# Unsupervised Learning

# Unsupervised Learning

- It is now time to begin learn about machine learning algorithms used for Unsupervised Learning!
- This will be a paradigm shift from our previous discussions on Supervised Learning.

# Unsupervised Learning

- If Data Science is a mix between an art and a mathematical science, unsupervised learning is where we get to dive deeper into the art.

# Unsupervised Learning

- Supervised Learning
  - Using historical **labeled** data, predict a label on new data (regression or classification).
- Unsupervised Learning
  - Using **unlabeled** data, discover patterns, clusters, or significant components.

# Unsupervised Learning

- Unsupervised Learning:
  - Clustering:
    - Using features, group together data rows into distinct clusters.
  - Dimensionality Reduction:
    - Using features, discover how to combine and reduce into fewer components.

# Unsupervised Learning

- Paradigm shift for supervised to unsupervised learning:
  - ***Supervised performance metrics will not apply for unsupervised learning!***
  - How can we compare to a correct label answer, if there was no label to begin with?

# Unsupervised Learning

- Instead of metrics like RMSE or Accuracy, we will need to figure out other ways of assessing unsupervised model performance or reasonableness.
- Even our understanding of what “performance” actually means will need to change with unsupervised learning!

# Unsupervised Learning

- What does our Machine Learning Pathway look like with Unsupervised Learning?

# ML Pathway

**Real World**

**Collect & Store Data** → **Clean & Organize Data** → **Exploratory Data Analysis** → **Machine Learning Models**

**Supervised Learning:**
*Predict an Outcome*
**Unsupervised Learning:**
*Discover Patterns in Data*

# ML Pathway

Real World

Collect & Store Data

Clean & Organize Data

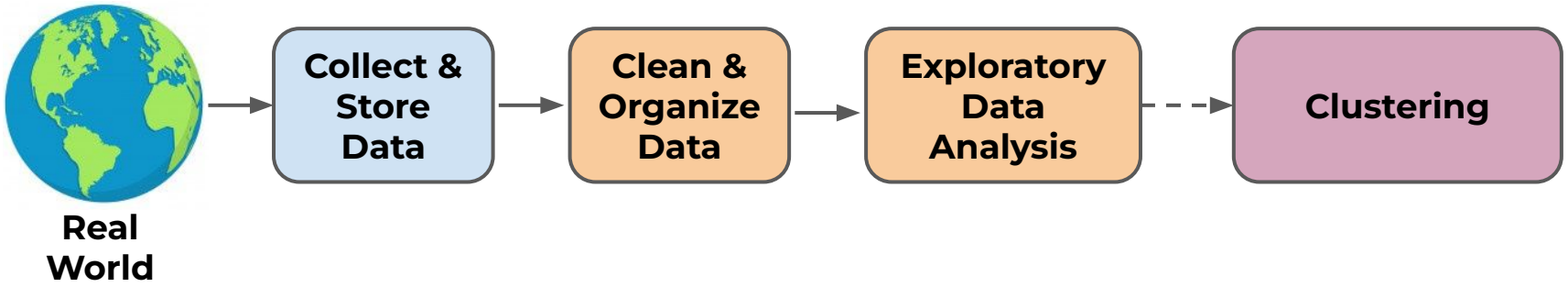
Exploratory Data Analysis

Clustering

Dimensionality Reduction

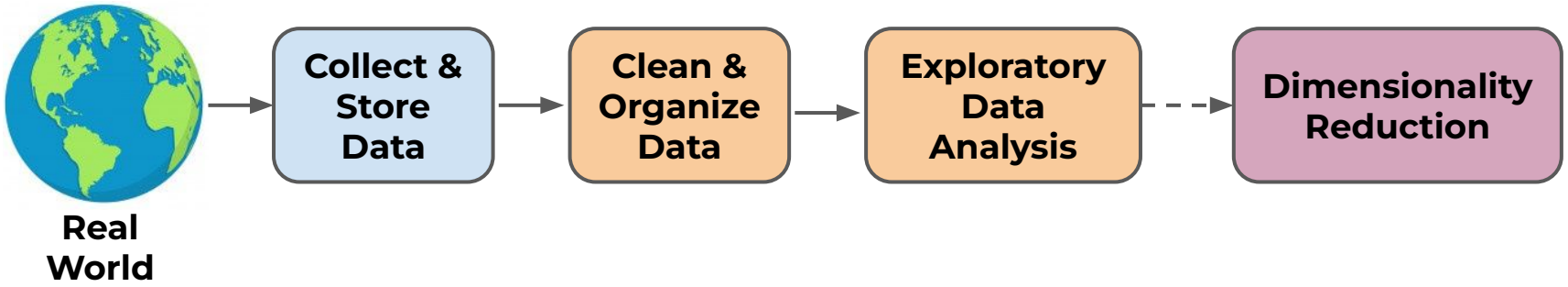
**Unsupervised Learning:**
*Discover Patterns in Data*

# ML Pathway




**Clustering:** If we have unlabeled data, can we attempt to cluster or group similar data points together to “discover” possible labels for clusters?

# ML Pathway




**Dimensionality Reduction:** If we have unlabeled data, can we attempt to reduce the number of features by combining them into new components? Do these new components give us further insight for the data?

# Unsupervised Learning

- We'll begin by discovering clustering methods such as K-Means and Hierarchical clustering, then move on to dimensionality reduction.
- We will also learn about methods for interpreting the model results, since results and performance is much more nuanced in unsupervised learning.

# Unsupervised Learning

- Questions to keep in mind:
  - *What does it really mean to “discover” labels through clustering?*
  - *Without known labels how do we measure performance?*
  - *Do combinations of features hold important insights?*