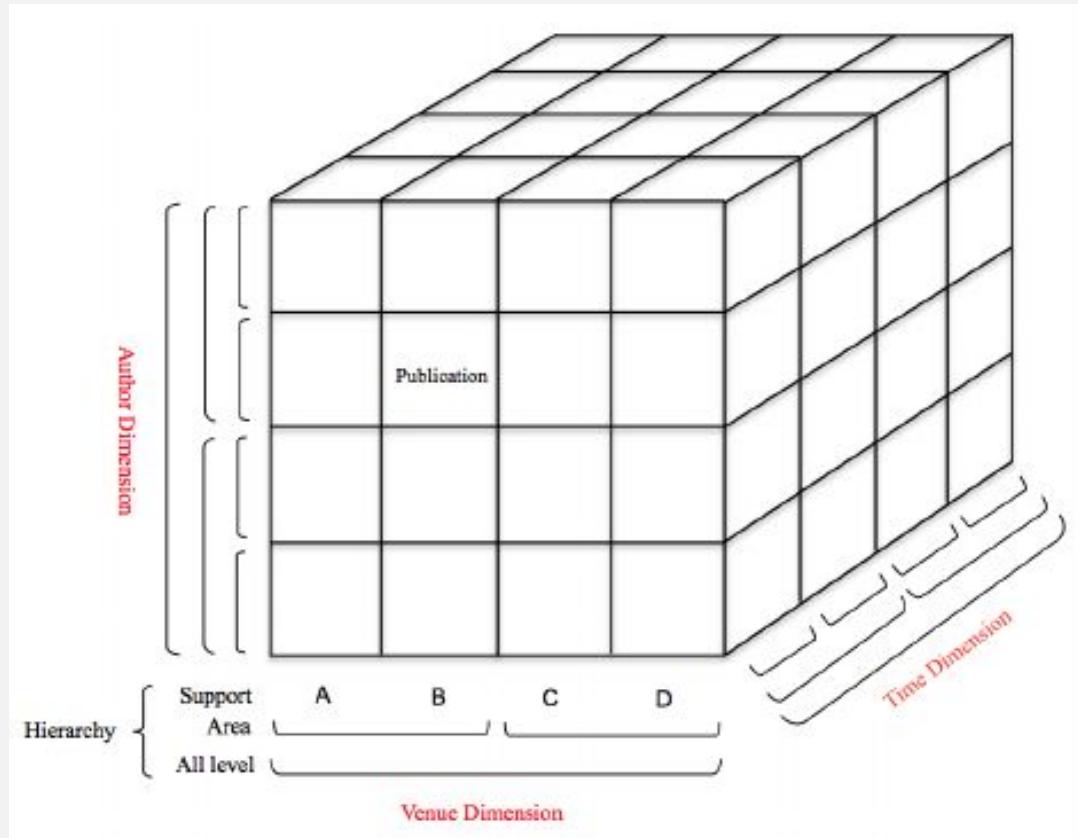
# Evolution and Scope of Data Analytics in Industry

1990–2005 – Business Intelligence (BI) Era



# Evolution and Scope of Data Analytics in Industry

## 1990–2005 – Business Intelligence (BI) Era



### Developments:

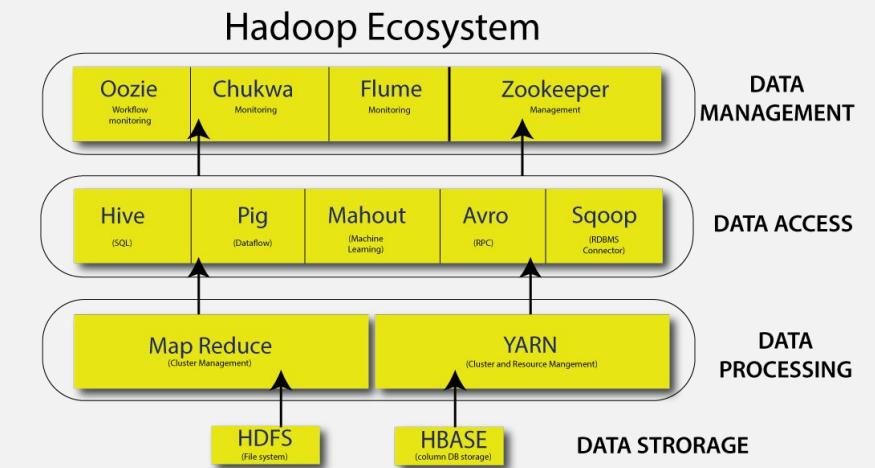
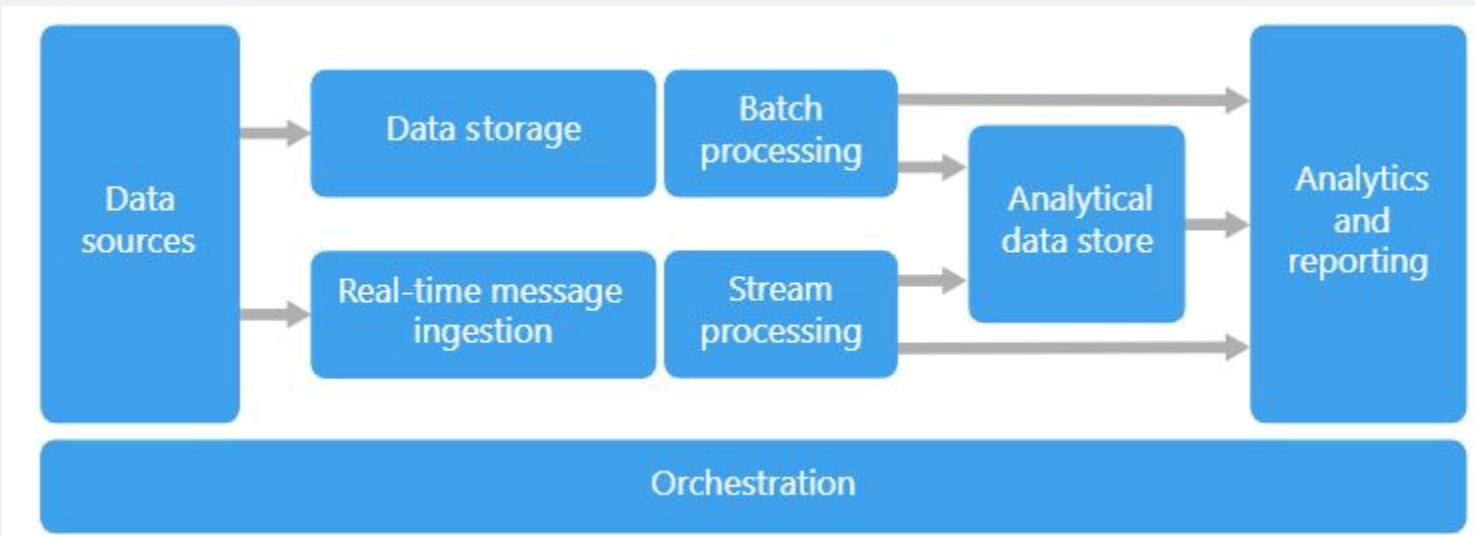
- Data Warehouses
- OLAP (Online Analytical Processing)
- Enterprise Reporting Tools
- Decision Support Systems

### Focus:

- ✓ What happened? (Descriptive Analytics)
- ✓ Structured data analysis

# Evolution and Scope of Data Analytics in Industry

2005–2015 – Big Data Era



# Evolution and Scope of Data Analytics in Industry

## **Key Changes:**

- Explosion of digital data
- Social media growth
- IoT devices
- Cloud computing

## **Technologies:**

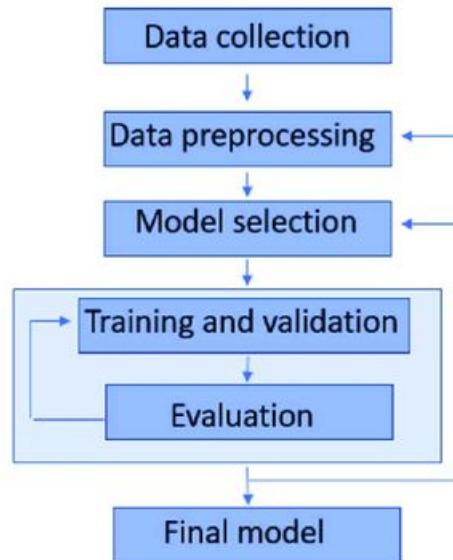
- Hadoop
- NoSQL databases
- Distributed computing

## **Focus:**

- ✓ Handling large volume, velocity, and variety (3Vs of Big Data)

# Evolution and Scope of Data Analytics in Industry

2015–Present – AI & Advanced Analytics Era



## Predictive analytics model performance tracking dashboard

This slide represents the predictive analytics model performance tracking dashboard, and it covers the details of total visitors, total buyers, total products added to the cart, filters by date and category, visitors to clients conversion rate, and so on.



This graph/chart is linked to excel, and changes automatically based on data. Just left click on it and select "Edit Data".

# Evolution and Scope of Data Analytics in Industry

## **Modern Developments:**

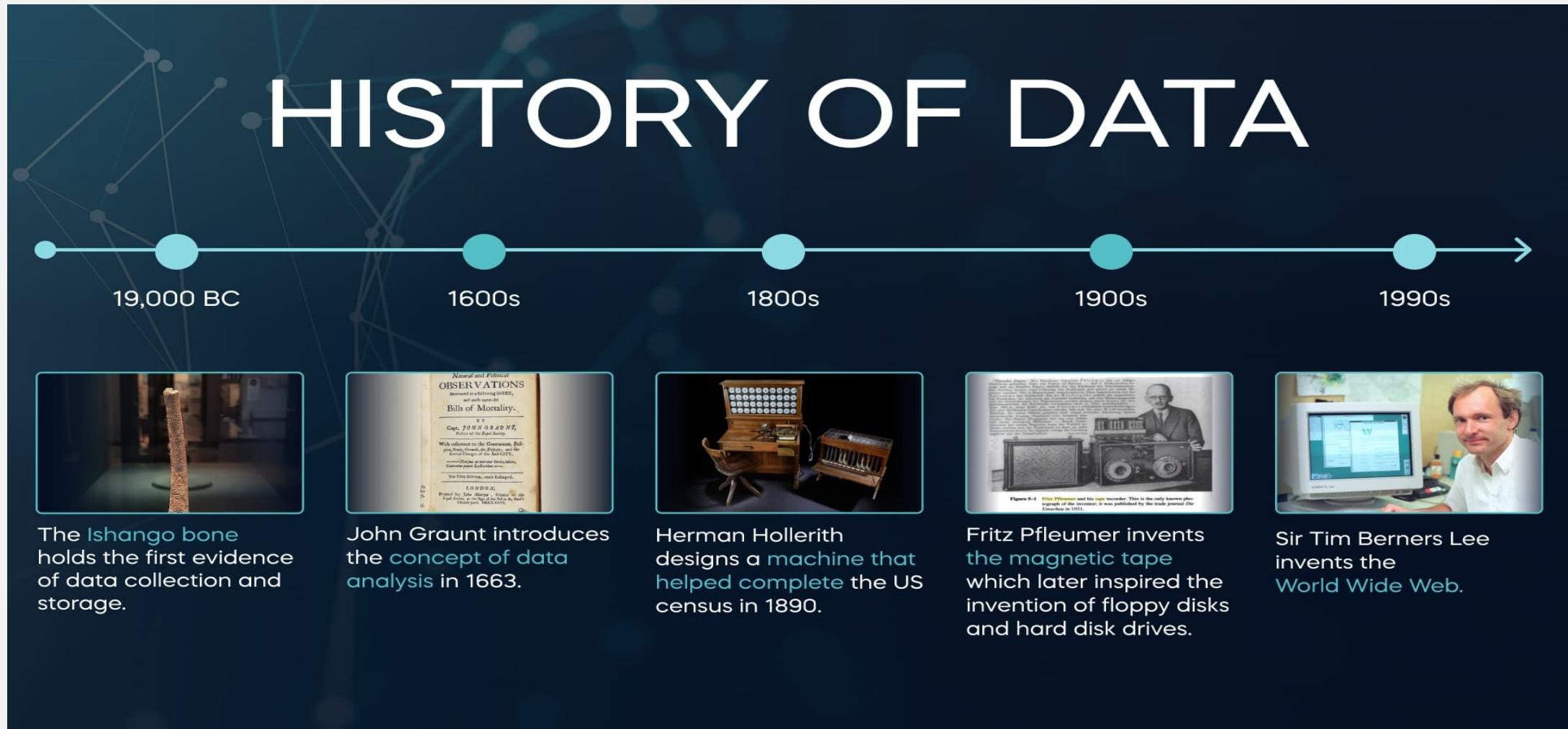
- Machine Learning
- Artificial Intelligence
- Predictive & Prescriptive Analytics
- Real-time data processing

## **Focus:**

- ✓ What will happen? (Predictive)
- ✓ What should we do? (Prescriptive)

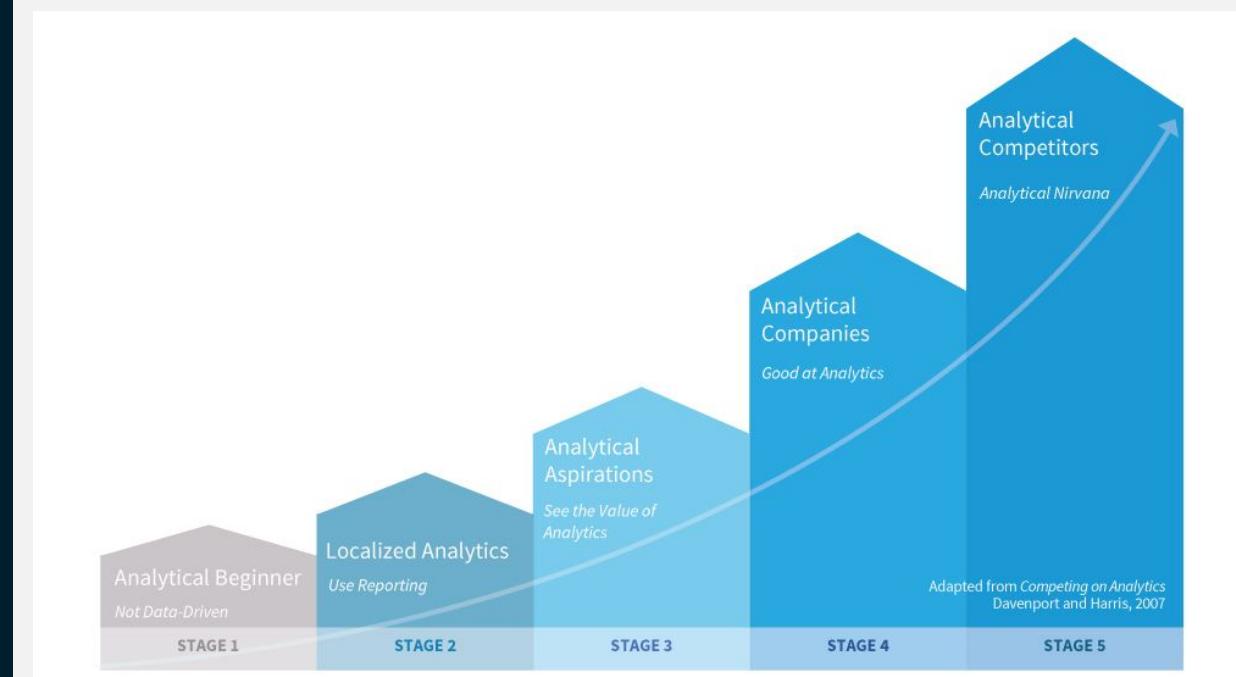
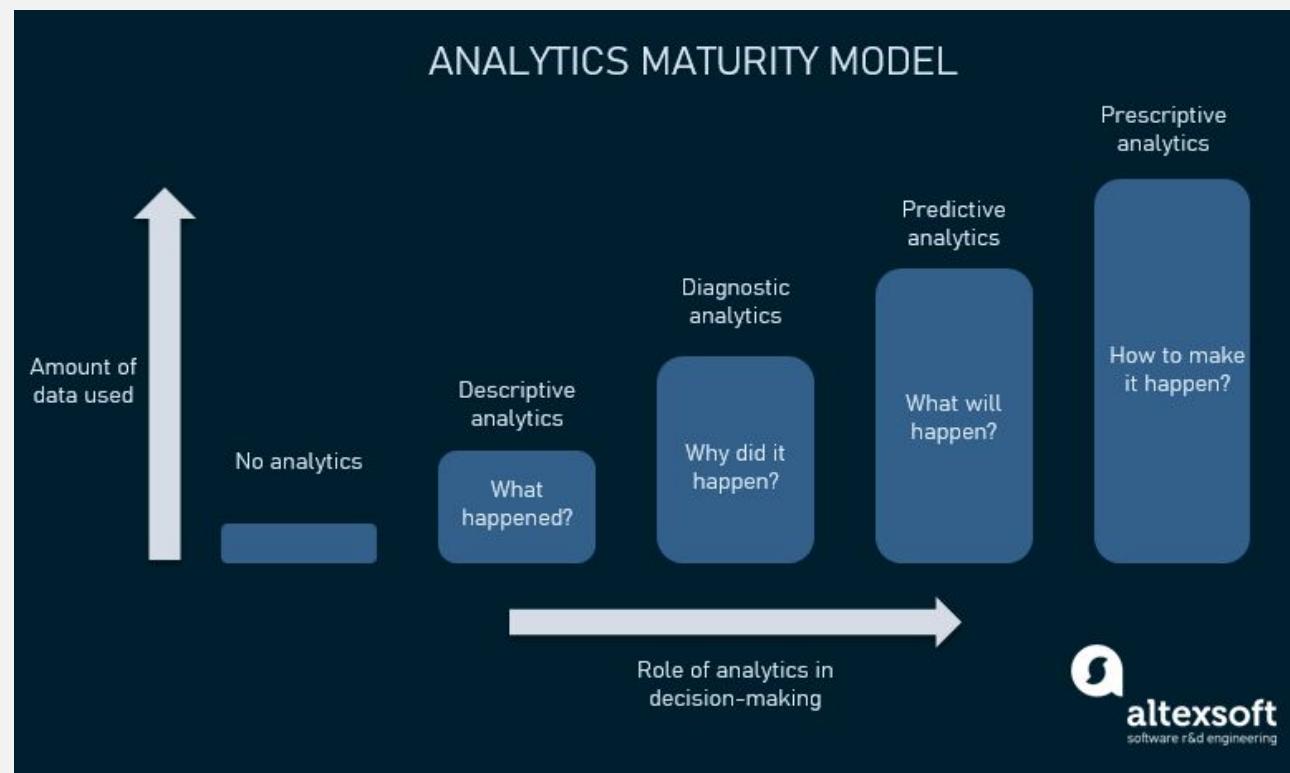
# Evolution and Scope of Data Analytics in Industry

## Timeline of Data Analytics Evolution



# Evolution and Scope of Data Analytics in Industry

## Timeline of Data Analytics Evolution



# Evolution and Scope of Data Analytics in Industry

## Evolution Summary:

Era	Focus	Technology
Traditional	Reporting	Mainframes
BI Era	Descriptive Analysis	Data Warehouses
Big Data	Large-scale Data	Hadoop, Cloud
AI Era	Predictive & Prescriptive	ML, AI

## Scope of Data Analytics in Industry

### Why Scope is Expanding?

Digital transformation

Online transactions

Smart devices (IoT)

Social media

Automation

Artificial Intelligence

Data is generated everywhere — leading to huge demand for analytics.

# Evolution and Scope of Data Analytics in Industry

## Healthcare

**DASHBOARDS** + **Patient Outcomes**

Date range: This year | Departments: All | Age Group: All | Diagnoses: All

Infection Control | Hospital Operations | Revenue Cycle Management | Cost of Care

**Healthcare KPIs**

- Average Length of Stay: **4.5 days** (-2.17% Versus Previous period)
- Readmission Rate: **12%** (-7.69% Versus Previous period)
- Patient Satisfaction Score: **88** (3.53% Versus Previous period)
- Mortality Rate: **2.8%** (-3.45% Versus Previous period)

**Admission and Readmission Overview**

**Admission Overview**

Column (Left): Total Patient Admission | Line (Right): Average Stay in Days

Month/Year	Total Patient Admission	Average Stay in Days
Jan 2024	165	11.5
Feb 2024	155	10.5
Mar 2024	170	12.5
Apr 2024	158	11.5
May 2024	162	12.0
Jun 2024	168	11.0
Jul 2024	159	10.5
Aug 2024	152	9.5
Sep 2024	157	10.0
Oct 2024	154	10.5
Nov 2024	156	10.0
Dec 2024	148	9.0

**Readmission**

# of Readmission

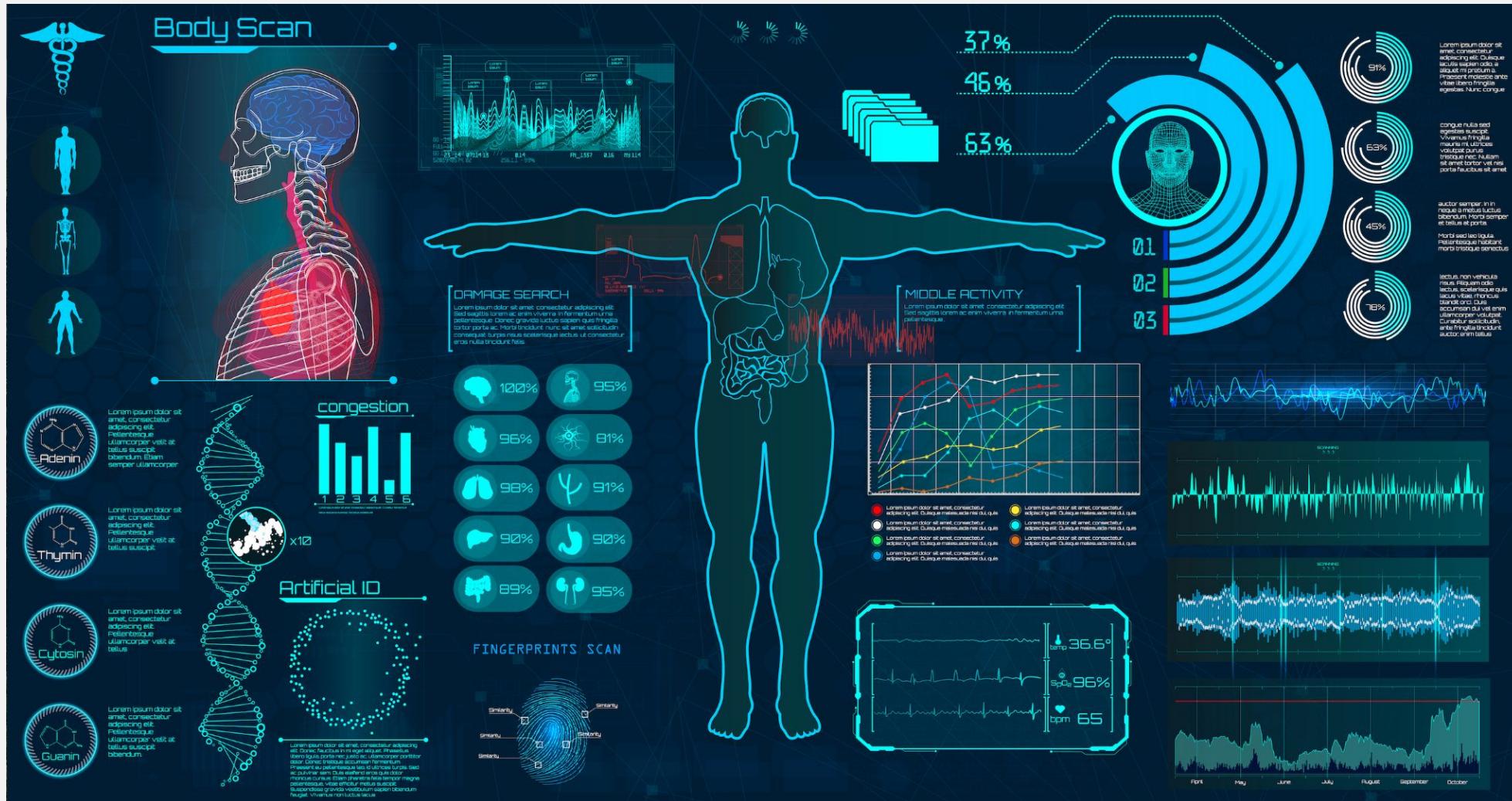
Payer	Readmission Rate within 7 days	Readmission Rate after 7 days
Self-payer	1,392	1,114
Medicare	400	2,211
Private	367	1,893
Medicaid	1,379	1,117

**Causes of Readmission**

# of Readmission

Cause	# of Readmission
Infections	132
Non-compliance	122
No Follow-up	66
Atrial Fibrillation	61
Falls	30
Blood Sugar	20
Respiratory	19
GI Bleed	15
Other	14

# Evolution and Scope of Data Analytics in Industry



# Evolution and Scope of Data Analytics in Industry

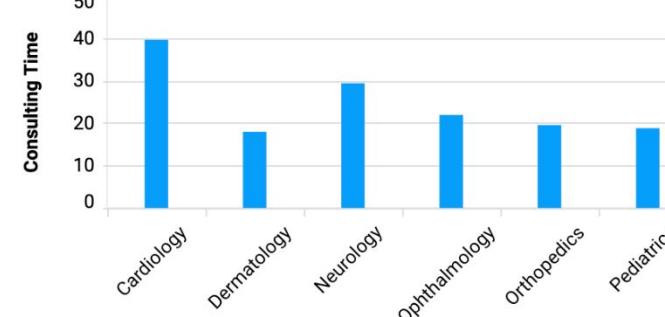
Patient Experience Analysis Dashboard

**Day of Week** ⓘ

**Department** ⓘ

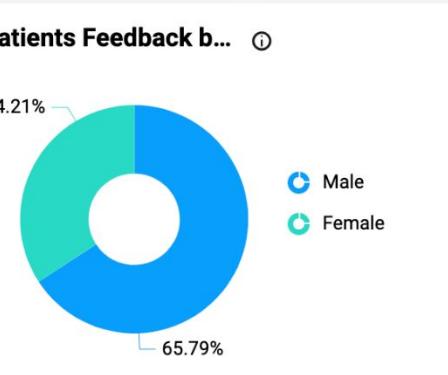
**Date** ⓘ

**Average Visit Length by Department** ⓘ



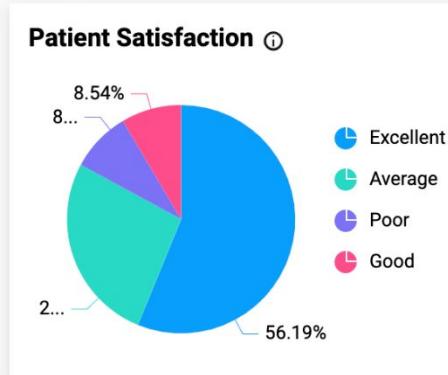
Department	Average Visit Length (Minutes)
Cardiology	~40
Dermatology	~18
Neurology	~30
Ophthalmology	~22
Orthopedics	~20
Pediatrics	~18

**Patients Feedback by Gender** ⓘ



Gender	Percentage
Male	65.79%
Female	34.21%

**Patient Satisfaction** ⓘ



Feedback Level	Percentage
Excellent	56.19%
Average	34.21%
Poor	8.54%
Good	2.06%

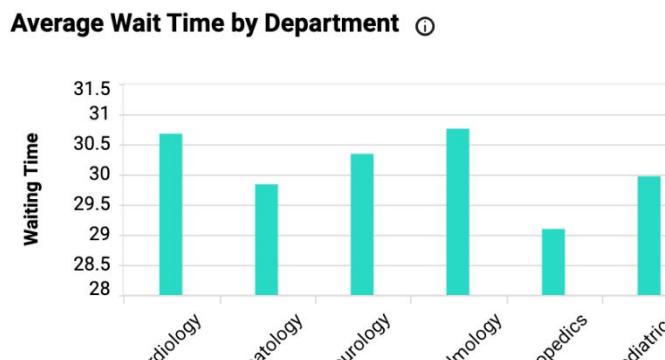
**Patient Count by Department** ⓘ

Department	Patients Count
Cardiology	2,344
Dermatology	2,321

**Patient Feedback Details** ⓘ

Name	Department	Feedback
Alen	Cardiology	Excellent
Alen	Dermatology	Excellent

**Average Wait Time by Department** ⓘ



Department	Average Wait Time (Minutes)
Cardiology	~30.5
Dermatology	~29.5
Neurology	~30.5
Ophthalmology	~30.5
Orthopedics	~28.8
Pediatrics	~29.5

- Disease prediction
- Patient monitoring
- Drug discovery
- Hospital resource management

# Evolution and Scope of Data Analytics in Industry

## Banking & Finance



# Evolution and Scope of Data Analytics in Industry

## Banking & Finance

### Credit Risk Assessment Dashboard Regulatory Parameters

This slide involves key parameters for assessing financial credit status of organization covering regulatory parameters, credit ratings and trend report etc.

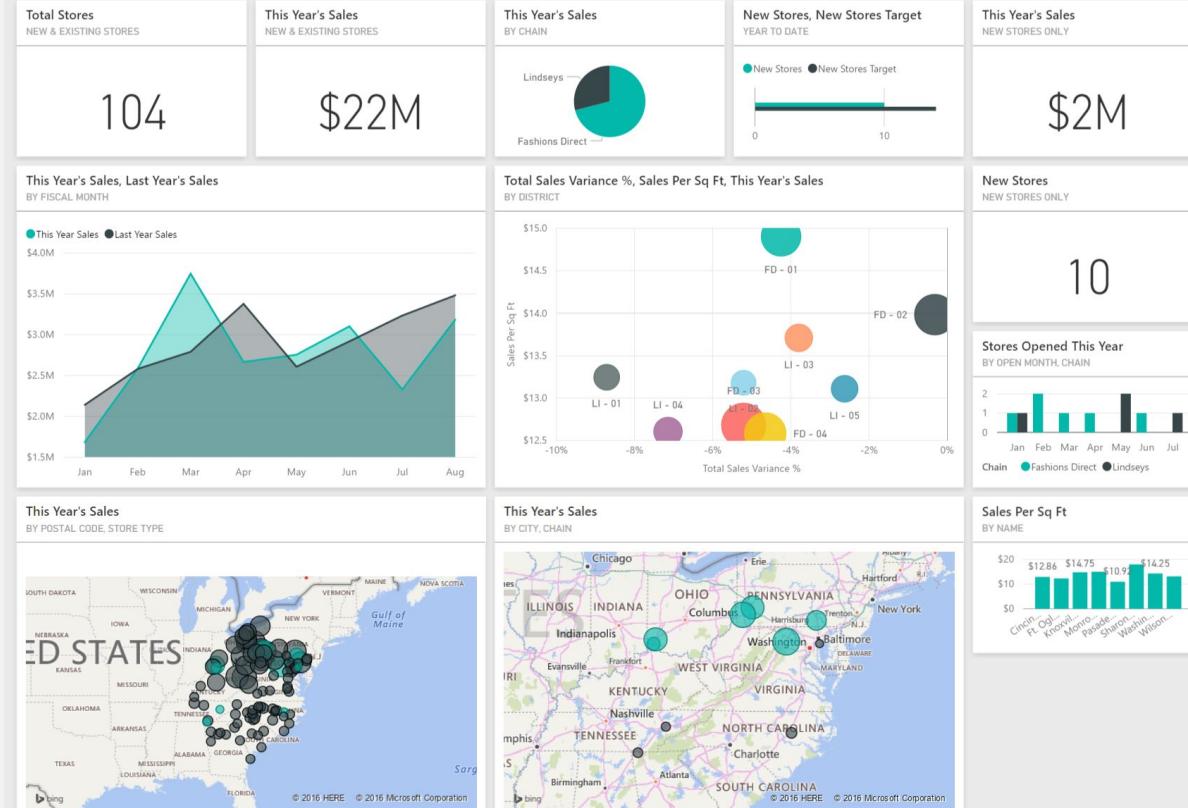


# Evolution and Scope of Data Analytics in Industry

## Retail & E-Commerce

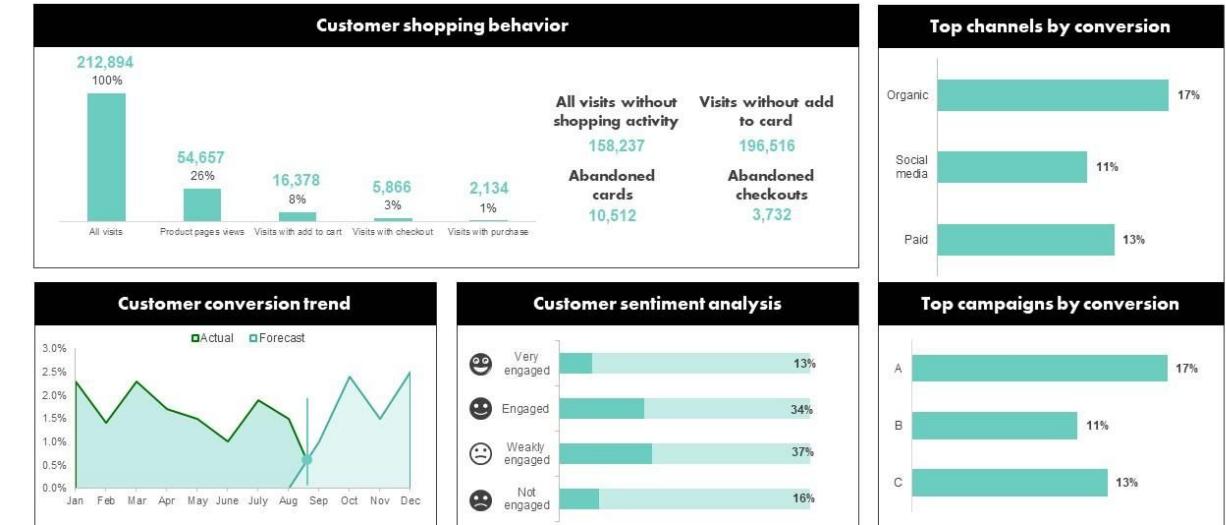
Retail Analysis Sample

Ask a question about your data



## Customer behavior data analytics dashboard

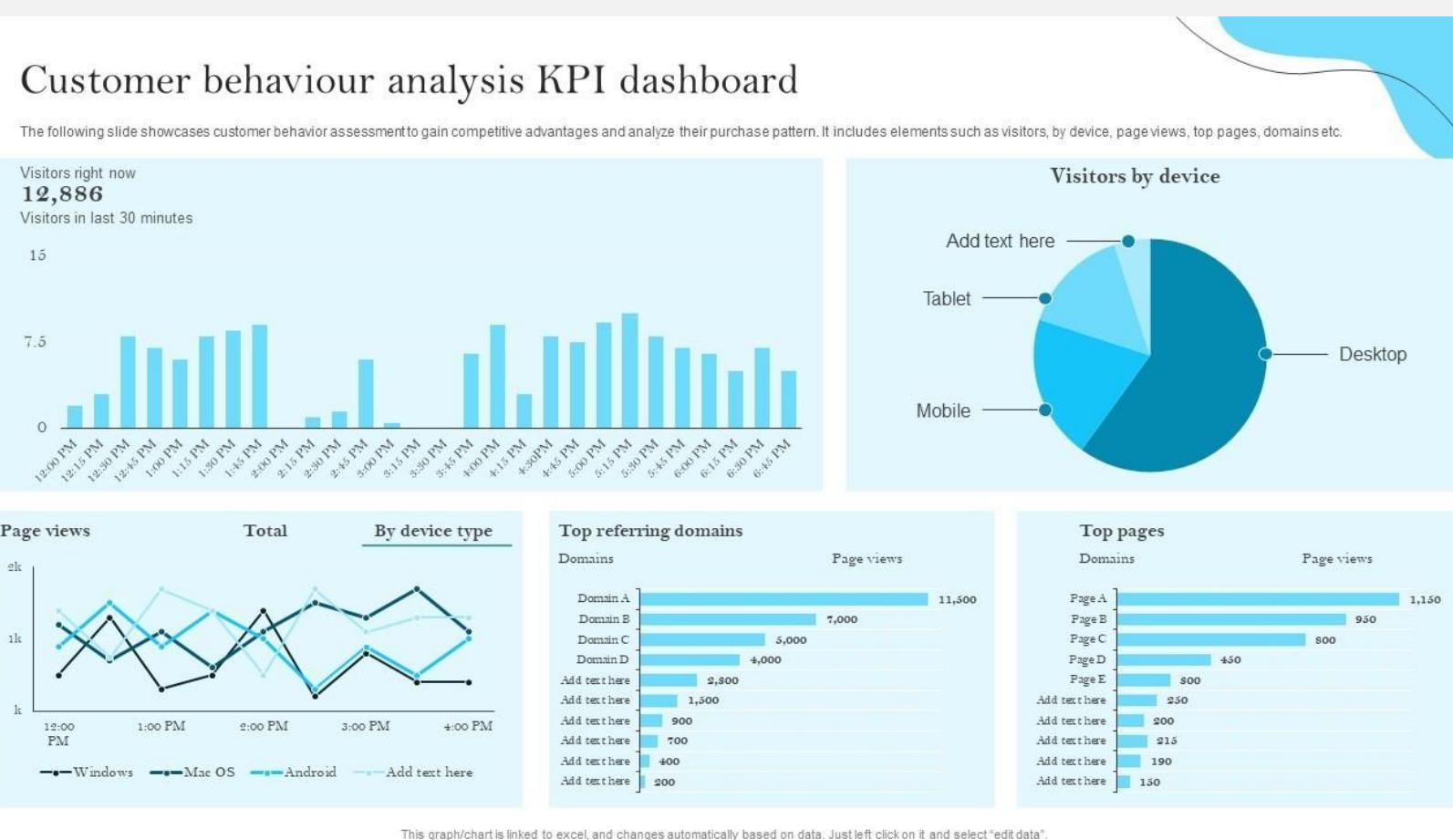
This slide depicts a customer behavior data analytics dashboard to provide businesses with a real-time representation of customers' behavior and preferences in order to make informed decisions. Key performance indicators are customer behavior, customer conversion trend etc.



This graph/chart is linked to excel, and changes automatically based on data. Just left click on it and select "Edit Data".

# Evolution and Scope of Data Analytics in Industry

## Retail & E-Commerce



- Customer behavior analysis
- Recommendation systems
- Demand forecasting
- Inventory management

# Evolution and Scope of Data Analytics in Industry

## Manufacturing

### IoT big data analytics dashboard for manufacturing industry

Following slide depicts dashboard that provides real time data about manufacturing industry operations and production. It includes metrics such as productivity, units cost, operators available by function, etc.



- Predictive maintenance
- Quality control
- Supply chain optimization
- Process automation

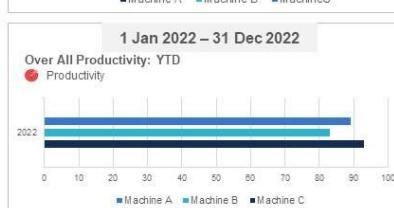
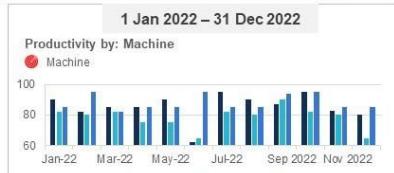
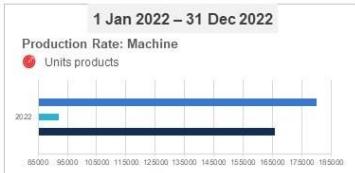
# Evolution and Scope of Data Analytics in Industry

## Manufacturing

### Manufacturing Analytics Dashboard with Key Performance Indicators

This slide shows the dashboard highlighting the improvement in supply chain management of an organization through the use of manufacturing analytics software.

#### Manufacturing



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# Evolution and Scope of Data Analytics in Industry

## Career Scope in Data Analytics

### **Popular Roles:**

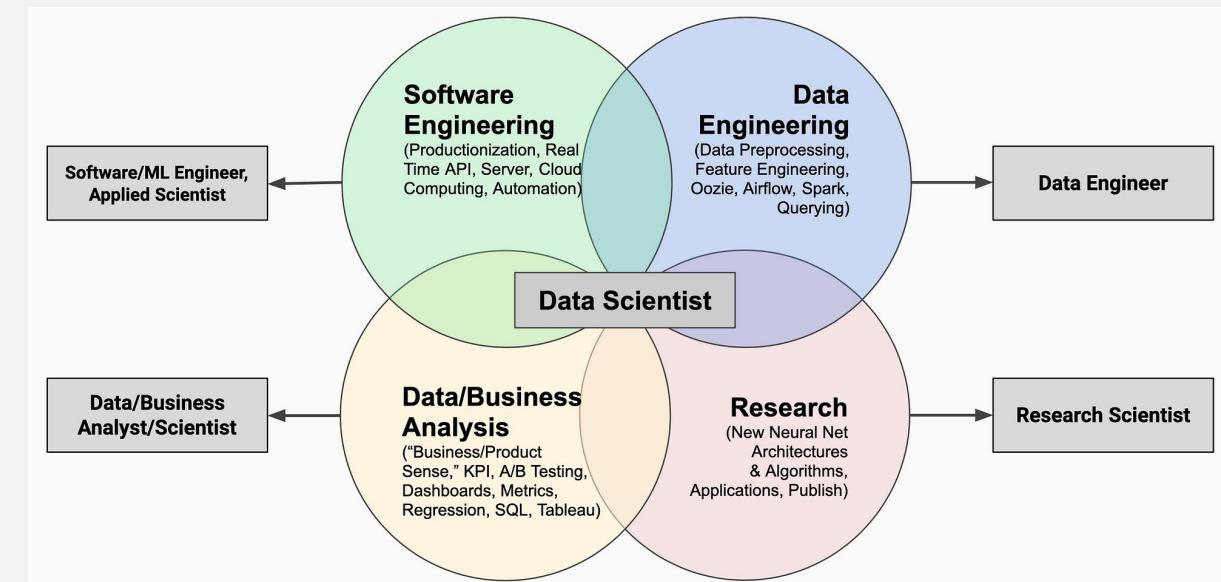
- Data Analyst
- Business Analyst
- Data Scientist
- Machine Learning Engineer
- BI Developer
- Data Engineer

### **Skills Required:**

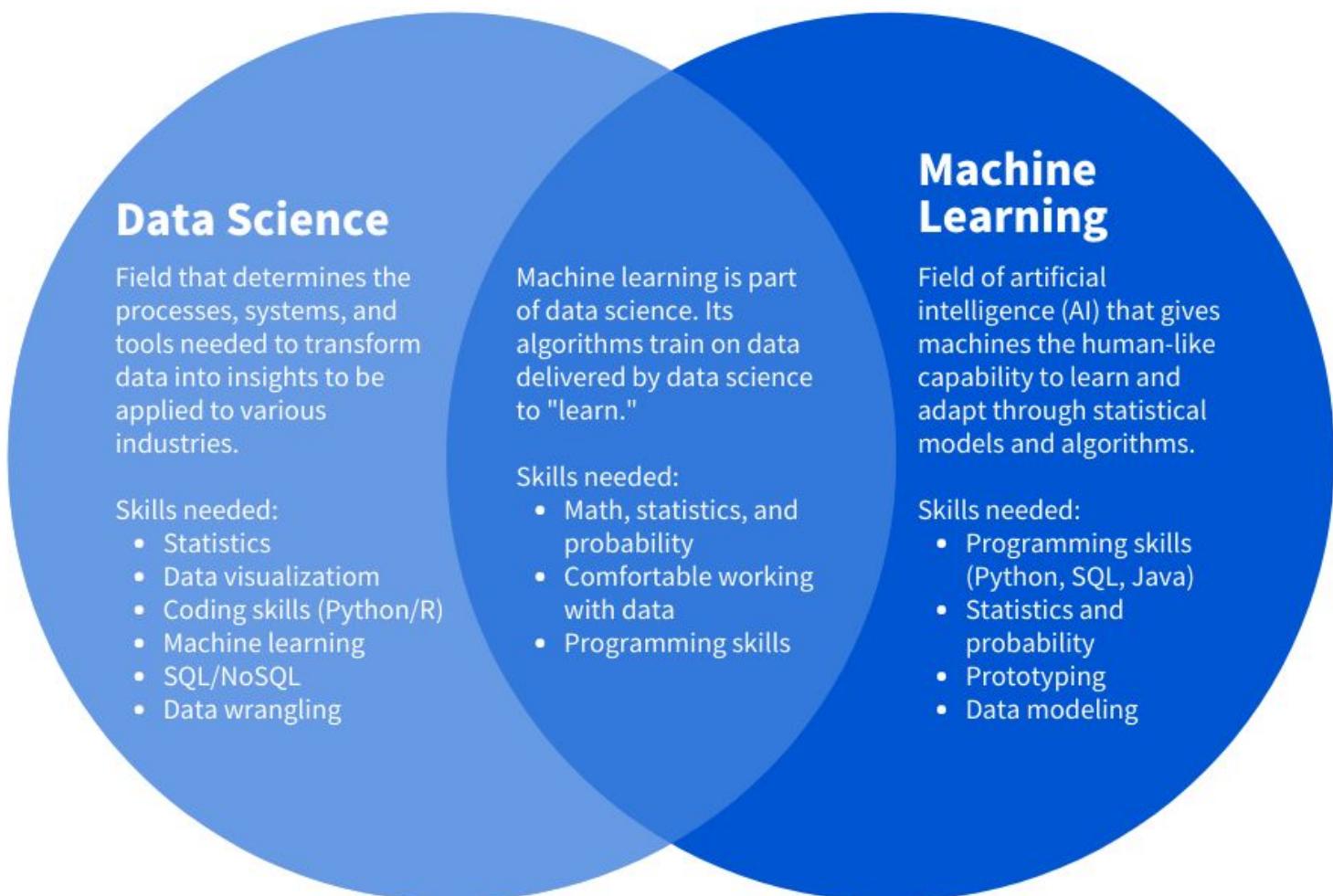
- Statistical knowledge
- Programming (Python, R)
- SQL
- Data Visualization tools
- Critical thinking

# Evolution and Scope of Data Analytics in Industry

## GOOGLE ANALYTICS REPORT



# Evolution and Scope of Data Analytics in Industry



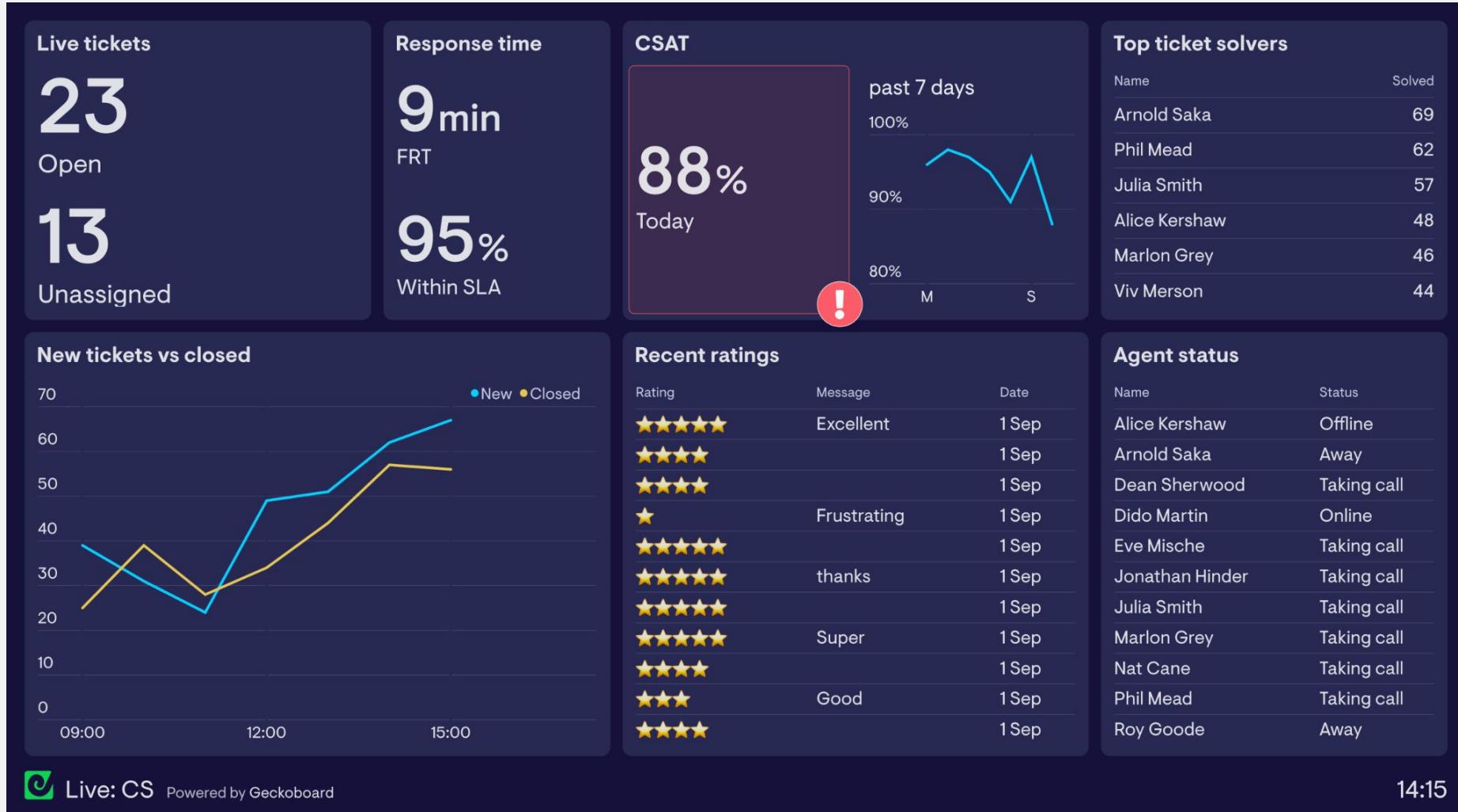
# **Evolution and Scope of Data Analytics in Industry**

## **Future Scope of Data Analytics**

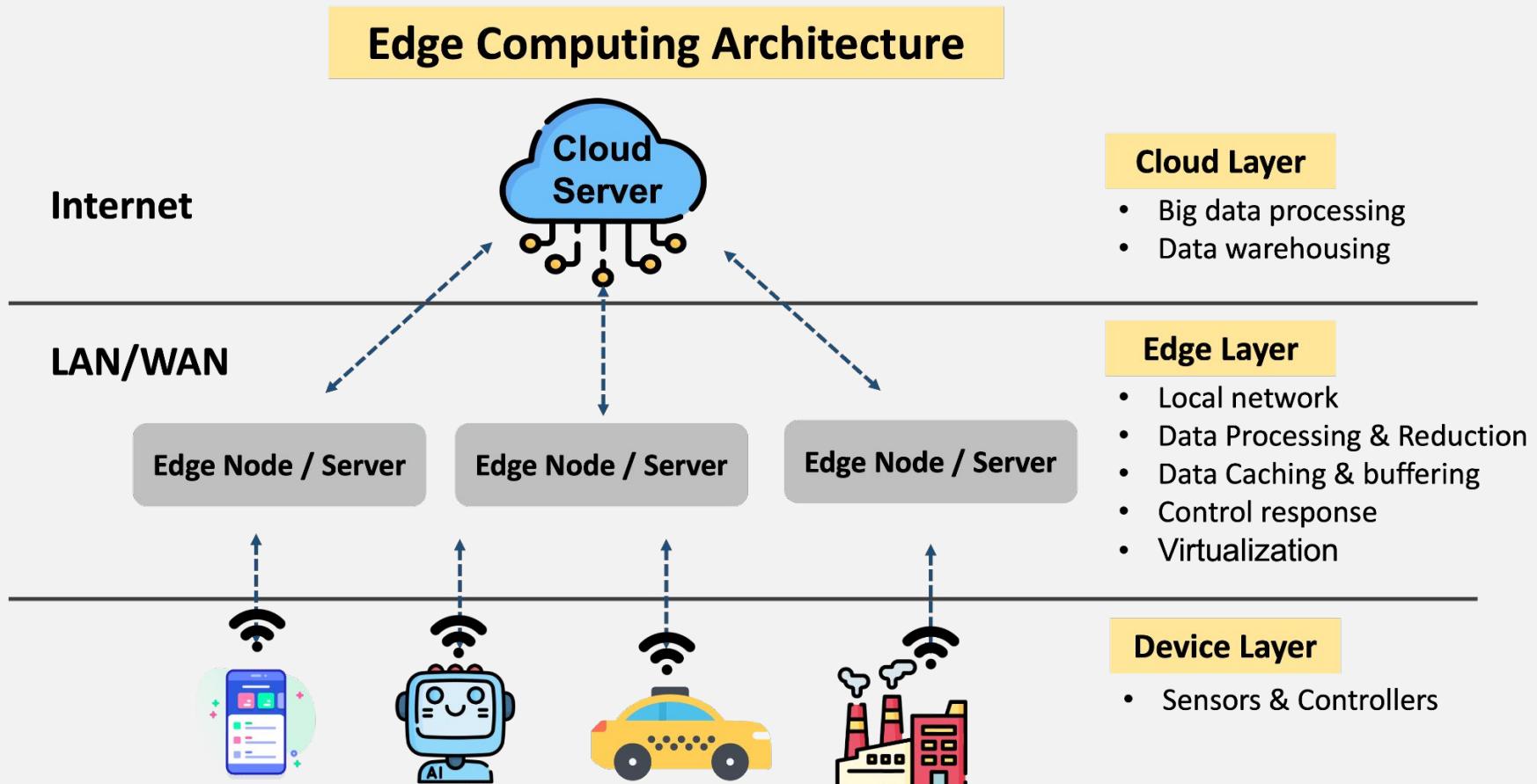
- Real-time analytics
- AI-driven automation
- Edge computing
- Smart cities
- Personalized services
- Industry 4.0

Data Analytics will become central to every business decision.

# Evolution and Scope of Data Analytics in Industry



# Evolution and Scope of Data Analytics in Industry



**Figure : Edge computing architecture overview**  
**Source : The research team**

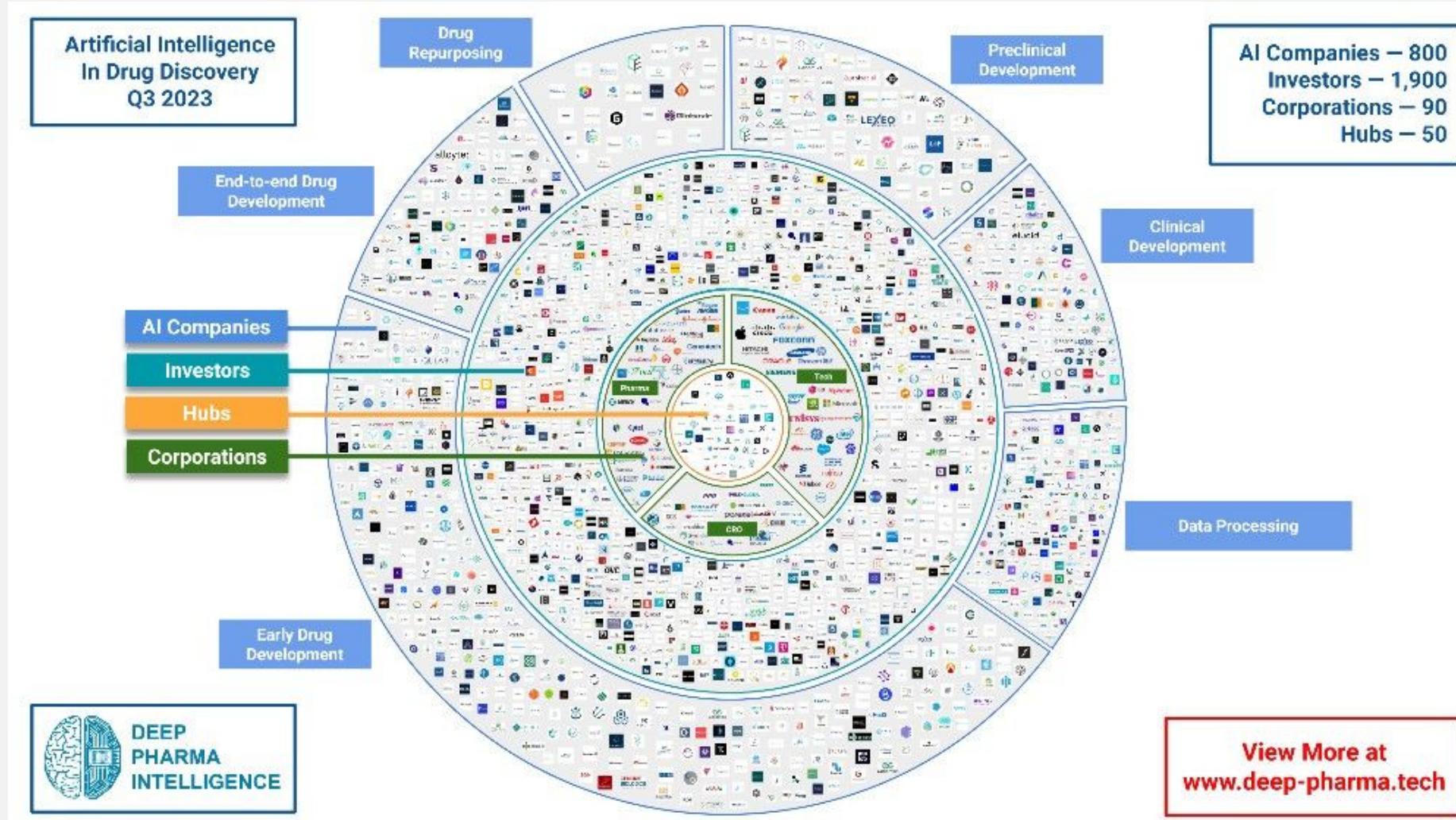
# **Evolution and Scope of Data Analytics in Industry**

## **Future Scope of Data Analytics**

- Real-time analytics
- AI-driven automation
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# Evolution and Scope of Data Analytics in Industry

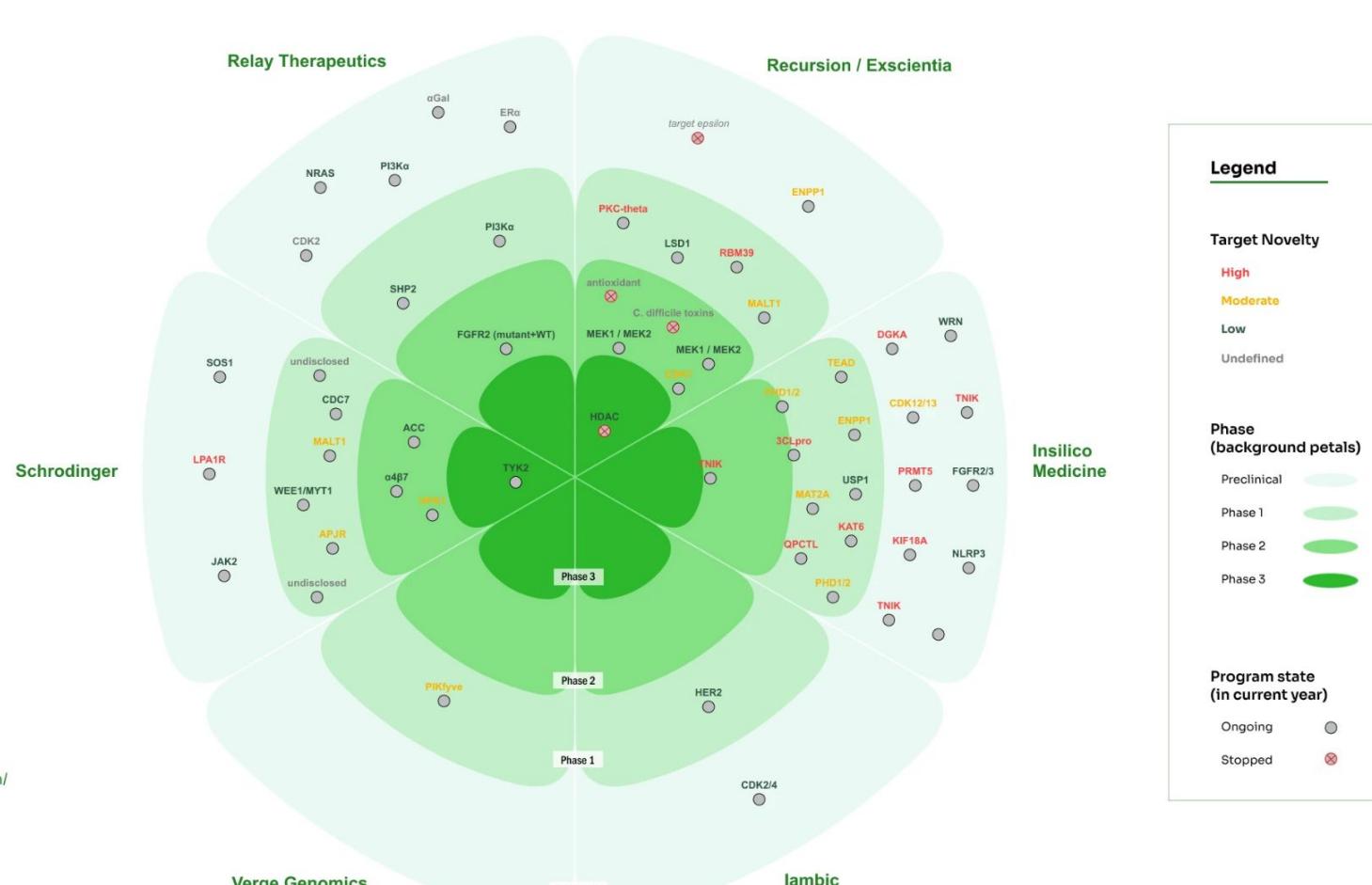


# Evolution and Scope of Data Analytics in Industry

## The Landscape of AI-discovered Drug Candidates and Targets

The indicated data are for March 2025 \*

Data includes both in-house and partner programs, data is NOT exhaustive, it reflects only information disclosed by companies on their websites.



 <https://www.biopharmatrend.com/>

 <https://www.TechLifeSci.com>

 @BiopharmaTrend

# Role of Data Analytics in Organizational Decision Making

## What is Organizational Decision Making?

Organizational decision-making is the process by which businesses select the best course of action to achieve their goals.

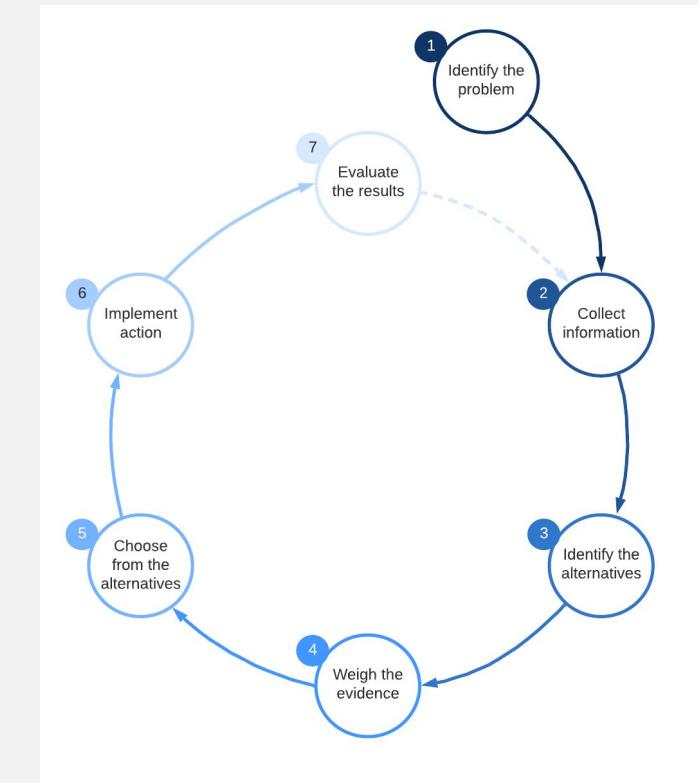
## Why Data Analytics is Important?

- Reduces uncertainty
- Improves accuracy
- Supports strategic planning
- Enhances operational efficiency

### Steps:

1. Define the Problem
2. Collect Relevant Data
3. Analyze Data
4. Generate Insights
5. Make Decision
6. Implement action
7. Evaluate the results

Modern organizations rely on **data-driven decisions** instead of assumptions.



# Role of Data Analytics in Organizational Decision Making

## Types of Decisions in Organizations

### ① Strategic Decisions

- Long-term planning
- Example: Expanding to new market

### ② Tactical Decisions

- Medium-term planning
- Example: Marketing campaign strategy

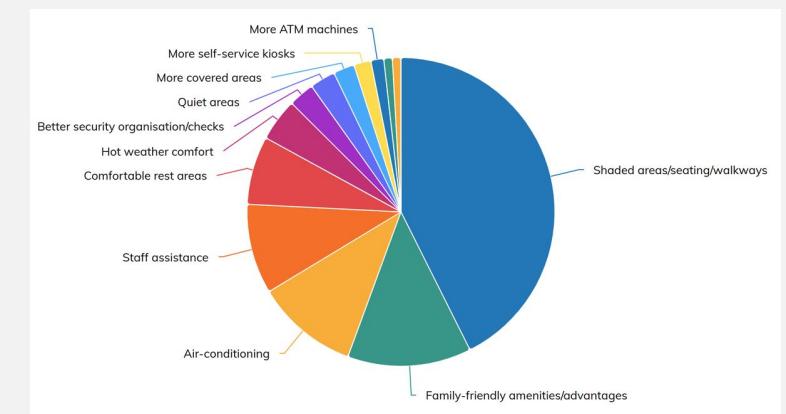
### ③ Operational Decisions

- Day-to-day activities
- Example: Inventory management

## Applications:

- Market trend analysis
- Competitor analysis
- Risk assessment
- Revenue forecasting

✓ Helps top management make informed long-term decisions



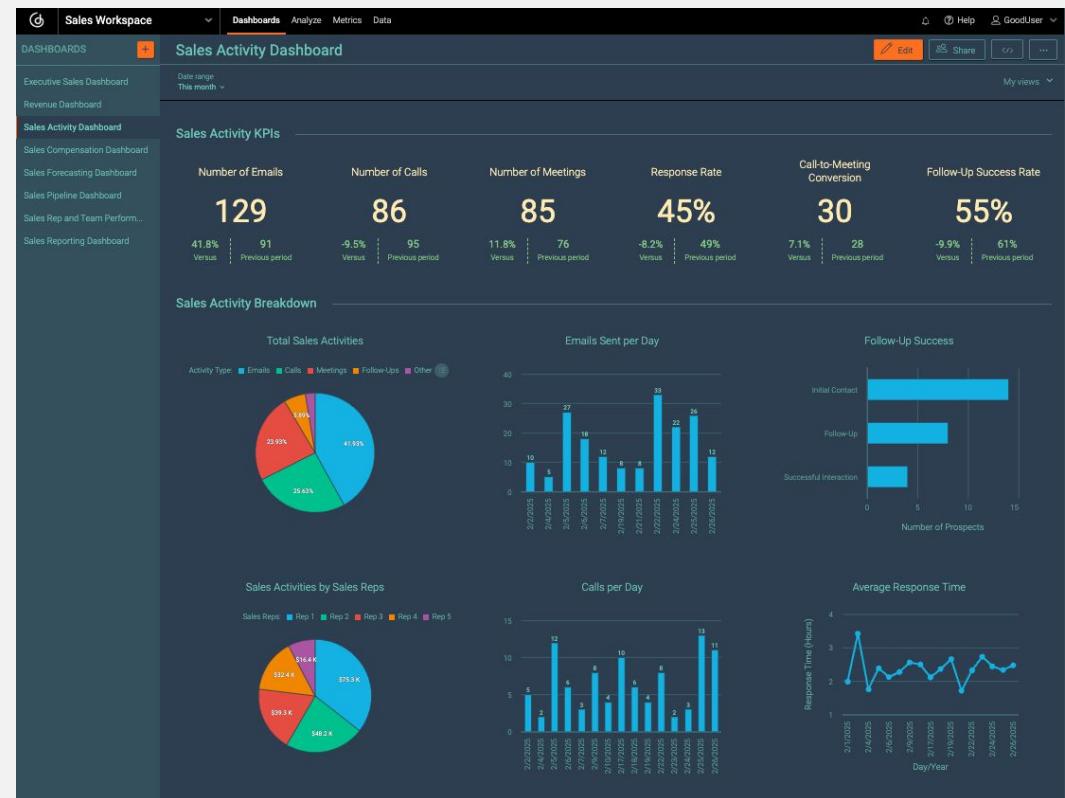
# Role of Data Analytics in Organizational Decision Making



## Applications:

- Customer segmentation
- Pricing strategies
- Campaign performance analysis
- Budget allocation

✓ Helps middle management optimize strategies.

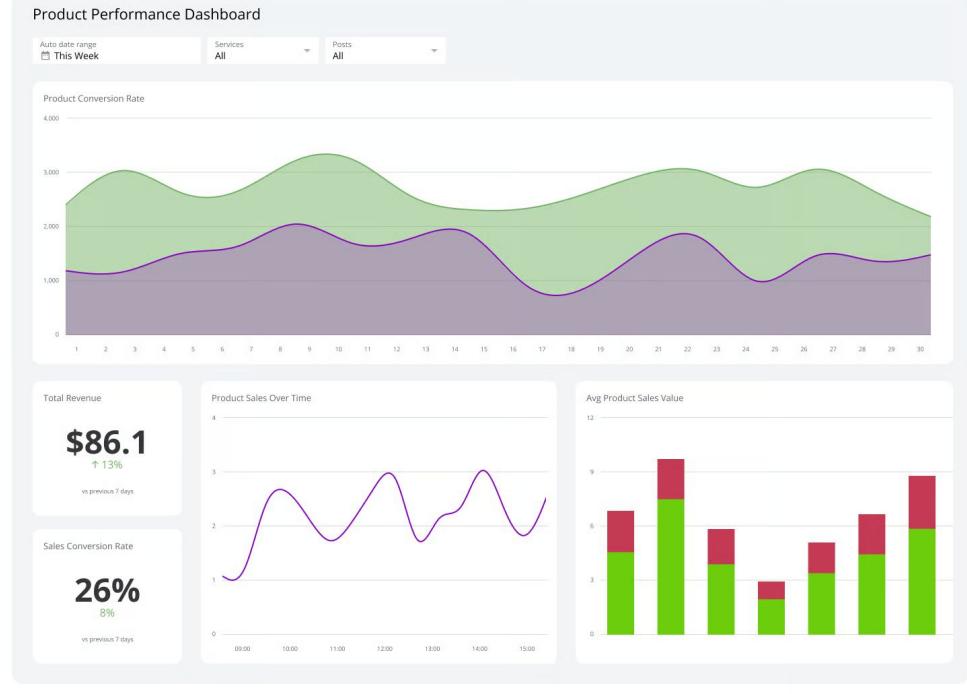


# Role of Data Analytics in Organizational Decision Making



## Applications:

1. Inventory control
  2. Supply chain optimization
  3. Workforce scheduling
  4. Quality control
- ✓ Improves daily operational efficiency.

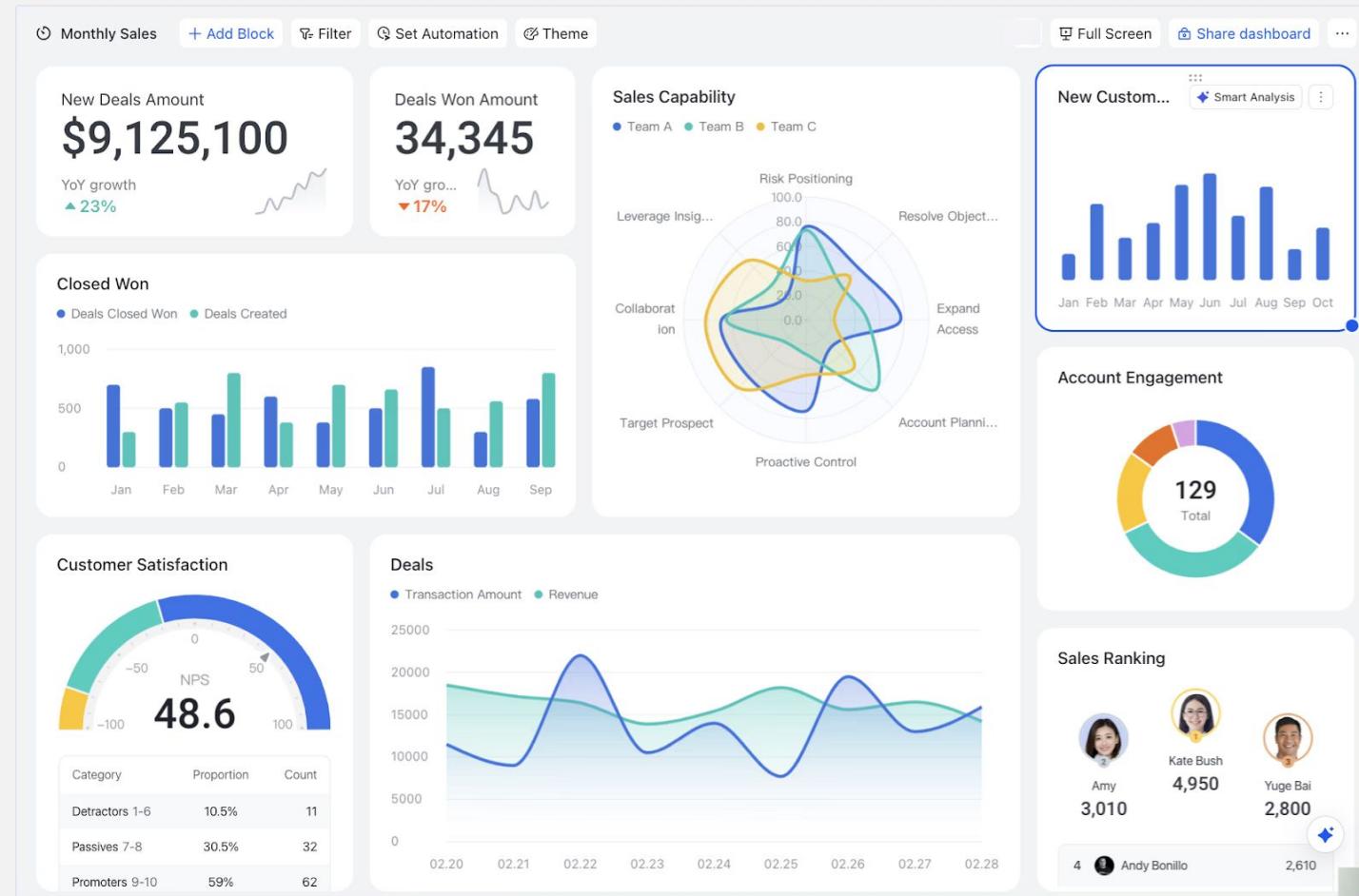
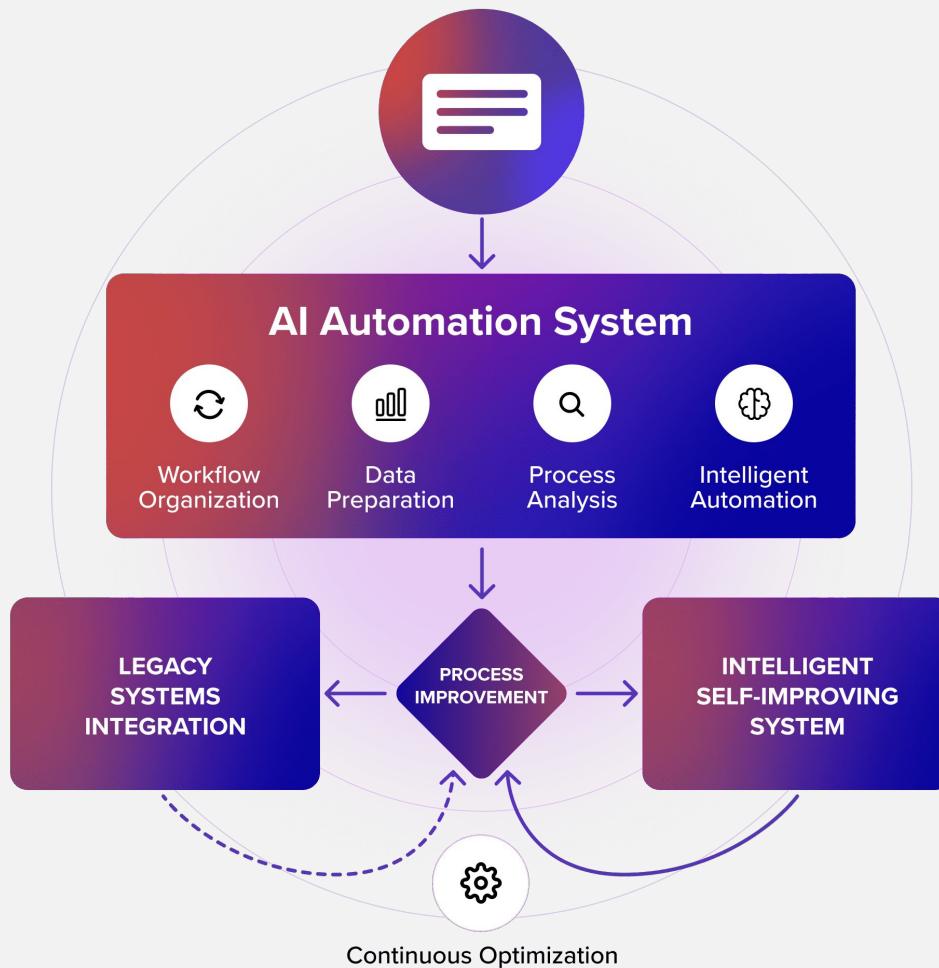


# Role of Data Analytics in Organizational Decision Making

## Benefits of Data Analytics in Organizations      Challenges in Data-Driven Decision Making

- Faster decision-making
- Reduced risks
- Improved accuracy
- Better customer satisfaction
- Increased profitability
- Competitive advantage
- Poor data quality
- Data privacy concerns
- Lack of skilled professionals
- Resistance to change
- High implementation cost

# Role of Data Analytics in Organizational Decision Making



# Data Analytics versus Data Science

<b>Sr. No.</b>	<b>Basis of Comparison</b>	<b>Data Analytics</b>	<b>Data Science</b>
1	Definition	Process of analyzing data to find meaningful insights and support decision-making	Broader field that uses scientific methods, algorithms, and systems to extract knowledge from data
2	Scope	Narrower scope	Broader scope
3	Focus	Analyzing past and present data	Predicting future trends and building models
4	Goal	Answer specific business questions	Discover hidden patterns and create predictive models
5	Type of Data	Mostly structured data	Structured, semi-structured, and unstructured data
6	Techniques Used	Statistical analysis, data visualization, reporting	Machine learning, deep learning, AI, advanced statistics

# Data Analytics versus Data Science

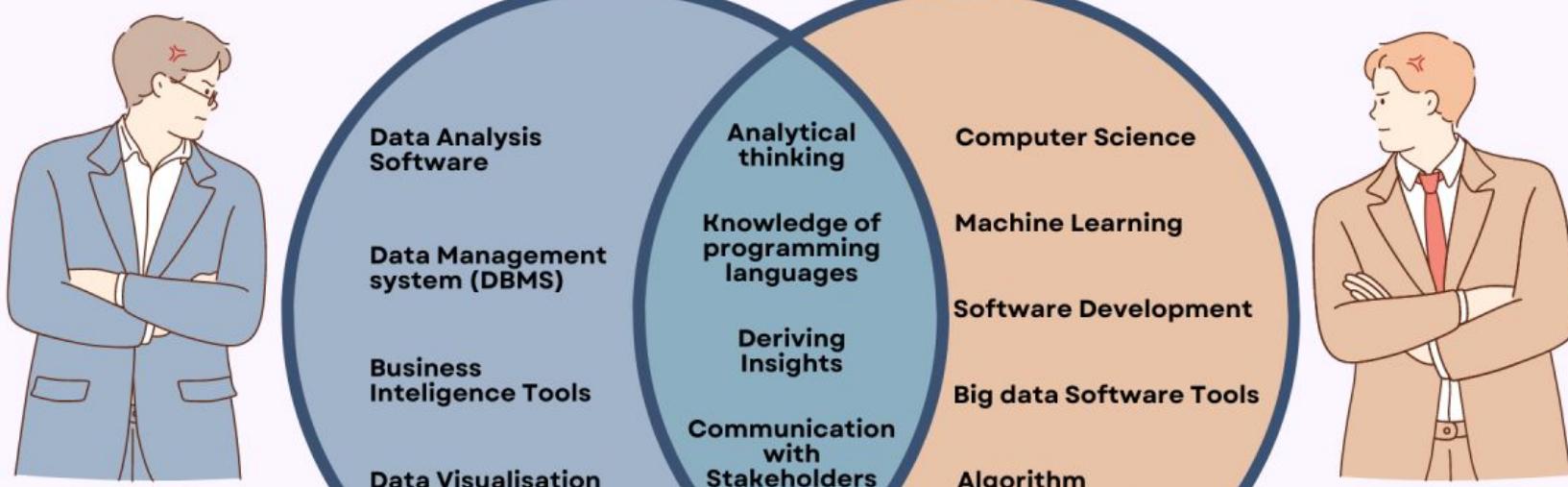
<b>Sr. No.</b>	<b>Basis of Comparison</b>	<b>Data Analytics</b>	<b>Data Science</b>
7	Programming Skills	Basic knowledge (SQL, Excel, Python)	Advanced programming (Python, R, ML frameworks)
8	Tools	Excel, SQL, Power BI, Tableau	Python, R, TensorFlow, Scikit-learn, Hadoop
9	Output	Reports, dashboards, trends	Predictive models, intelligent systems
10	Decision Type	Descriptive & Diagnostic decisions	Predictive & Prescriptive decisions
11	Example	Sales performance analysis	Fraud detection system using ML
12	Required Skills	Analytical thinking, visualization skills	Strong mathematics, statistics, programming & ML knowledge

- **Data Analytics** focuses on analyzing existing data to support decision-making.
- **Data Science** includes analytics but also involves machine learning and AI to predict future outcomes.

# Data Analytics versus Data Science

## DATA ANALYST VS DATA SCIENTIST

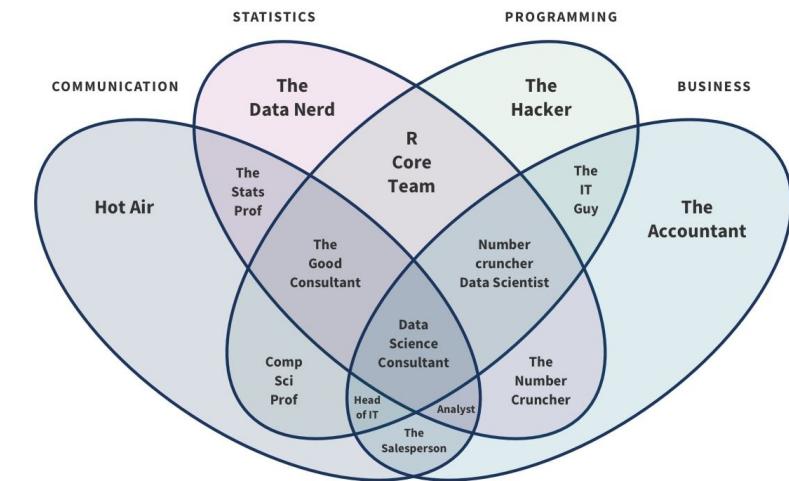
The Ultimate Comparison



# Data Analytics versus Data Science

## 5 Key Differences Between Data Science & Data Analytics

	DATA SCIENTISTS	DATA ANALYSTS
1	"Explore" data	"Cleanse" data
2	Focus on the future	Focus on what's happening now
3	Utilize machine learning & algorithms	Utilize coding languages (SQL, R, or Python)
4	Look for connections in information	Look for hypothesis validation in information
5	Lean on predictive modeling and analytics	Use broad statistical patterns and analysis



# Overview of Machine Learning Concepts

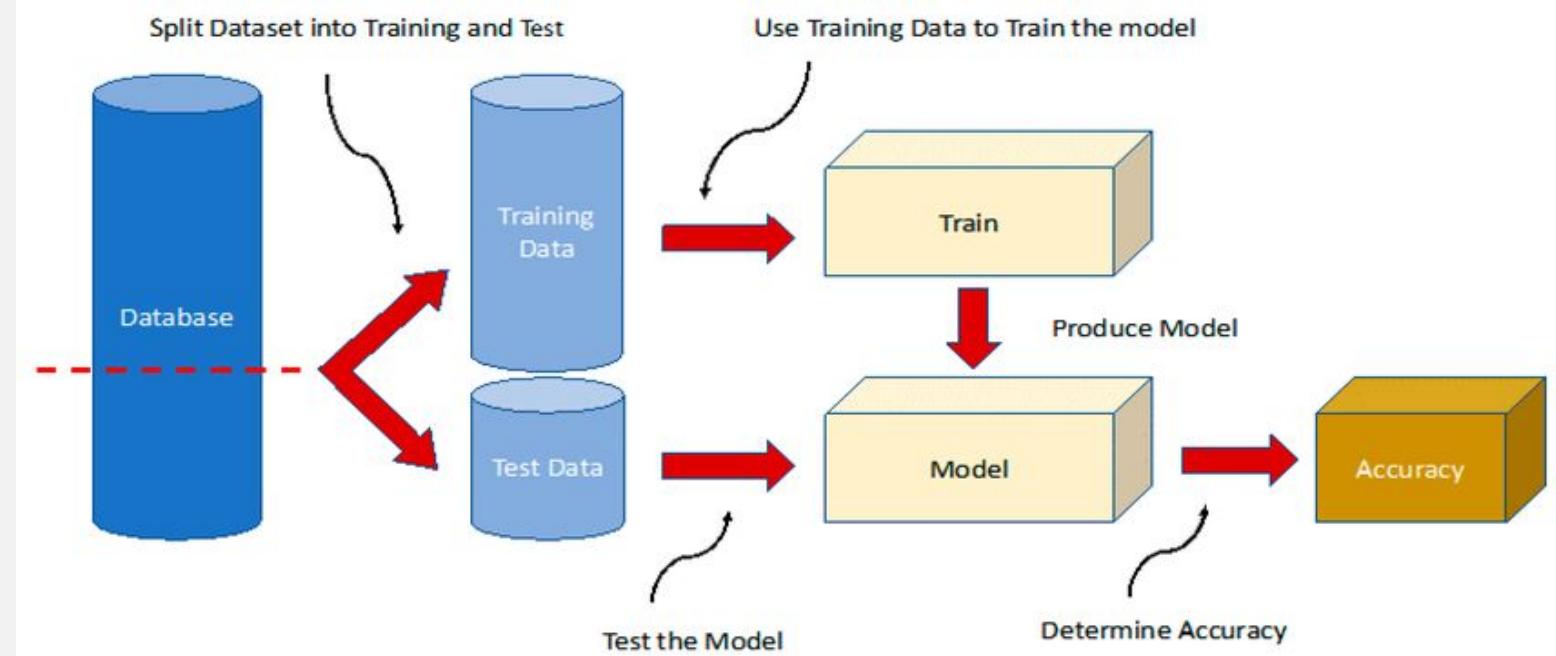
## What is Machine Learning?

Machine Learning (ML) is a subset of Artificial Intelligence that enables systems to learn from data and improve performance without being explicitly programmed.

Instead of writing rules manually, machines learn patterns from data.

## Basic Workflow:

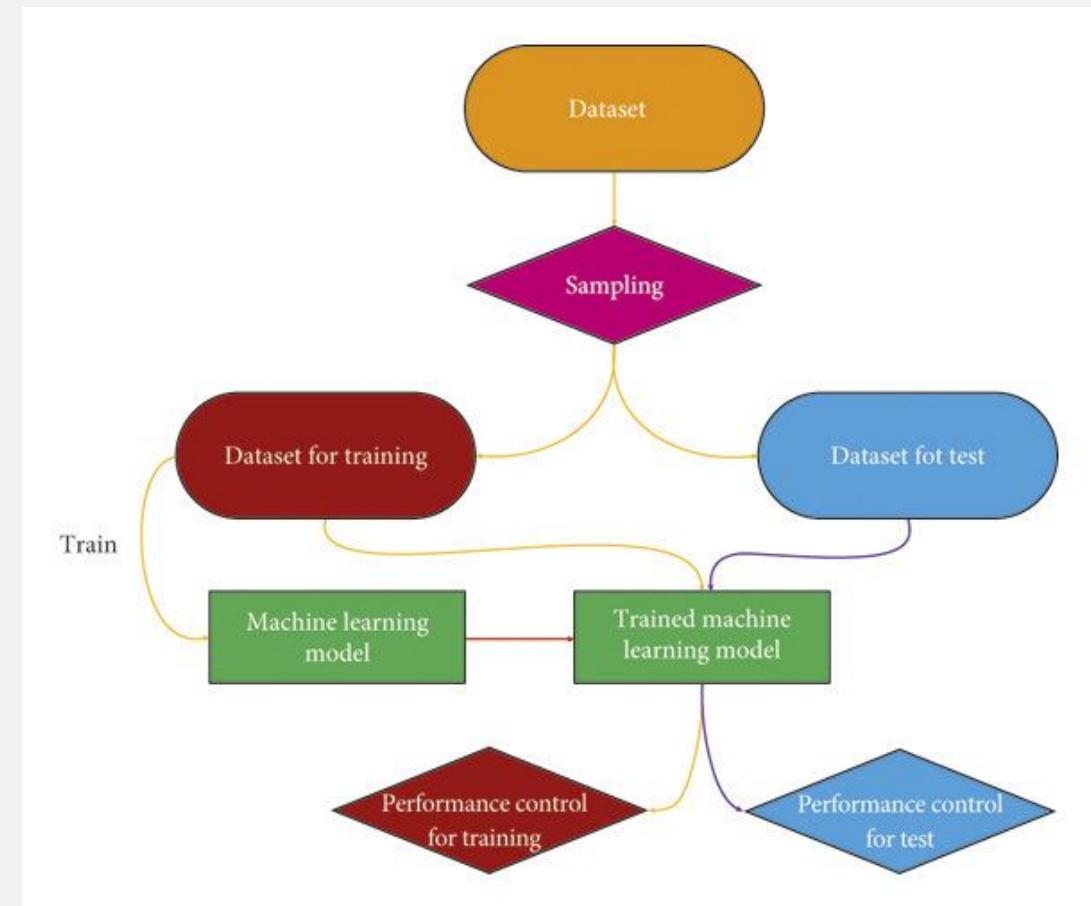
1. Collect Data
2. Preprocess Data
3. Choose Model
4. Train Model
5. Test Model
6. Make Predictions



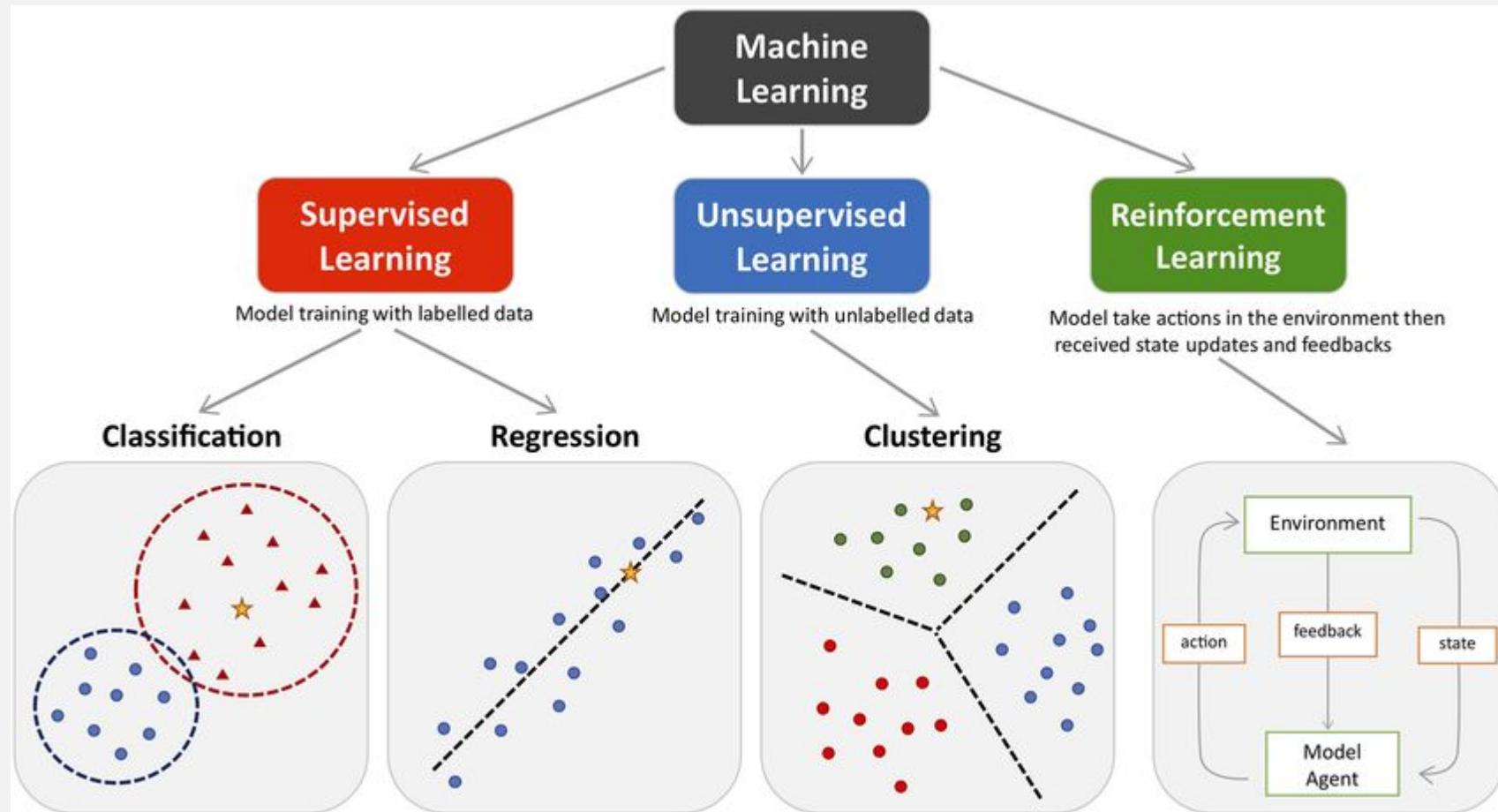
# Overview of Machine Learning Concepts

## Key Terminologies in ML

- **Dataset** – Collection of data used for training
- **Features** – Input variables
- **Label/Target** – Output variable
- **Training Data** – Data used to train model
- **Testing Data** – Data used to evaluate model
- **Model** – Mathematical algorithm
- **Accuracy** – Measure of correctness



# Overview of Machine Learning Concepts



Unsupervised vs Supervised Learning		
Supervised learning:		Unsupervised learning:
<b>Definition</b>	A computer uses given labels as examples to take and sort series of data and thus to predict future events. In supervised learning people teach or train the machine using labeled data.	Unsupervised learning sorts data without using predefined labels. The unsupervised machine learning algorithms act without human guidance.
<b>Input Data</b>	Uses known and labeled input data	Uses unknown input data
<b>Computational Complexity</b>	More complex in computation	Less complex in computation
<b>Number of Classes</b>	Number of classes is known	Number of classes is not known
<b>Real Time</b>	Uses off-line analysis	Uses real-time analysis of data
<b>Types</b>	Two types of supervised machine learning: • Classification • Regression	Two types of unsupervised machine learning: • Clustering • Association

# Overview of Machine Learning Concepts

## ① Supervised Learning

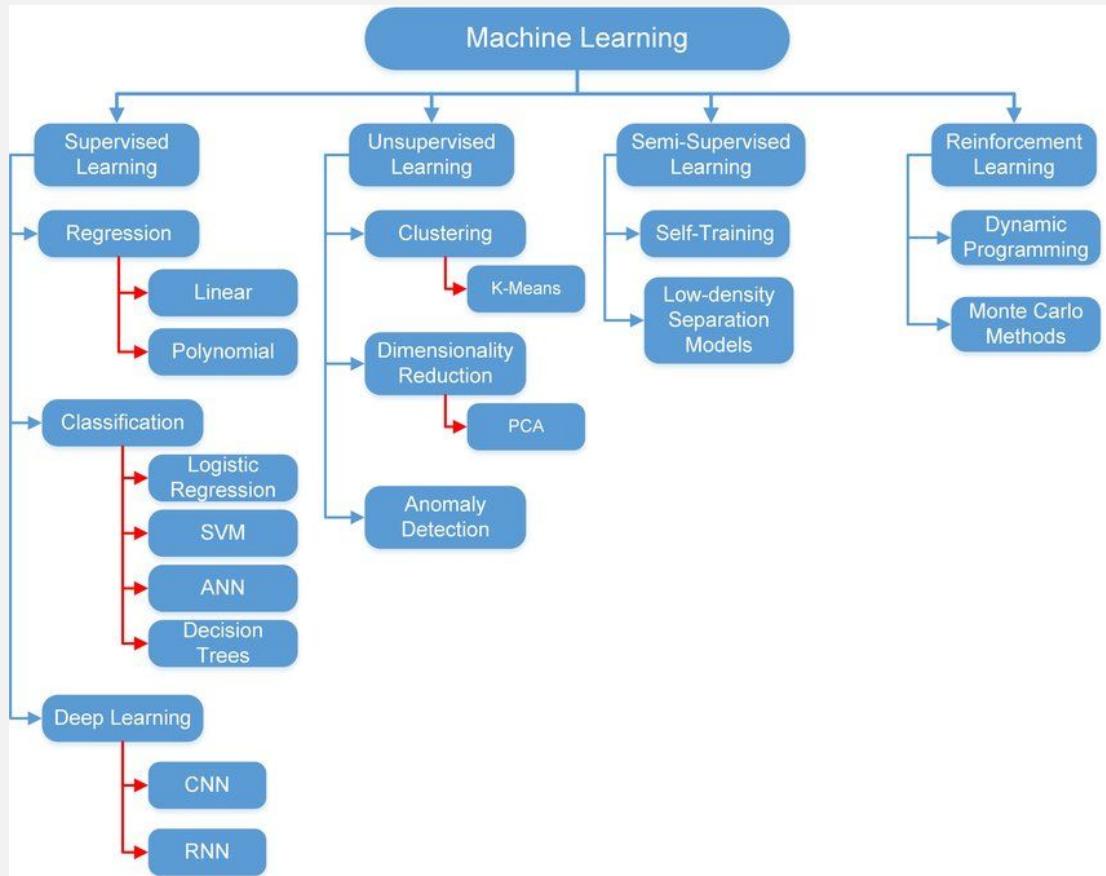
- Labeled data
- Examples: Classification, Regression

## ② Unsupervised Learning

- No labeled data
- Example: Clustering

## ③ Reinforcement Learning

- Learning by rewards and penalties
- Used in robotics and gaming



# Overview of Machine Learning Concepts

## Supervised Learning

### Two Main Types:

- **Classification** → Predict categories  
Example: Spam or Not Spam
- **Regression** → Predict numerical values  
Example: House price prediction

### Common Algorithms:

- Linear Regression
- Logistic Regression
- Decision Tree
- K-Nearest Neighbors

## Unsupervised Learning

### Focus:

- Finding hidden patterns
- Grouping similar data

### Examples:

- Customer segmentation
- Market basket analysis

### Common Algorithms:

- K-Means Clustering
- Hierarchical Clustering
- PCA (Dimensionality Reduction)

## Reinforcement Learning

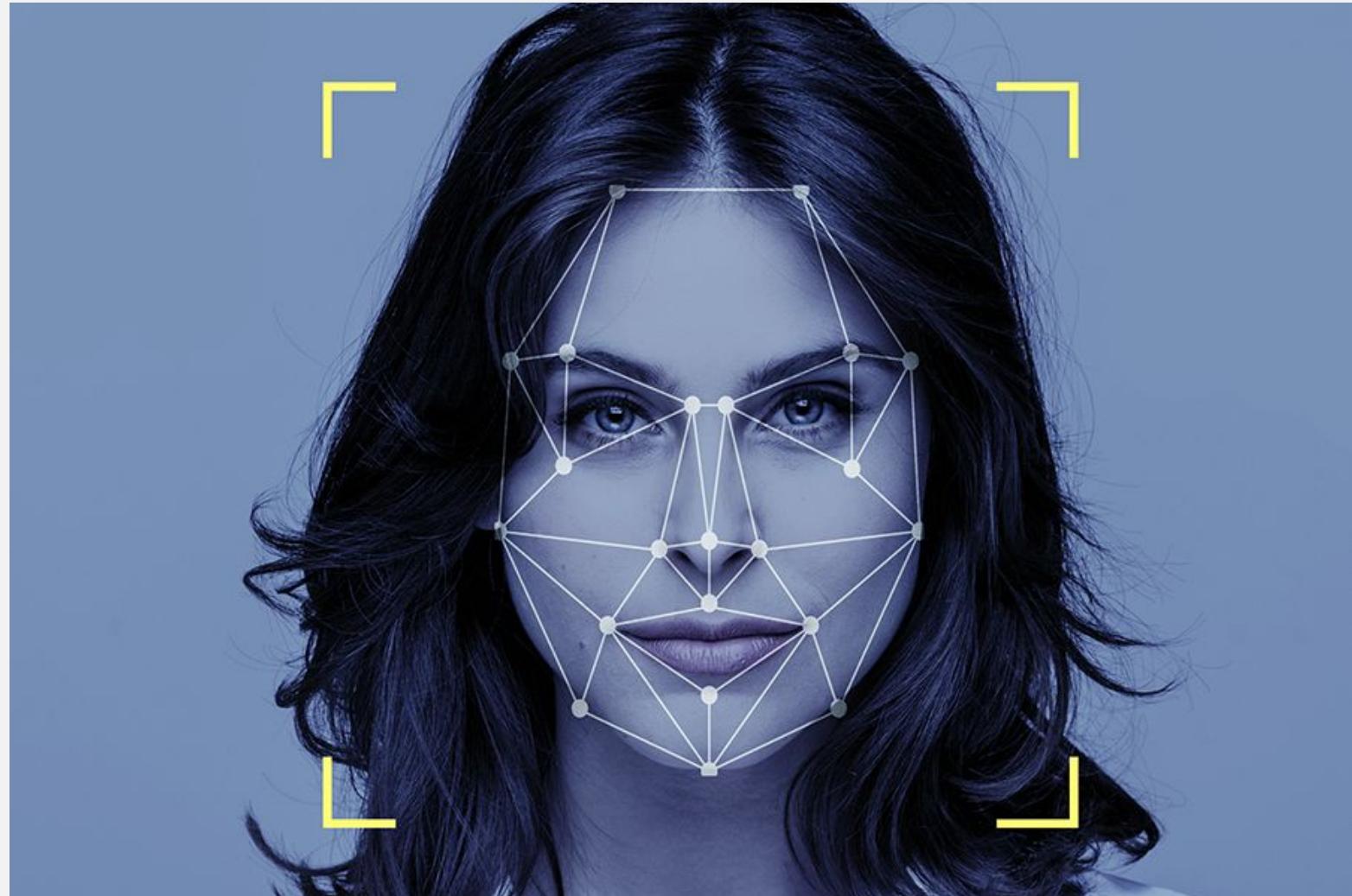
### Components:

- Agent
- Environment
- Action
- Reward

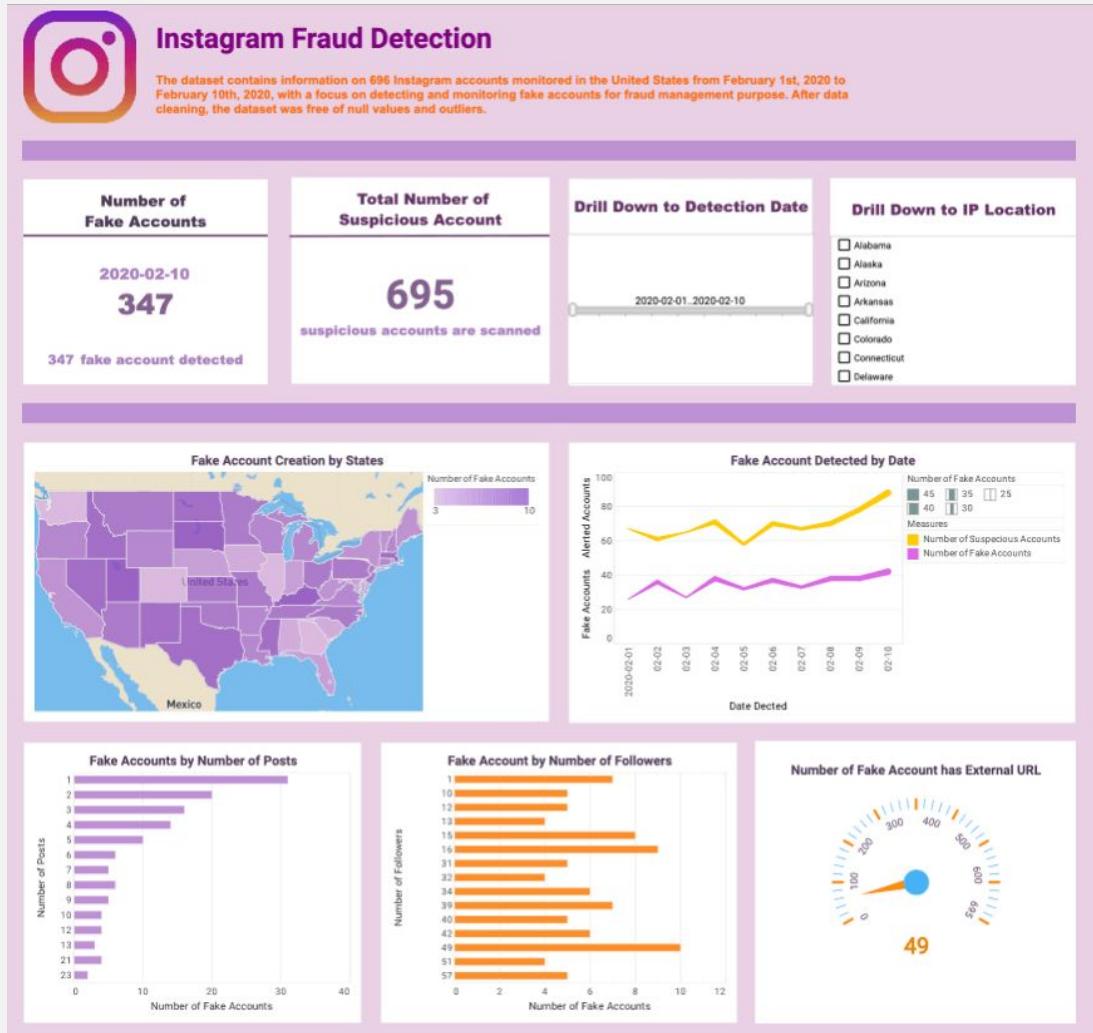
### Used in:

- Self-driving cars
- Robotics
- Game AI

# Overview of Machine Learning Concepts



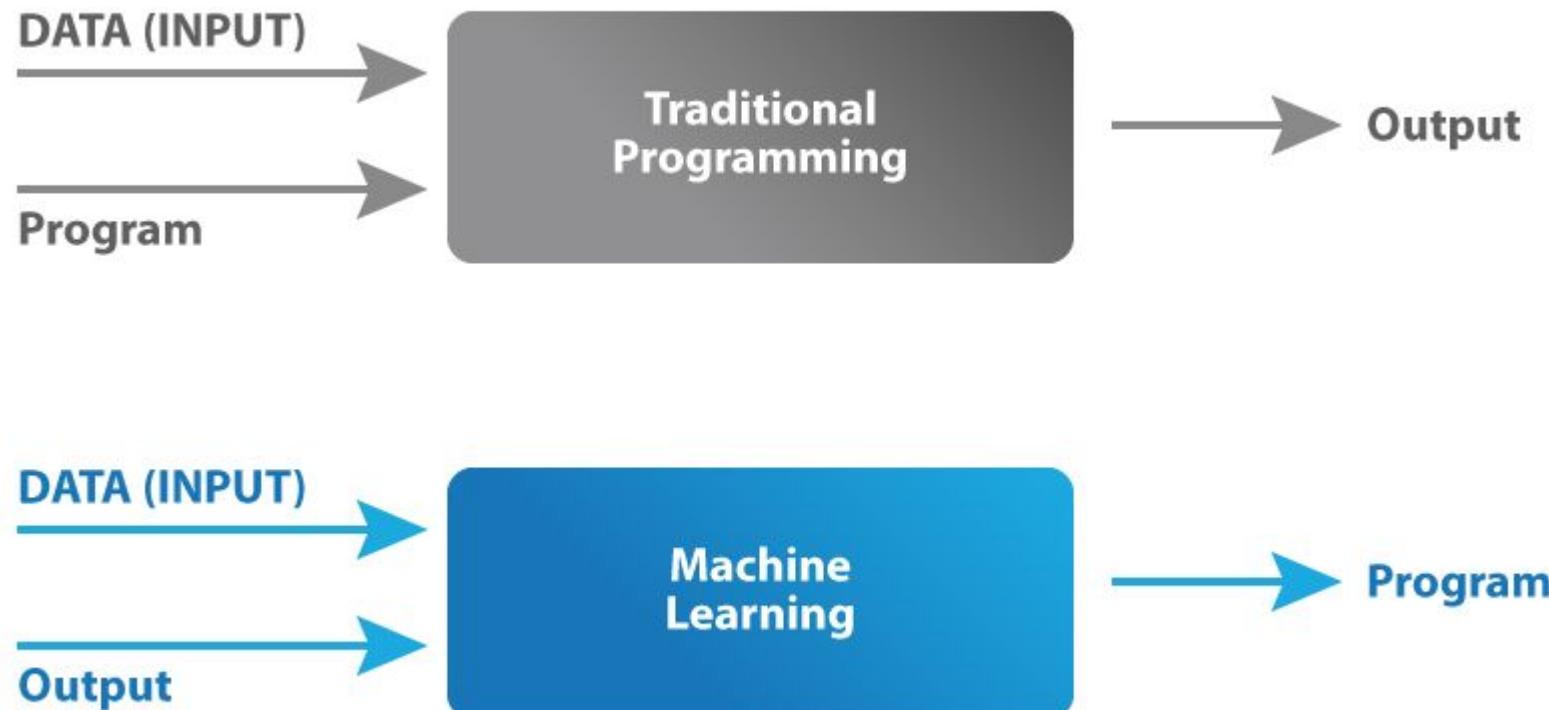
# Overview of Machine Learning Concepts



## Real-World Applications:

- Face Recognition
- Fraud Detection
- Recommendation Systems
- Healthcare Diagnosis
- Chatbots
- Autonomous Vehicles

# Overview of Machine Learning Concepts



## Traditional Programming:

$\text{Input} + \text{Rules} \rightarrow \text{Output}$

## Machine Learning:

$\text{Input} + \text{Output} \rightarrow \text{Model}$   
(learned rules)

# Overview of Machine Learning Concepts

## Advantages of Machine Learning

- ✓ Automates decision-making
- ✓ Handles large data efficiently
- ✓ Improves accuracy over time
- ✓ Identifies hidden patterns
- ✓ Supports predictive analytics

## Challenges of Machine Learning

- Requires large datasets
- High computational cost
- Risk of bias
- Overfitting & underfitting
- Data privacy concerns

# Overview of Artificial Intelligence Concepts

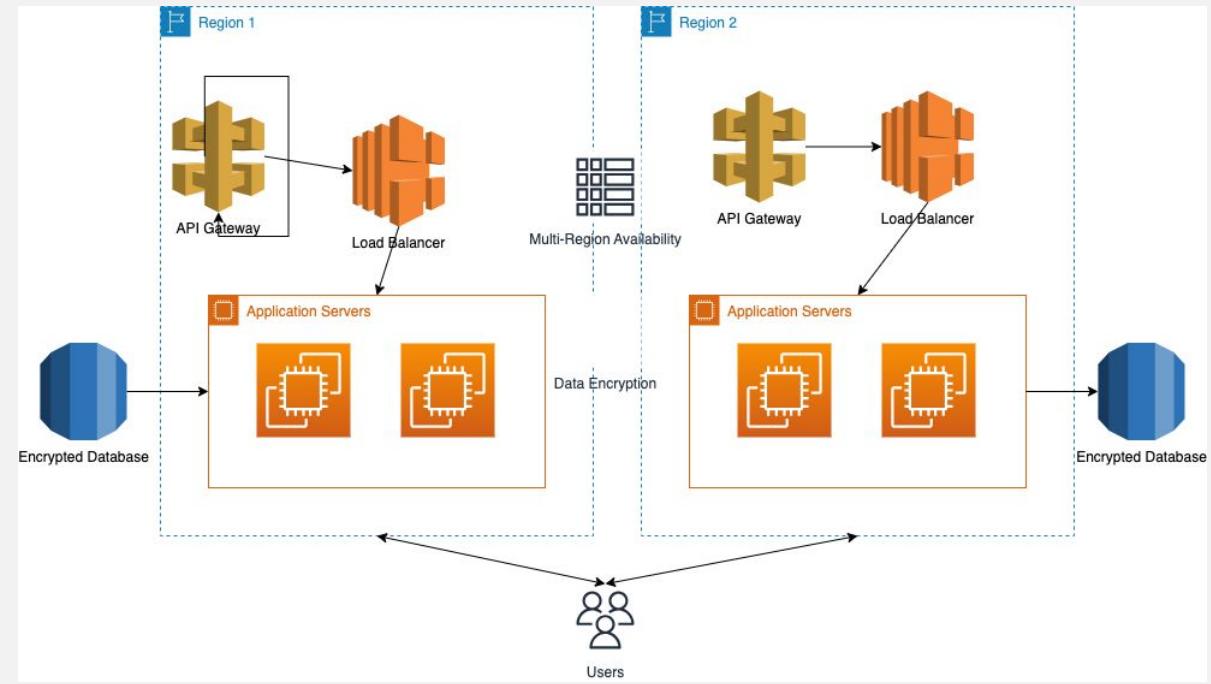
## What is Artificial Intelligence?

### Definition:

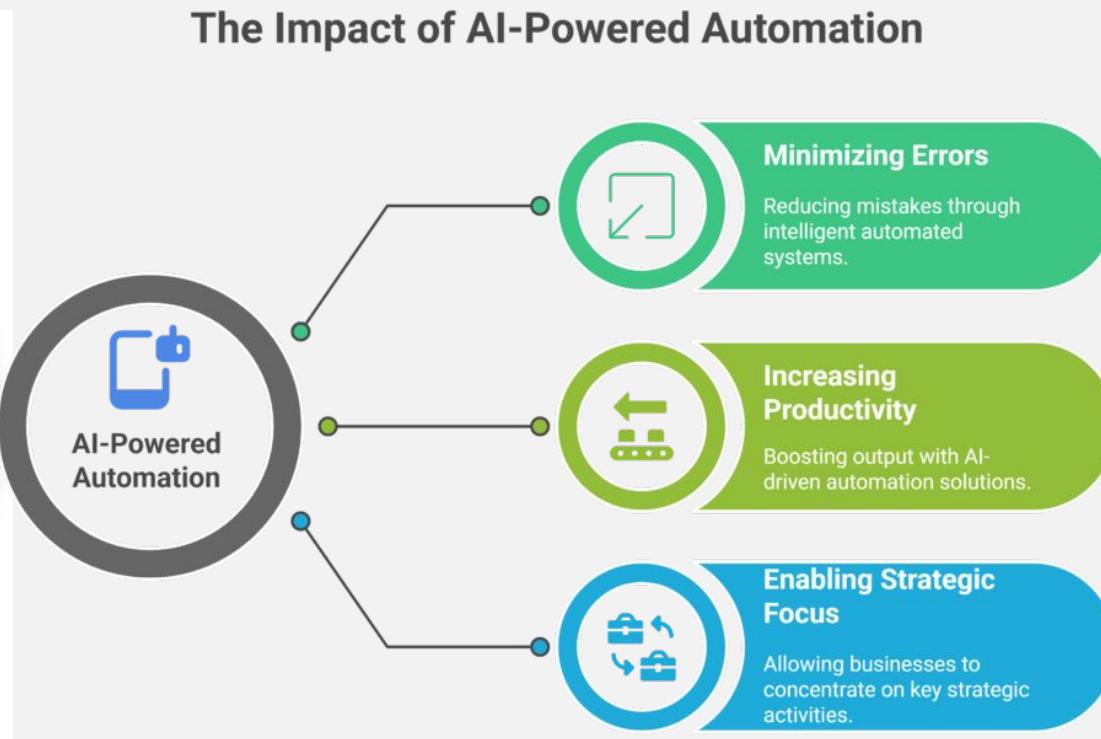
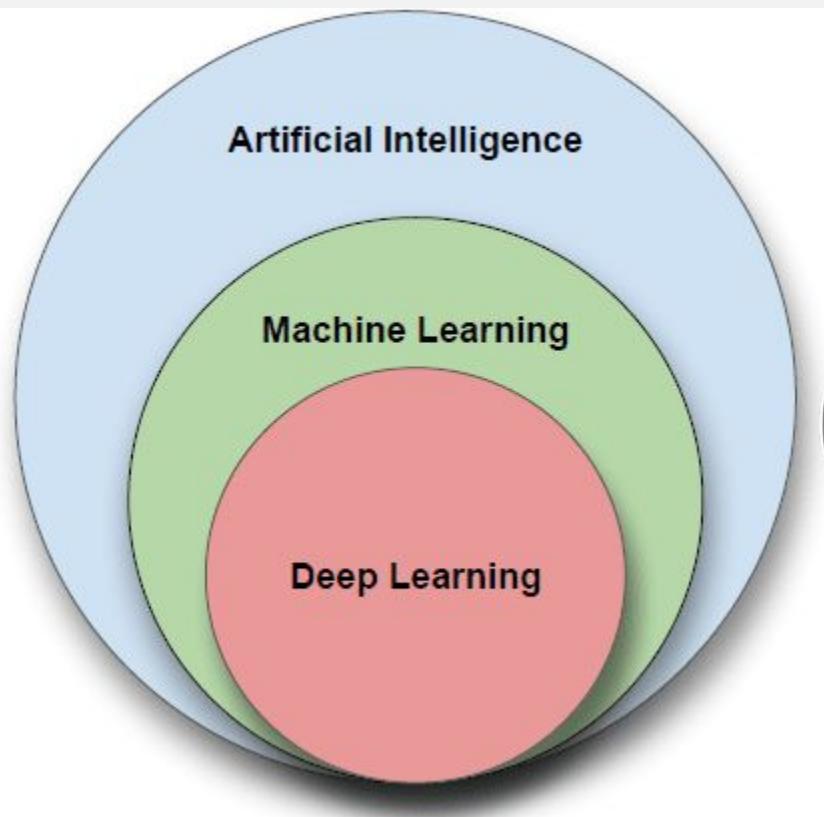
Artificial Intelligence (AI) is the branch of computer science that enables machines to simulate human intelligence such as learning, reasoning, problem-solving, and decision-making.

### Simple Meaning:

AI allows computers to think and act like humans.



# Overview of Artificial Intelligence Concepts



## Core Capabilities of AI:

- Learning (from data)
- Reasoning (logical thinking)
- Problem Solving
- Perception (image, speech recognition)
- Language Understanding

# Overview of Artificial Intelligence Concepts



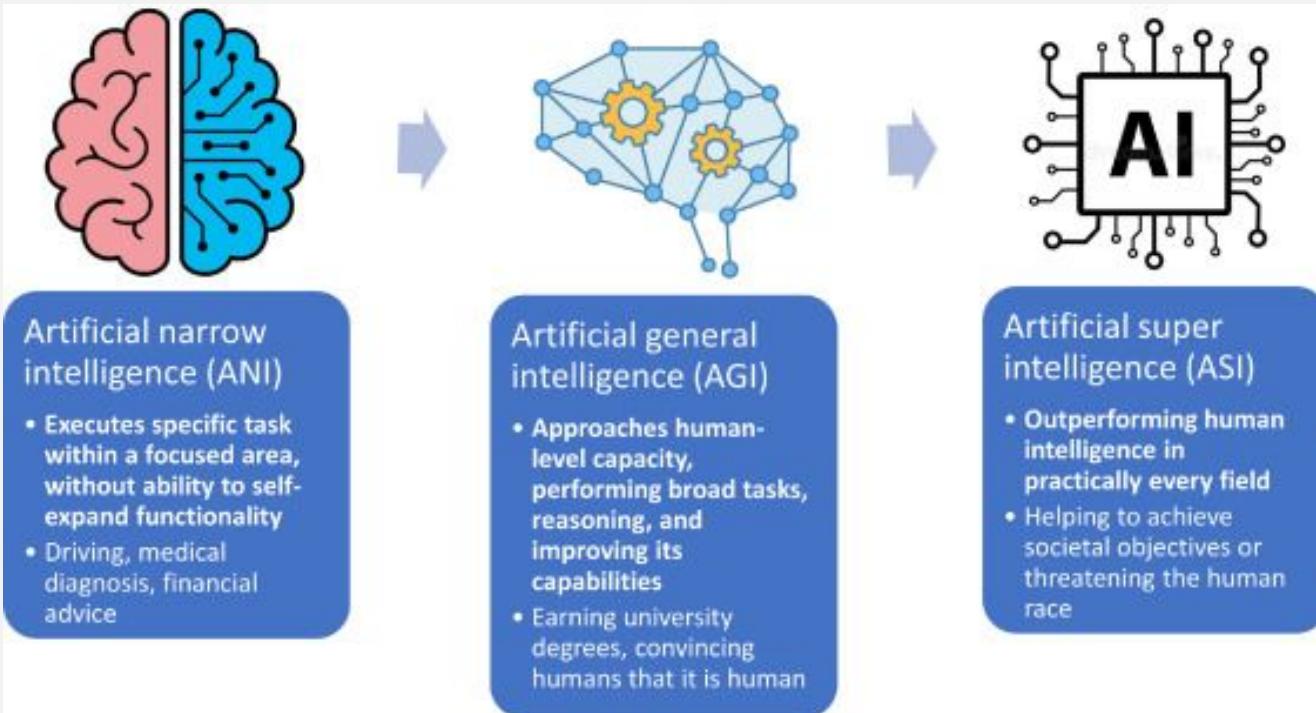
## Evolution of Artificial Intelligence

### Key Phases:

1. 1950s – Birth of AI (Alan Turing concept)
2. 1980s – Expert Systems
3. 2000s – Machine Learning growth
4. 2010s – Deep Learning & Big Data
5. Present – Generative AI & Automation

# Overview of Artificial Intelligence Concepts

## Types of Artificial Intelligence



### ① Artificial Narrow Intelligence (ANI)

- Specialized in one task
- Example: Siri, Alexa

### ② Artificial General Intelligence (AGI)

- Human-level intelligence
- Still theoretical

### ③ Artificial Super Intelligence (ASI)

- Beyond human intelligence
- Future concept

# Overview of Artificial Intelligence Concepts

## Types of AI Based on Functionality

### ① Reactive Machines

- No memory
- Example: IBM Chess program

### ② Limited Memory

- Uses past data
- Example: Self-driving cars

### ③ Theory of Mind

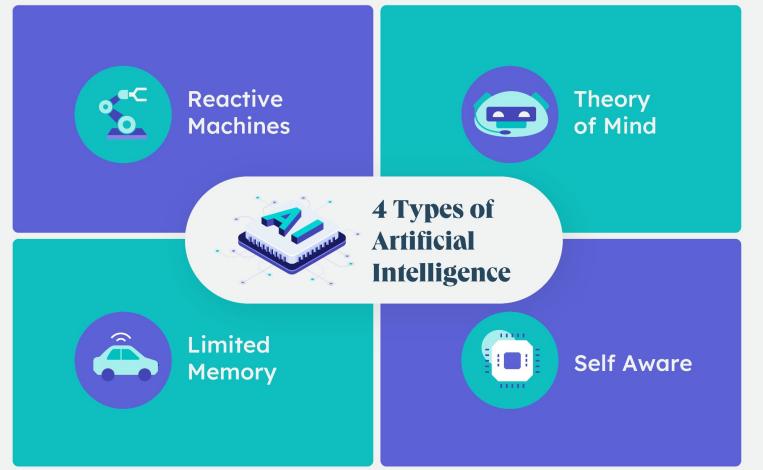
- Understands emotions (Under research)

### ④ Self-Aware AI

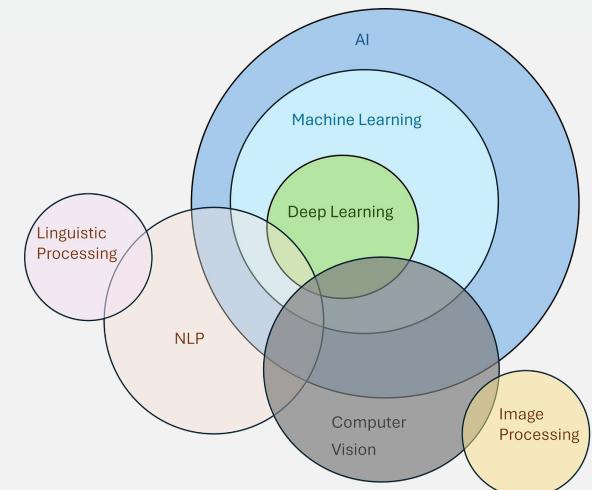
- Conscious machines (Future concept)

## Major Branches:

- Machine Learning (ML)
- Deep Learning (DL)
- Natural Language Processing (NLP)
- Computer Vision
- Robotics
- Expert Systems



HubSpot



# Overview of Artificial Intelligence Concepts

## AI vs Machine Learning vs Deep Learning

<b>Sr.No.</b>	<b>Feature</b>	<b>Artificial Intelligence (AI)</b>	<b>Machine Learning (ML)</b>	<b>Deep Learning (DL)</b>
1	Scope	Broadest (Any "smart" system)	Subset of AI	Subset of ML
2	Core Goal	Simulate human intelligence	Learn from data	Use neural networks to solve complex tasks
3	Methodology	Rules, logic, or algorithms	Statistical models	Multi-layered artificial neural networks
4	Data Type	Any (logical or raw)	Mostly structured (rows/columns)	Unstructured (audio, video, images)
5	Data Volume	Low to High	Moderate to High	Massive (Big Data)
6	Feature Engineering	Manual (Hand-coded rules)	Manual (Human-selected features)	Automatic (Model learns features)
7	Logic Type	Predetermined logic (If-Then)	Pattern recognition	Biological brain simulation
8	Hardware	Low (Runs on simple CPUs)	Moderate (Standard CPUs)	High (Requires GPUs/TPUs)
9	Training Time	Low (Instant for rule-based)	Minutes to hours	Days to weeks

# Overview of Artificial Intelligence Concepts

## AI vs Machine Learning vs Deep Learning

10	Accuracy	Varies by rule quality	High (but can plateau)	Very High (improves with more data)
11	Interpretability	High (Clear logic path)	Moderate (White-box models)	Low ("Black Box" nature)
12	Error Handling	Brittle (Fails if rules change)	Requires manual adjustment	Self-optimizes during training
13	Complexity	Simple to Complex	Moderate complexity	Extremely complex
14	Mathematics	Discrete math, search trees	Statistics, linear algebra	Calculus, deep probability
15	Intervention	High (Humans write logic)	Moderate (Manual data labeling)	Minimal (End-to-end learning)
16	Flexibility	Fixed to specific logic	Adaptable to new data	Highly generalizable
17	Dependency	Independent of ML/DL	Dependent on AI	Dependent on ML and AI
18	Evolution	Since 1950s (Early AI)	Since 1980s (Classic ML)	Since 2010s (Modern DL)
19	Cost	Low (Development hours)	Moderate (Data & Compute)	High (Data, Compute, & Energy)
20	Key Example	Chess engines, Siri	Spam filters, Recommendations	Face ID, Self-driving cars

# Overview of Artificial Intelligence Concepts

## Applications of Artificial Intelligence

### Healthcare

- Disease prediction
- Medical imaging analysis

### Banking

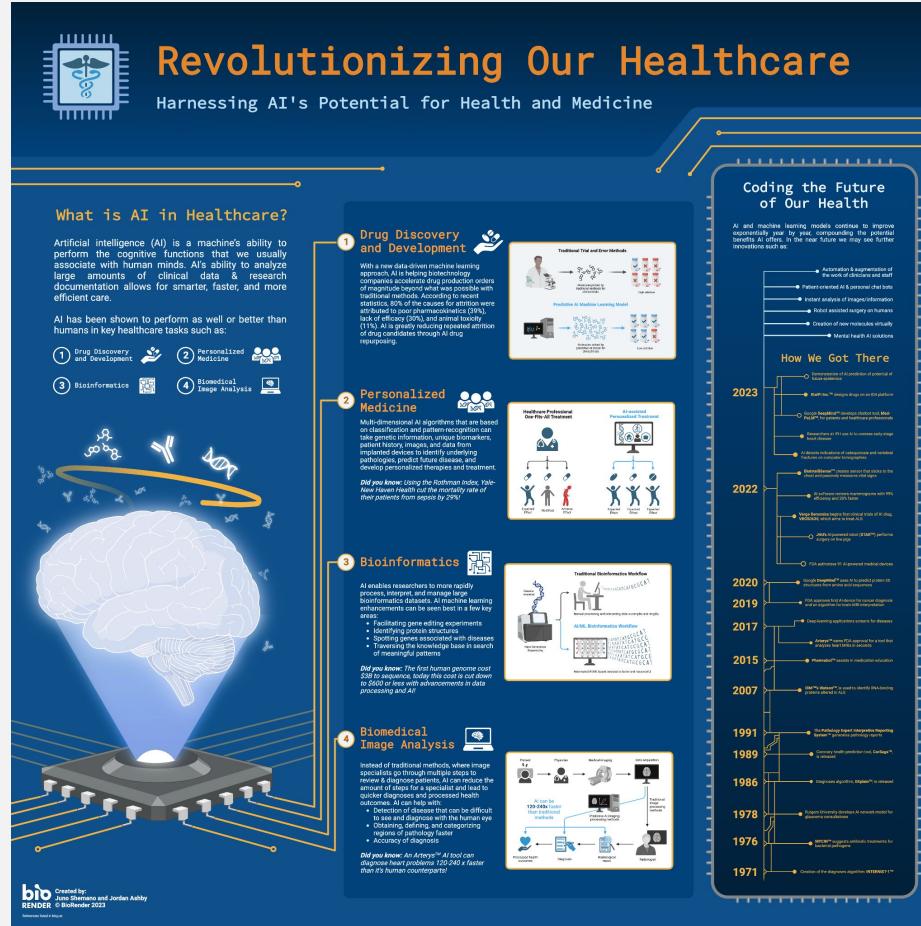
- Fraud detection
- Risk analysis

### Retail

- Personalized recommendations

### Transportation

- Self-driving cars



## Emerging Trends:

- Generative AI
- AI-powered automation
- Smart cities
- Human-AI collaboration
- Industry 4.0 integration

# Overview of Artificial Intelligence Concepts

## Benefits of AI

- Faster decision-making
- Automation of repetitive tasks
- Improved accuracy
- Cost reduction
- Better customer experience

## Challenges of AI

- High development cost
- Data privacy concerns
- Job displacement fear
- Ethical issues
- Bias in AI systems



# Types of Analytics – Descriptive Analytics

## What is Descriptive Analytics?

### 📌 Definition:

Descriptive Analytics is the process of analyzing historical data to understand **what has happened** in the past.

👉 It summarizes raw data into meaningful information.

❓ “**What happened?**”

Examples:

- How many products were sold last month?
- What was last year's revenue?
- Which product had the highest sales?

# Types of Analytics – Descriptive Analytics

## How It Works

### Process:

- ① Collect historical data
- ② Organize and clean data
- ③ Analyze using basic statistics
- ④ Present using charts and reports

### Tools Used

- Excel
- SQL
- Power BI
- Tableau
- Google Data Studio

## Techniques Used

- Data aggregation
- Data mining
- Data visualization
- Basic statistics (mean, median, percentage)

## Advantages

- ✓ Easy to understand
- ✓ Helps identify trends
- ✓ Supports decision-making
- ✓ Improves business monitoring

## Real-Life Examples

-  Monthly Sales Report
-  Website traffic summary
-  Hospital patient count report
-  Bank transaction summary

## Limitations

- ✗ Does not predict future
- ✗ Does not explain why something happened
- ✗ Only focuses on past data

# Types of Analytics – Diagnostic Analytics

## What is Diagnostic Analytics?

### 📌 Definition:

Diagnostic Analytics is the process of analyzing data to understand **why something happened**.

👉 It goes deeper than descriptive analytics.

## Key Question Answered

❓ “**Why did it happen?**”

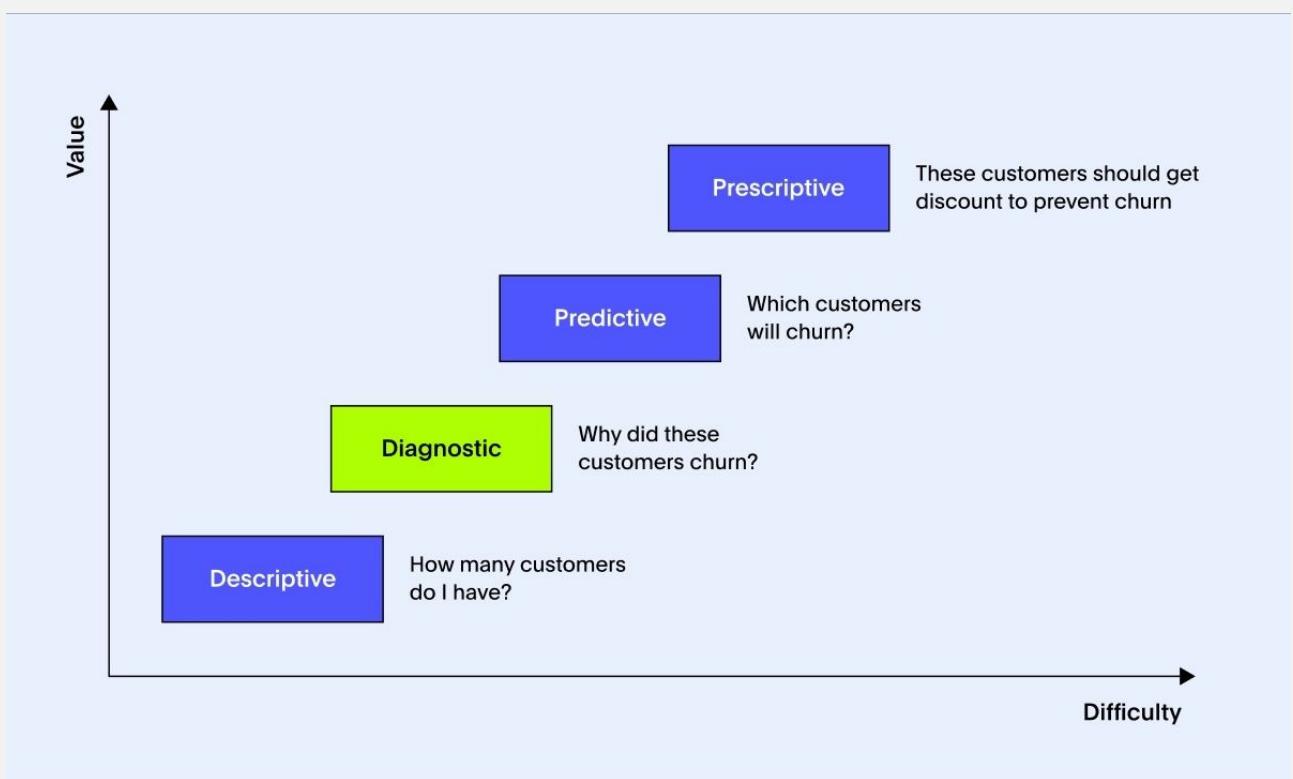
Examples:

- Why did sales drop last month?
- Why did website traffic increase suddenly?
- Why are customers leaving?

## How It Works:

### Process:

- 1 Identify the problem
- 2 Compare current vs past data
- 3 Find patterns & relationships
- 4 Identify root cause



# Types of Analytics – Diagnostic Analytics

**Root-cause Analysis Diagram**

