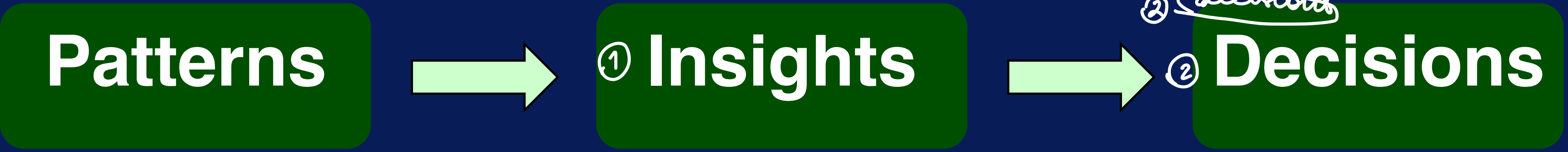
# Analytical Operations

# After this video you will be able to..

- List common analytical operations within big data pipelines.
- Describe sample applications for these analytical operations.

# Analytical Operations

used in analitics : the process of transforming data into ① insights for making more informed ② decisions



Patterns → ① Insights → ② Decisions

- **Purpose**
  - Discover meaningful trends and patterns in data
  - Gain insights into problem
  - Make data-driven decisions

# Sample Analytical Operations

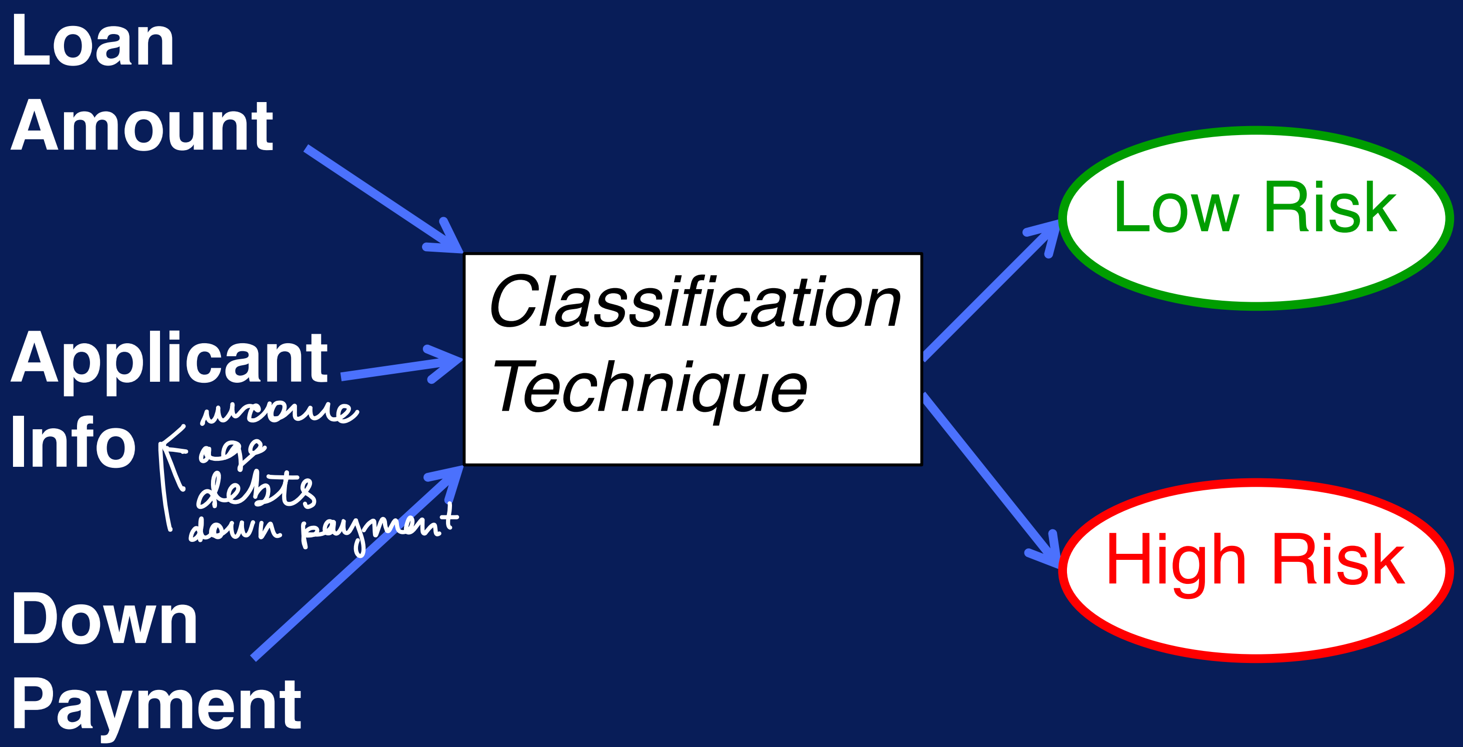
- Classification
- Clustering
- Path analysis
- Connectivity analysis

# Classification

goal: predict a categorical target from the input data

- Classify loan application risk

one with discrete values or categories instead of continous values



Loan Amount

Applicant Info

income
age
debts
down payment

Down Payment

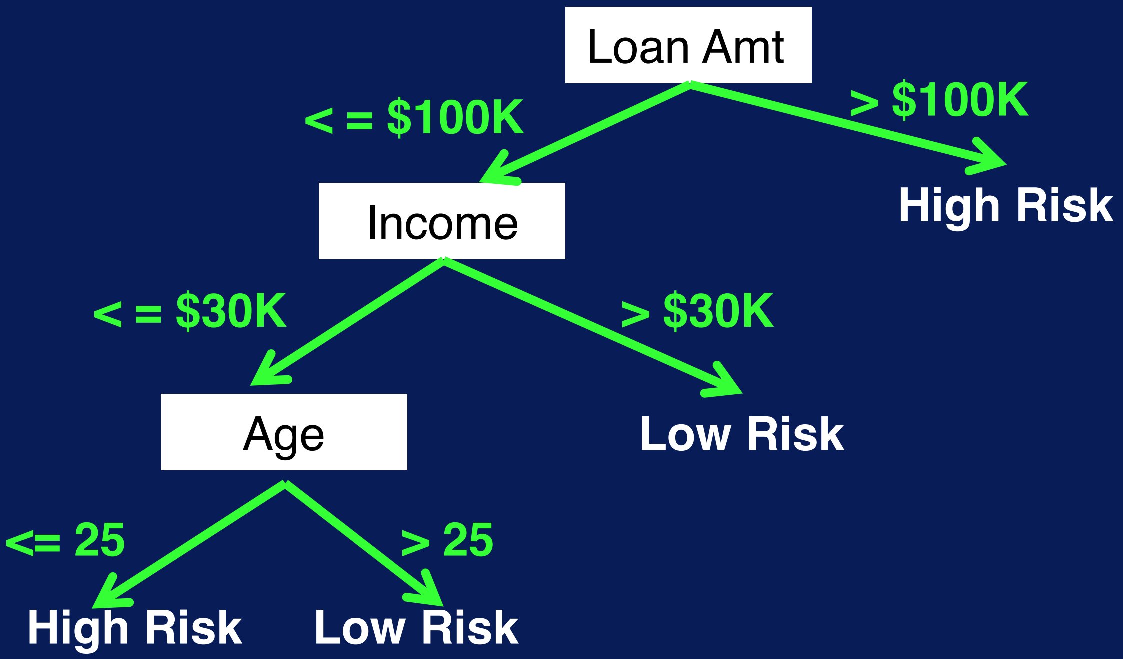
*Classification Technique*

Low Risk

High Risk

# Classification – Decision Tree

- One analytical technique for classification
- Decisions modeled as a tree structure



Loan Amt

< = $100K

> $100K

High Risk

Income

< = $30K

> $30K

Low Risk

Age

<= 25

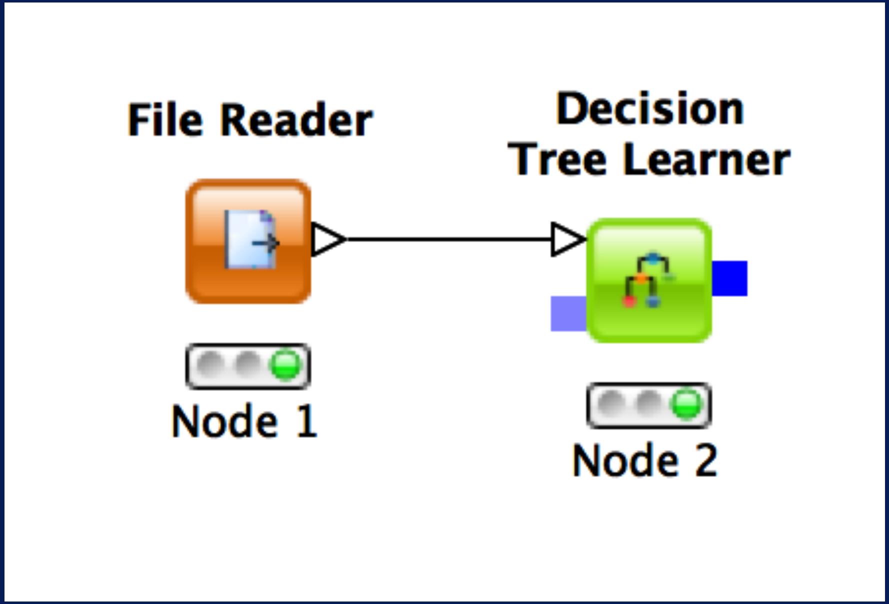
> 25

High Risk

Low Risk

# Decision Tree in KNIME

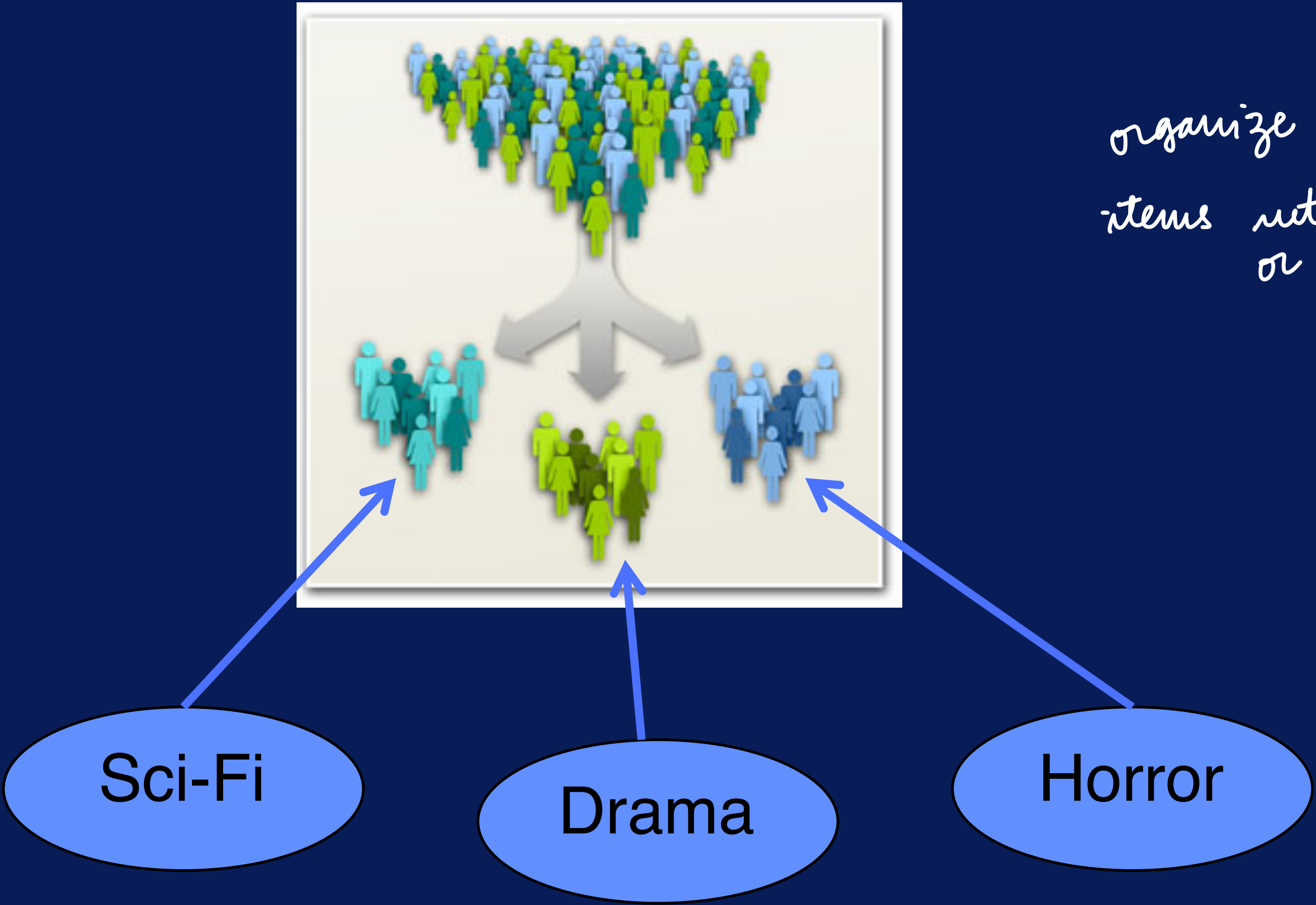
- KNIME workflow for building decision tree from input data



# Classification Examples

- Predict whether tumor cells are benign or malignant
- Categorize handwritten digits
- Determine whether credit card transaction is legitimate or fraudulent
- Classify loan application as low-, medium-, or high-risk.

# Cluster Analysis



Sci-Fi

Drama

Horror

organize similar items into groups or association

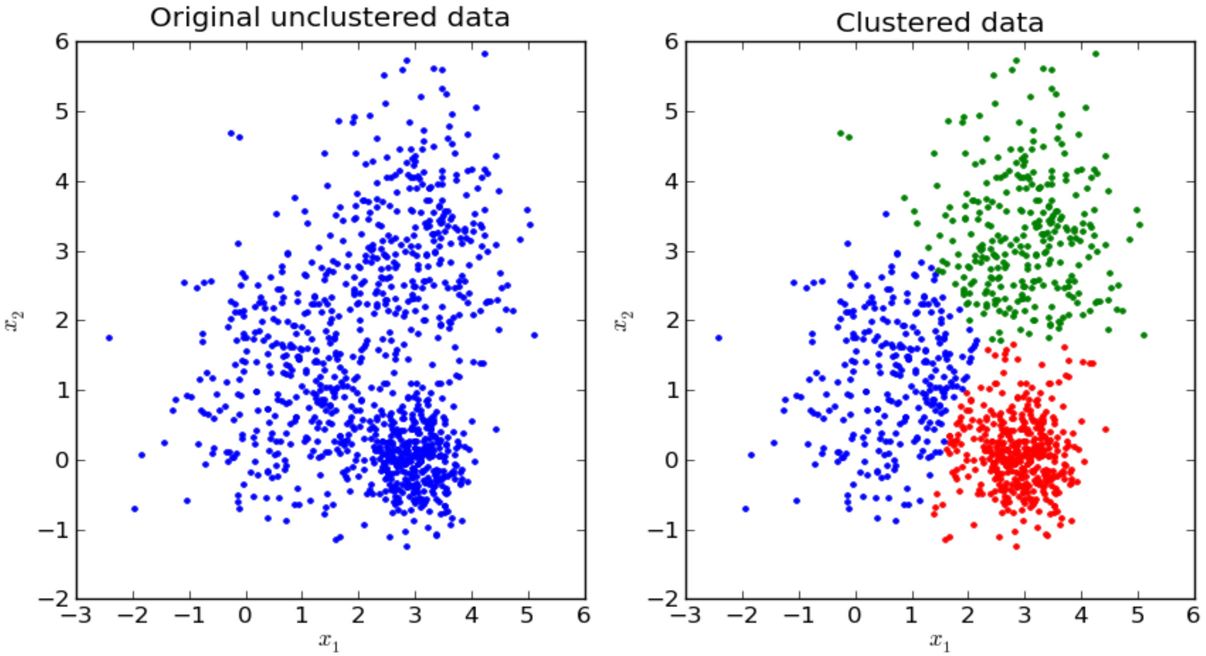
# Cluster Analysis – k-Means

- **K-Means Clustering**
  - Group samples into k clusters

done to minimise variance

or similarity between samples within the same cluster

using similarity measures (like eucladian distance)



→ k=3 (blue, green, red)

# K-Means in Spark

- **Spark Python code for performing k-means on data**

```
# Load and parse the data
data = sc.textFile("data/mllib/kmeans_data.txt")
parsedData = data.map(lambda line:
      array([float(x) for x in line.split(' ')]))

# Cluster the data
clusters = KMeans.train(parsedData, 2,
maxIterations=10, runs=10,
initializationMode="random")
```

# Cluster Analysis Examples

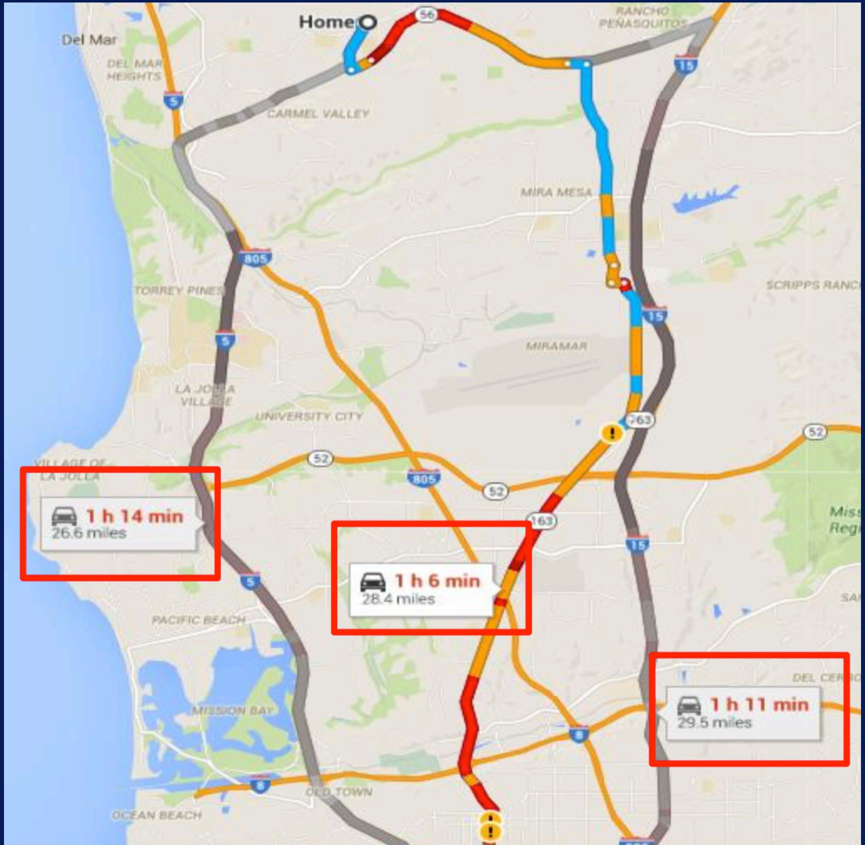
- Group customer base into distinct segments — for targeted marketing
- Find articles or webpages with similar topics
- Identify areas with high incidences of particular crimes
- Determine weather patterns

# Path Analysis

analizes sequences of nodes and edges in a graph

## Find shortest path from home to work.

– routes



analytical operations from graph analytics: the field of analytics where the underlying data is structured as, or can be modeled as a set of graphs

# Path Analysis

- **Path analysis using Cypher on neo4j**

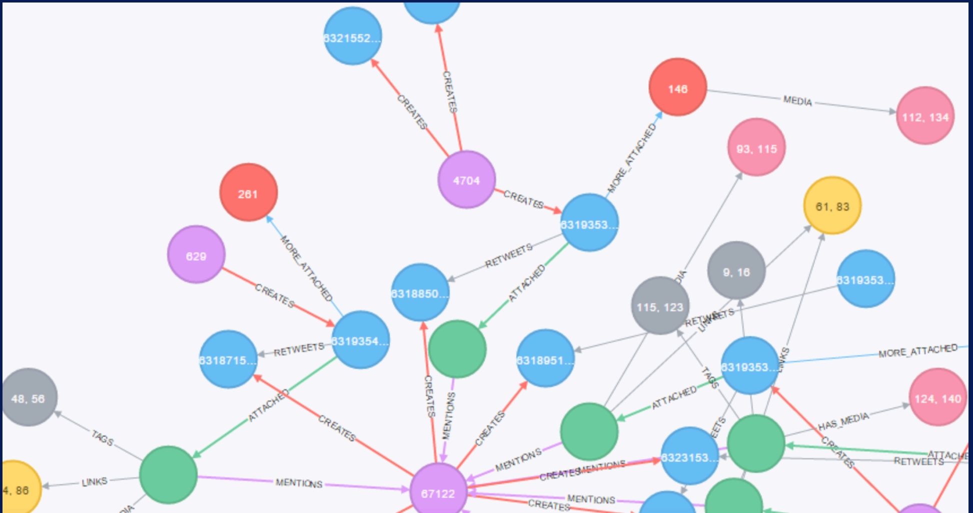
```
//Finding shortest path between specific nodes:
match p=shortestPath((a)-[:TO*]-(c))
where a.Name='A' and c.Name='P'
return p, length(p) limit 1

//Find all shortest paths:
match p = allShortestPaths((source)-[r:TO*]-(destination))
where source.Name='A' and destination.Name = 'P'
return extract(n in nodes (p)| n.Name) as Paths
```

# Connectivity Analysis

finding and tracking groups to determine interactions between entities

- **Analyzing tweets**
  - Extract conversation threads
  - Find interacting groups
  - Find influencers in community



# Connectivity Analysis

- Connectivity analysis using Cypher on neo4j

**// Find the degree of all nodes**

```
match (n:MyNode)-[r]-()
return n.Name, count(distinct r) as degree
order by degree
```

**// Find degree histogram of the graph**

```
match (n:MyNode)-[r]-()
with n as nodes, count(distinct r) as degree
return degree, count(nodes) order by degree asc
```

# Machine Learning Algorithms

- free decision
- k means

field of analytics focused on the study and construction of computer systems that can learn from data without being explicitly programmed

- Classification
- Regression
- Cluster Analysis
- Associative Analysis

# Graph Analytics Techniques

field where the underlying data is structured or can be modeled as a set of graphs

- Path Analytics
- Connectivity Analytics
- Community Analytics
- Centrality Analytics

# Main Take-Aways

- Analytic operations are used to discover meaningful patterns in data to provide insights.
  - e.g.: classification, cluster analysis, path analysis, connectivity analysis
- More analytics are covered in Machine Learning & Graph Analytics courses.