

# Introduction to Data Analytics

Fundamentals & Practical Applications



Data Types



Data Lifecycle



Key Roles



Essential Tools

From theory to practice: Descriptive, Diagnostic, Predictive & Prescriptive Analytics

Hands-on Lab:   
Python, Anaconda & Jupyter

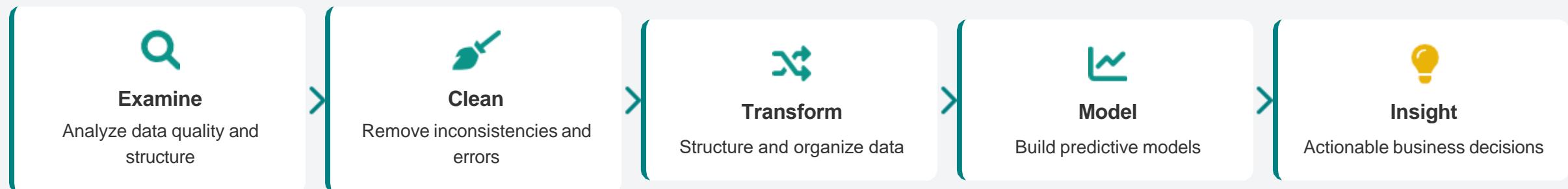
# What is Data Analytics?

## Definition

Data analytics is the process of **examining, cleaning, transforming, and modeling data** with the goal of discovering useful information, informing conclusions, and supporting decision-making.

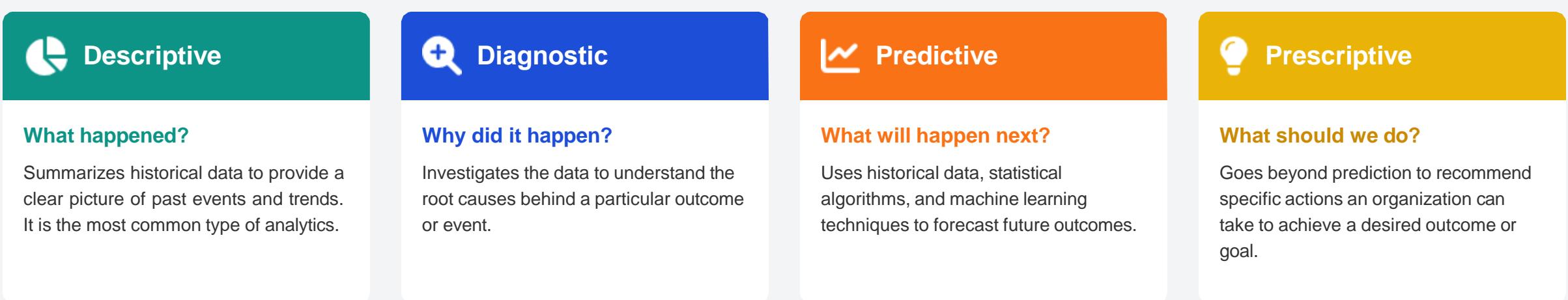
## Importance

In today's data-driven world, organizations leverage analytics to turn **raw information into actionable insights**, which is critical for improving operational efficiency, enhancing customer experiences, and maintaining a competitive advantage.



# Types of Data Analytics

Data analytics can be categorized into four main types, each serving a different purpose and providing a different level of insight. These types build upon each other, moving from a simple summary of the past to recommendations for the future.



# Descriptive & Diagnostic Analytics

## Descriptive Analytics

### What happened?

Summarizes historical data to provide a clear picture of past events and trends. It is the most common type of analytics.

#### Example

*A retail company's dashboard showing total sales, revenue by region, and top-selling products for the previous quarter.*



From  
Data

## Diagnostic Analytics

### Why did it happen?

Investigates the data to understand the root causes behind a particular outcome or event.

#### Example

*If sales dropped in a specific month, diagnostic analytics would explore factors like a new competitor, supply chain issues, or a failed marketing campaign.*



Identify patterns → Discover causes → Understand impact

# Predictive & Prescriptive Analytics

## Predictive Analytics

**Question:** **What will happen next?**

Uses historical data, statistical algorithms, and machine learning techniques to forecast future outcomes.

 **Example:** A financial institution using a model to predict which loan applicants are most likely to default based on their credit history and financial behavior.

## Prescriptive Analytics

**Question:** **What should we do?**

Goes beyond prediction to recommend specific actions an organization can take to achieve a desired outcome or goal.

 **Example:** An e-commerce platform suggesting which products to feature in a targeted marketing campaign to maximize sales, based on predictive models of customer behavior.

## Business Impact

-  Predictive analytics helps organizations anticipate future events and prepare strategic responses.
-  Reduces uncertainty and minimizes reliance on intuition for decision-making.
-  Prescriptive analytics takes action a step further by recommending specific courses of action to achieve goals.
-  Increases the likelihood of successful outcomes, leading to improved performance and sustainable growth.

## Analytics Maturity Progression

Descriptive

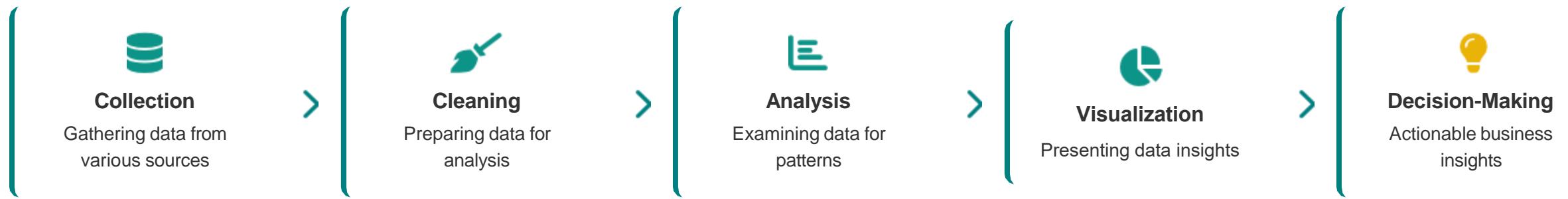
Diagnostic

Predictive

Prescriptive

# The Data Analytics Lifecycle

The data lifecycle outlines the journey of data from its creation to its final application in decision-making. This structured process ensures that data is managed efficiently, remains high-quality, and is leveraged to its full potential. Each stage builds upon the last, transforming **raw information into a strategic asset** that drives business success.



# Data Collection & Cleaning

## Data Collection

The foundational stage where information is generated and gathered from various sources. The quality and relevance directly impact analysis accuracy.

### Internal Sources

CRM systems, transaction records, databases

### External Sources

APIs, social media feeds, public datasets, IoT sensors

### Manual Sources

Surveys, customer feedback, manual data entry

### Data Types

Structured

Unstructured

## Data Cleaning

Raw data is often inconsistent, incomplete, or inaccurate. The cleaning phase transforms data into a reliable and usable format for analysis.

### Importance

Errors in raw data can lead to flawed conclusions. Quality data is essential for trustworthy analysis.

### Key Processes

#### Error Correction

Identifying and fixing inaccuracies or inconsistencies

#### Data Transformation

Converting data into a suitable format for analysis

#### Handling Missing Values

Addressing gaps in the dataset

#### Removing Duplicates

Eliminating redundant entries to prevent skewed results

# Analysis & Visualization

## Analysis

Examines cleaned data to uncover patterns, trends, and correlations, transforming raw information into meaningful insights.

### Common Methods



Statistical Modeling



Machine Learning



Data Mining



Algorithms

### Tools

Python, R, SQL, and specialized analytics platforms power the analysis process.



## Visualization

Translates complex analytical findings into accessible graphical representations for effective communication.

### Key Techniques



Charts & Graphs



Dashboards



Maps



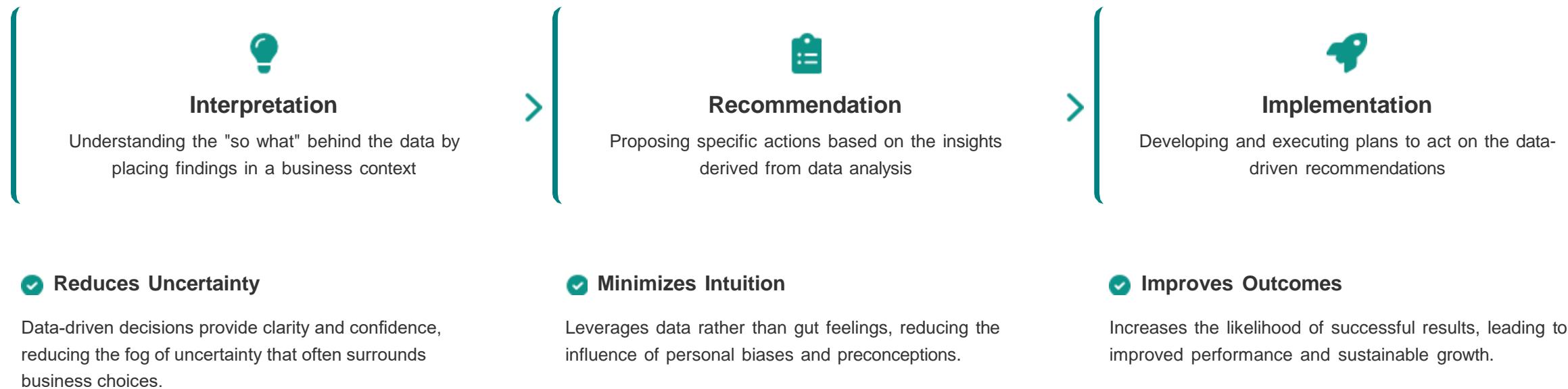
Interactive Elements

### Popular Tools

Tableau and Power BI are leading tools for creating interactive and compelling data visualizations.

# Decision-Making with Data

The final stage of the data lifecycle involves using insights gained from analysis to make informed, strategic decisions. This is where **data-driven insights are translated into tangible business actions** and value.



## Impact on Business Success

Organizations that effectively leverage data analytics are five times more likely to make quicker decisions than their competitors, giving them a significant edge in today's fast-moving business environment.

# Key Roles in Data Analytics

As data becomes increasingly central to business strategy, specialized roles have emerged to manage, interpret, and leverage it effectively. These roles collaborate closely to transform raw data into actionable business insights.



## Data Analyst

Acts as a bridge between raw data and strategic direction. Focuses on what happened (descriptive & diagnostic analytics).

- SQL
- Python/R
- Visualization



## Data Scientist

More forward-looking role. Builds predictive models using machine learning to forecast future events and devise strategies.

- Machine Learning
- Predictive Modeling
- Big Data



## Business Analyst

Focuses on business implications of data. Acts as intermediary between IT and business departments.

- Critical Thinking
- Communication
- Business Acumen



**Collaborative Relationship:** These roles work closely together to transform data into business value

# Data Analyst Role

## Core Responsibilities

-  **Data Management:** Designing and maintaining data systems and databases
-  **Data Preparation:** Mining data from various sources and cleaning it
-  **Analysis:** Using statistical tools to identify trends and patterns
-  **Reporting:** Creating visualizations to communicate findings

## Required Skills



SQL



Programming



Spreadsheets



Visualization

## Typical Deliverables



Reports

Written analysis of data findings



Dashboards

Interactive data displays



Visualizations

Charts and graphs



Insights

Actionable recommendations

## Key Focus



**What happened?** (Descriptive & Diagnostic)

Primarily works with **structured data** to extract insights

# Data Scientist vs Business Analyst

## Data Scientist

### Focus

What will happen? (Predictive & Prescriptive)

### Core Task

Builds predictive models and algorithms.

### Key Skills

- Advanced Programming (Python, R, SAS)
- Machine Learning algorithms
- Big Data Technologies
- Statistical Modeling

### Business Contribution

Creates predictive models, data products, and strategic plans that forecast future outcomes and recommend specific actions.

## Business Analyst

### Focus

So what? (Applying insights to business)

### Core Task

Improves business processes and strategies.

### Key Skills

- Analytical & Critical Thinking
- Communication
- Business Acumen
- Technical Proficiency (Excel, SQL, Tableau)

### Business Contribution

Bridges IT and business departments, translating technical data insights into actionable recommendations for non-technical stakeholders.

# Essential Data Analytics Tools

A data analyst's effectiveness is significantly enhanced by their proficiency with a range of powerful tools. No single tool can address every challenge; instead, a well-rounded toolkit enables analysts to collect, process, analyze, and visualize data efficiently.

## Data Processing Tools



### Python

Programming language with libraries for data analysis

Pandas, NumPy, Matplotlib for data manipulation and visualization



### SQL

Language for managing and querying databases

Data querying, manipulation, and aggregation for relational databases



### Excel

Spreadsheet for data analysis and visualization

Pivot tables, charts, and data modeling for structured data

## Data Visualization Tools



### Tableau

Interactive data visualization platform

Creates interactive dashboards and reports, connects to various data sources



### Power BI

Business intelligence platform

Interactive visualizations with AI-powered insights, integrates with Microsoft ecosystem

# Python & SQL for Analytics

## Python

A versatile programming language with **simple, readable syntax** for data analysis.

### Key Libraries

 **Pandas:** Data structures

 **NumPy:** Scientific computing

 **Matplotlib:** Visualizations

### Common Uses

 **ETL:** Extracting and cleaning data

 **Statistical Analysis:** Complex calculations

 **Why it matters:** Bridges data exploration and insights.

## SQL

The standard language for **querying relational databases**.

### Core Functions

 **Querying:** Retrieving data

 **Manipulation:** Inserting,  
updating

 **Aggregation:** SUM,  
AVG, GROUP BY

### Importance

 Vital for ETL tasks

 Foundation for data pipelines

 **Why it matters:** Essential for data analysts to access databases.

# Excel, Tableau & Power BI

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## Excel

Despite the rise of more advanced tools, Excel remains a cornerstone for day-to-day data analysis.

### Key Features:

- Pivot Tables & Charts
- Formulas and Functions
- Data Modeling with Power Pivot
- Conditional Formatting

### Integration:

Smooth integration with other Microsoft products, particularly Power BI, allowing for seamless downstream analysis and reporting.

## Tableau

A leading data visualization tool that enables users to create interactive and visually compelling dashboards.

### Key Features:

- Interactive Dashboards
- Connects to various data sources
- Collaboration with Tableau Online
- Advanced Analytics

### Use Case:

Ideal for business analysts and data professionals who need to create interactive visualizations for exploring data.

## Power BI

Microsoft's business intelligence platform for data visualization and sharing insights across organizations.

### Key Features:

- Interactive Visualizations
- Connects to hundreds of data sources
- AI-Powered Insights
- Ecosystem Integration

### Integration:

Works seamlessly with other Microsoft tools like Excel, Azure, and Microsoft Fabric, creating a unified analytics workflow.

# Real-World Applications of Data Analytics

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-  **Healthcare** → Predicting disease outbreaks, improving patient care
-  **Finance** → Fraud detection, credit scoring, investment strategies
-  **Retail & E-commerce** → Personalized recommendations, inventory management
-  **Sports** → Player performance analysis, game strategy optimization
-  **Transportation** → Traffic prediction, route optimization
-  **Government** → Smart cities, public policy decision-making

# Summary & Next Steps

## Key Concepts Covered

### Types of Analytics

Descriptive, Diagnostic, Predictive, & Prescriptive

### Data Lifecycle

Collection, Cleaning, Analysis, Visualization, Decision-Making

### Key Roles

Data Analyst, Data Scientist, Business Analyst

### Essential Tools

Python, SQL, Excel, Tableau, Power BI

## → Continued Learning

### Advanced Python

Libraries, data manipulation, visualization

### SQL for Data Warehousing

Advanced queries, joins, window functions

### Tableau & Power BI

Dashboards, interactive reports, storytelling

### Practical Applications

Industry-specific use cases, case studies

# Thank You!

You're now ready to apply these concepts in your data analytics journey.



# Lab Activity 1: Data in Everyday Life

- 1 Form small groups (3–4 people)
- 2 Write down 3 examples of data in daily life
- 3 Categorize each into:
  - Descriptive → What happened?
  - Diagnostic → Why did it happen?
  - Predictive → What will happen?
  - Prescriptive → What should we do?
- 4 Share 1 example with the class



## Lab Activity 2: Role-Playing



Scenario: Online store reports 20% drop in sales last month

Roles:



Data Analyst: Collects, cleans, analyzes sales data



Business Analyst: Connects insights to business goals



Data Scientist: Builds predictive models to forecast sales



Task: In groups, discuss what your role would do to solve this



Each group prepares a 1-min presentation