Introduction to PANDAS

Yokshita :)

What is Pandas?

- *Open-source data analysis & manipulation tool*
- *Built on top of NumPy*
- *Created by Wes McKinney in 2008*
- *Highly preferred for data cleaning, transformation, and exploration*

Key Features

- Fast and efficient DataFrame object
- Tools for reading and writing data
- Handling of missing data
- Merge and join datasets

Core Data Structures

Series

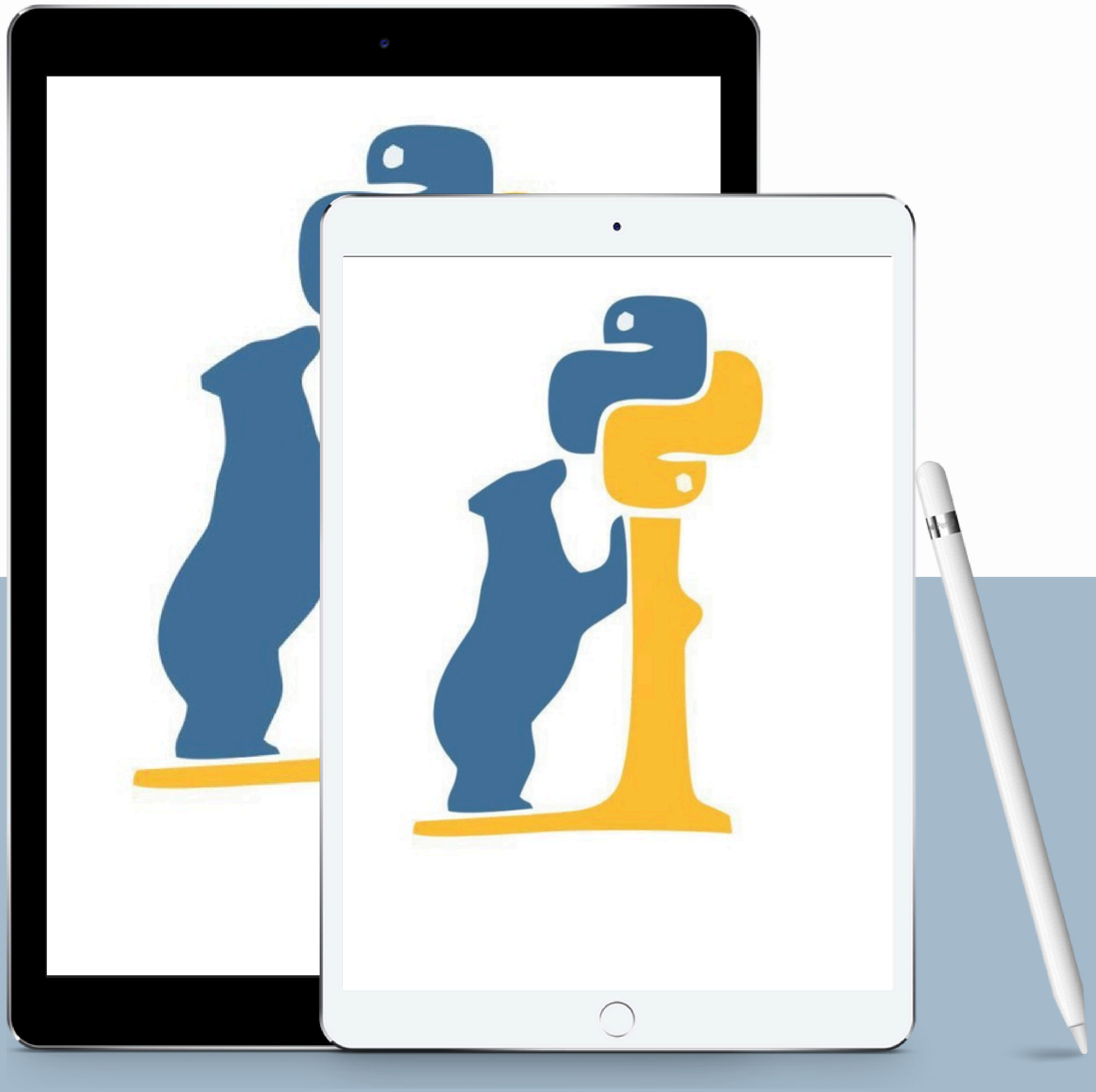
- One-dimensional labeled array
- Example:

```
pd.Series([1, 2, 3])
```

DataFrame

- Two-dimensional labeled data structure
- Example:

```
pd.DataFrame({'Name': ['Alice', 'Bob'], 'Age': [25, 30]})
```



Reading Data

From CSV

- df = pd.read_csv("data.csv")

From Excel

- df = pd.read_excel("data.xlsx")

Data Exploration

Viewing Data

df.head(n)	*View first n rows (default: 5)*
df.tail(n)	*View last n rows (default: 5)*

Data Summary

df.info()	*Overview of data types, non-null values, memory usage*
df.describe()	*Statistical summary (mean, std, min, etc.)*

Data Structure

df.shape	*Returns (rows, columns)*
df.columns	*List of column names*
df.index	*Row index range*

Data Exploration

Value Counts

Frequency of unique values in a column

EXAMPLE	*df['column_name'].value_counts()*

Checking for Missing Data

df.isnull().sum()	*Total missing values per column*
df.isnull().any()	*Checks if any column has missing values*

Data Cleaning

Handling Missing Values

```
df.dropna(inplace=True)
```

Fill missing values

```
df.fillna(0, inplace=True)
df.fillna(method='ffill')  # Forward fill
df.fillna(method='bfill')  # Backward fill
```

Renaming Columns

```
df.rename(columns={'oldName': 'newName'}, inplace=True)
```

Removing Duplicates

```
df.drop_duplicates(inplace=True)
```

Replacing Values

```
df['Column'].replace('old', 'new', inplace=True)
```

Data Manipulation

Adding Columns

```
df['New_Col'] = [value1, value2, ...]
df['Double_Age'] = df['Age'] * 2
```

Deleting Columns / Rows

```
df.drop('ColumnName', axis=1, inplace=True)  # Drop column
df.drop(index_number, axis=0, inplace=True)  # Drop row
```

Filtering Data

```
df[df['Age'] > 25]
```

Sorting Data

```
df.sort_values(by='Age', ascending=False)
```

Grouping & Aggregating

Basic Syntax

```
df.groupby('Department')
```

Aggregation Functions

```
df.groupby('Department')
['Salary'].mean()

df.groupby('Department')
['Salary'].sum()

df.groupby('Department')
['Salary'].count()
```

Multiple Aggregations

```
df.groupby('Department')
['Salary'].agg(['mean', 'max',
'min'])
```

Grouping by Multiple Columns

```
df.groupby(['Department',
'Gender'])['Salary'].mean()
```

Merging and Joining

merge()

Combines DataFrames based on column values

```
pd.merge(df1, df2, on='ID', how='inner')
```

join()

Simpler syntax than merge(), joins on index by default

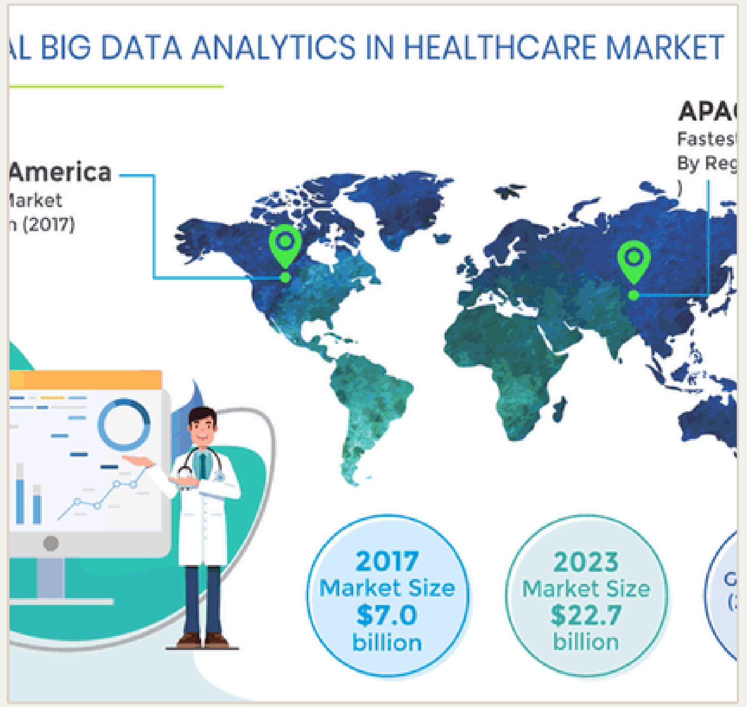
```
df1.join(df2, how='left')
```

concat()

```
pd.concat([df1, df2])  # Row-wise

pd.concat([df1, df2], axis=1)  # Column-wise
```

Real-World Use Cases


L BIG DATA ANALYTICS IN HEALTHCARE MARKET
America
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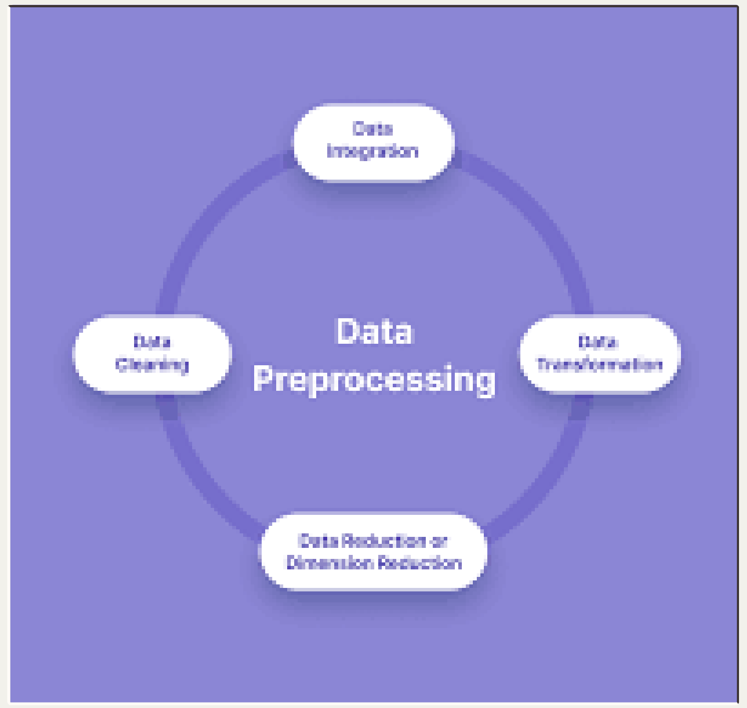
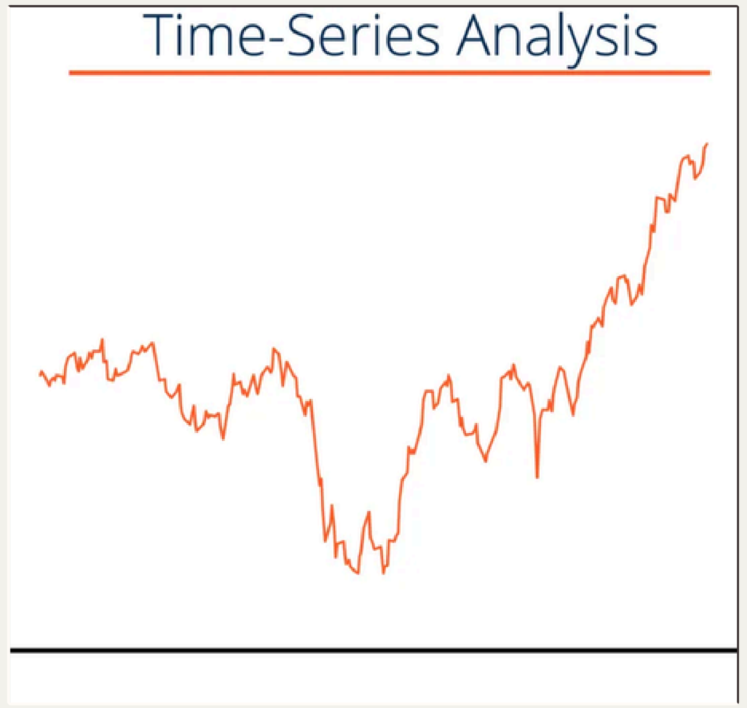
n (2017)
APA
Fastes
By Reg
2017 Market Size $7.0 billion
2023 Market Size $22.7 billion

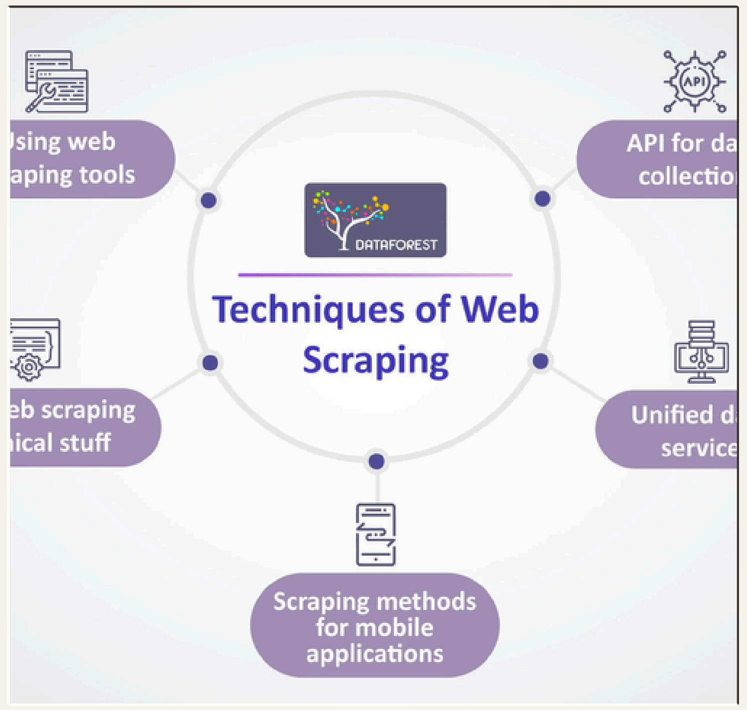
Data Analysis in Finance, Healthcare, Marketing



Machine Learning preprocessing



Time-series analysis



Web scraping and cleaning