CIS 635 Knowledge Discovery & Data Mining

Introduction to Unsupervised Learning

Supervised Learning

- We learned about **Classification** and **Regression**
- These are examples of **supervised** learning

Supervised Learning

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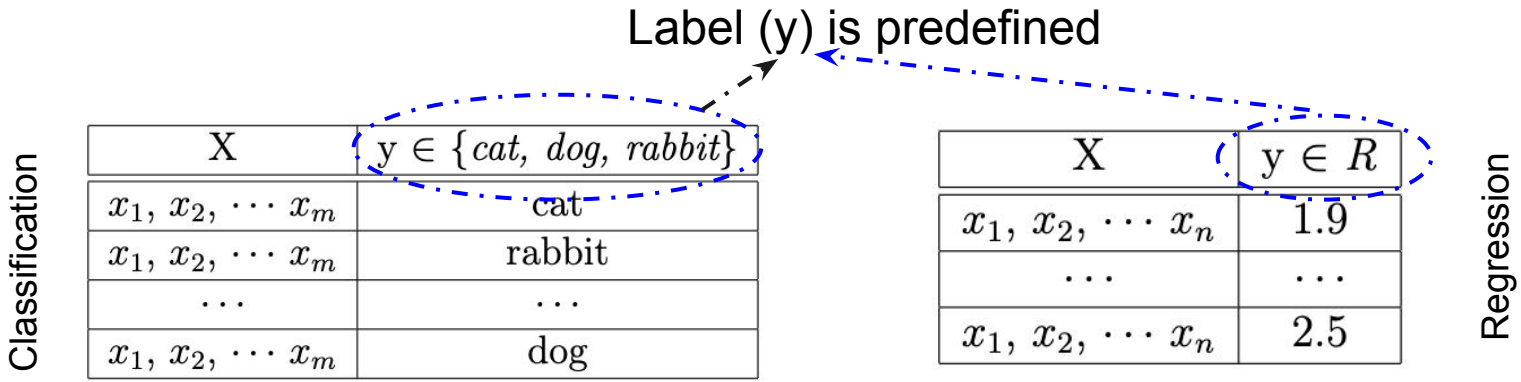
- These are examples of **supervised** learning
- In your data you have both **X(features)** and **y(Labels)**



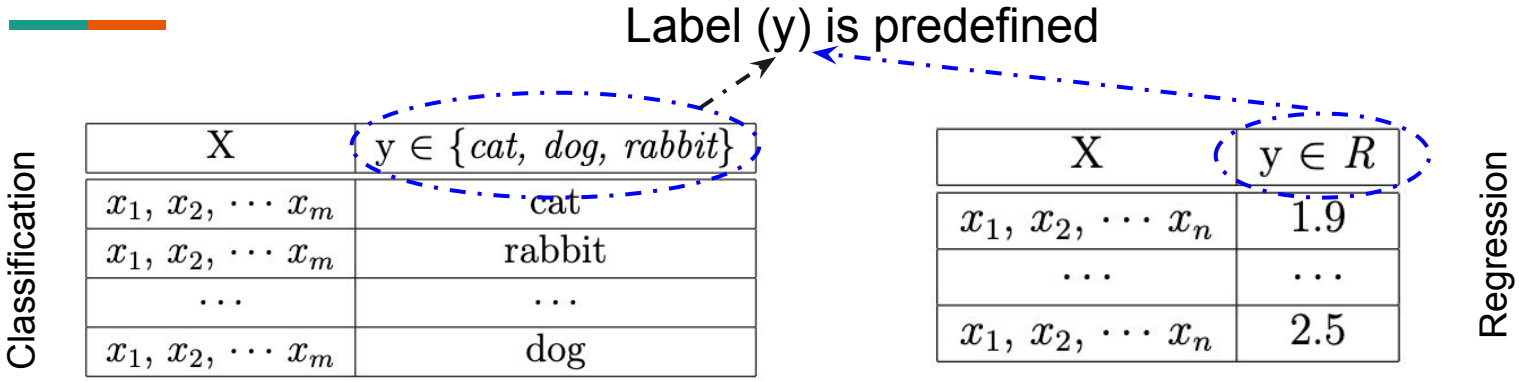
Unsupervised Learning

- In contrast, in **Unsupervised learning**, we have to learn meaningful **representations/models** from **X(features)** only.
- **Clustering** is an example of unsupervised learning

X
$x_1, x_2, \cdots x_o$
$\cdots$
$x_1, x_2, \cdots x_o$

No concept of data label (y)

Unsupervised Learning



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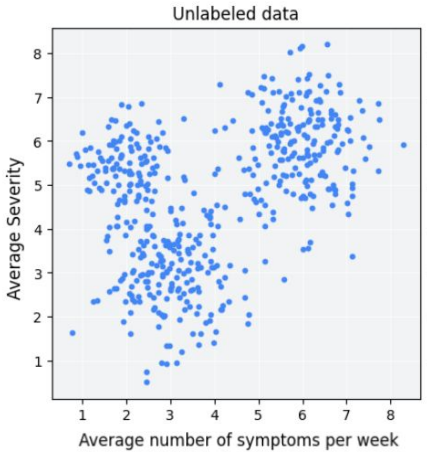
No concept of data label (y)

- Another way to understand the concept of clustering in terms of input data
- For classification/regression we need both **features** and **labels (X, Y)**, where as for clustering we only need **features (X)** as input

Clustering

- A medical study involving
  - Average number of symptoms per week
  - Average severity



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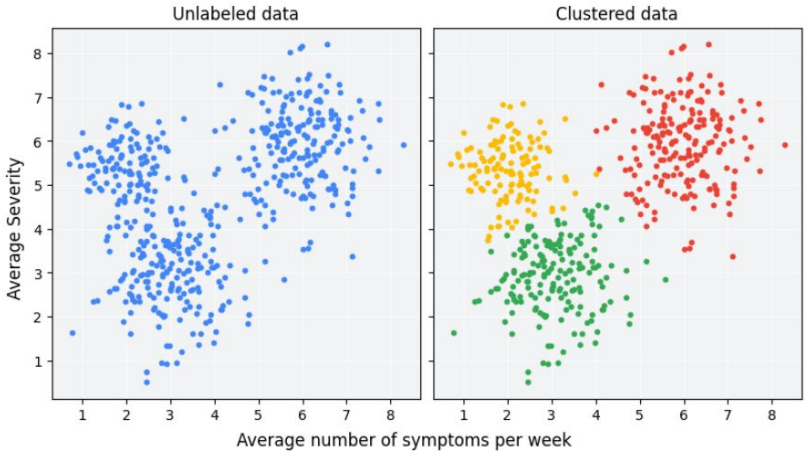

Clustering

- What is clustering?
- **Clustering algorithms:**
  - **K-Means**: Centroid Based
  - **Hierarchical clustering**: Distance connectivity based
  - **GMM**: Distribution based
  - **DBSCAN**: Density Based

- Identifying the number of clusters ?

What is clustering ?

- Grouping of data points based on some features (**X**). Group **indices** are the output

- An example of unsupervised learning

We can use features such as **X {size, color}** to group apples on the right

https://www.codeproject.com/Articles/1273113/Apple-tron-an-AI-for-farmers

What is clustering ?

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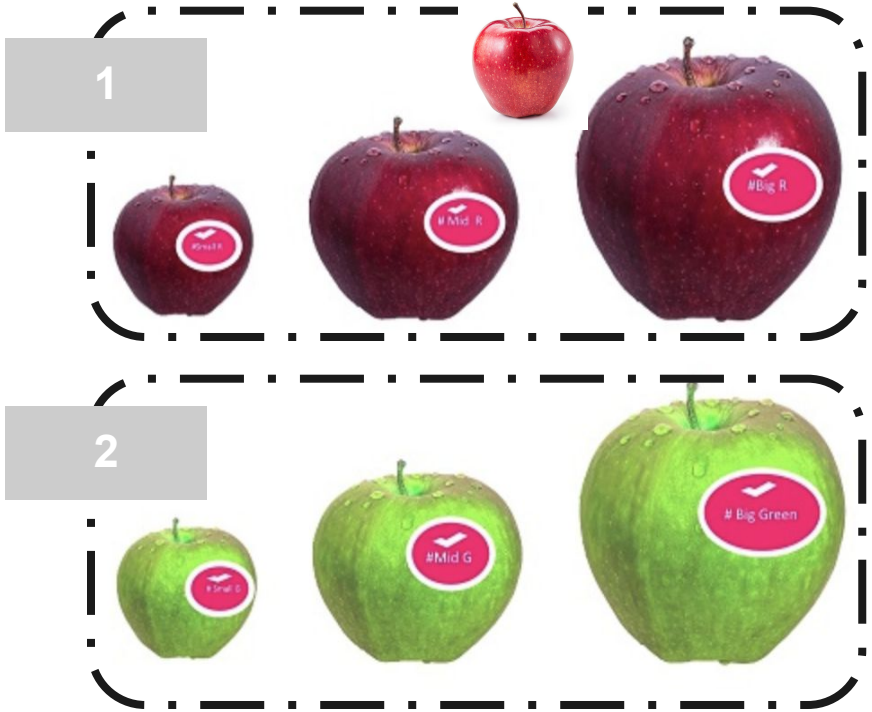
- **Labeling a test case:**

  Output: group index **1**



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Based on color

What is clustering ?

- Grouping of data points based on some features (**X**). Group **indices** are the output

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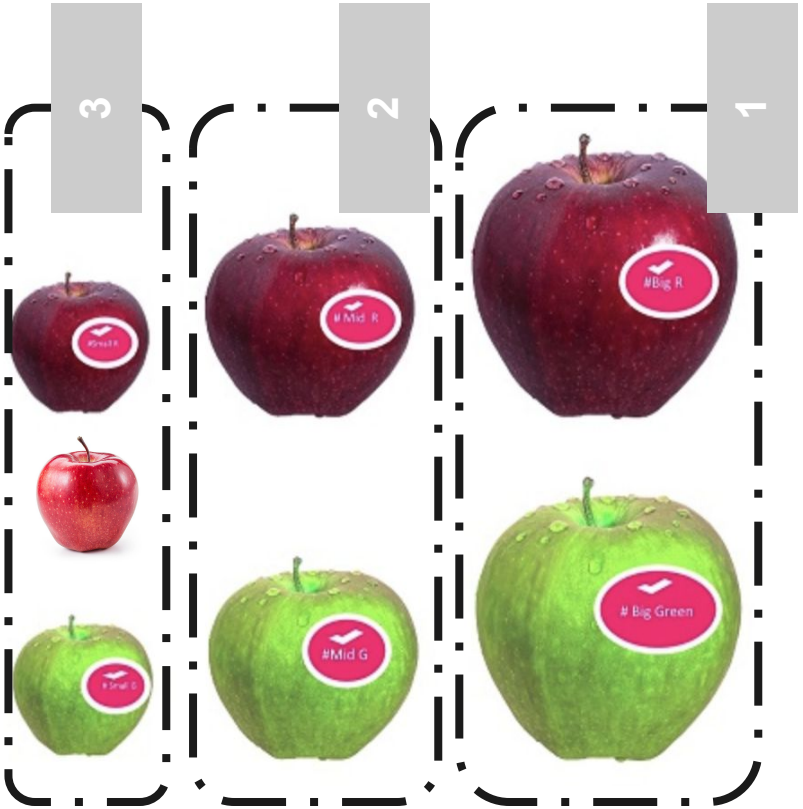
- **Labeling a test case:**

  Output: group index **3**



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Based on size

What is clustering ?

What if we want use both features: size and color?

What is clustering ?

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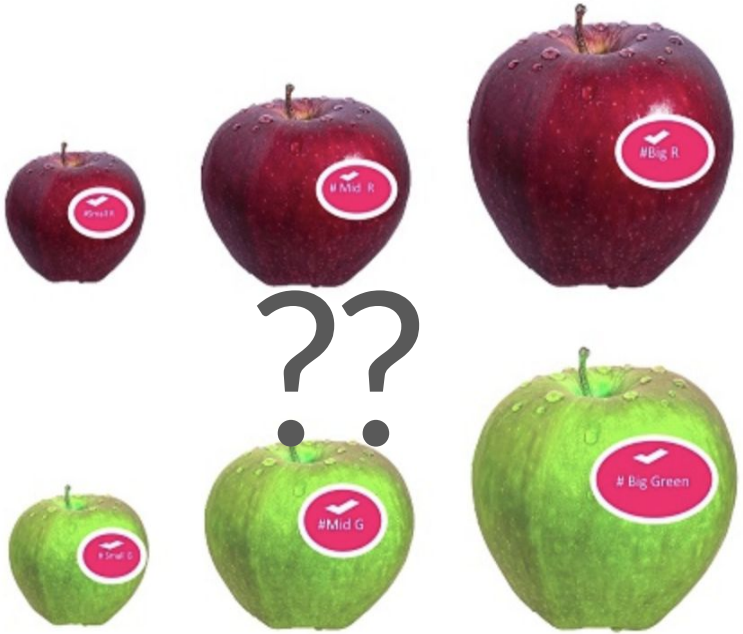
- An example of unsupervised learning

We can use features such as **X {size, color}** to group apples on the right



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Usages of Clustering

Clustering has a myriad of uses in a variety of industries. Some common applications for clustering include the following:

- market segmentation
- social network analysis
- search result grouping
- medical imaging
- image segmentation
- anomaly detection

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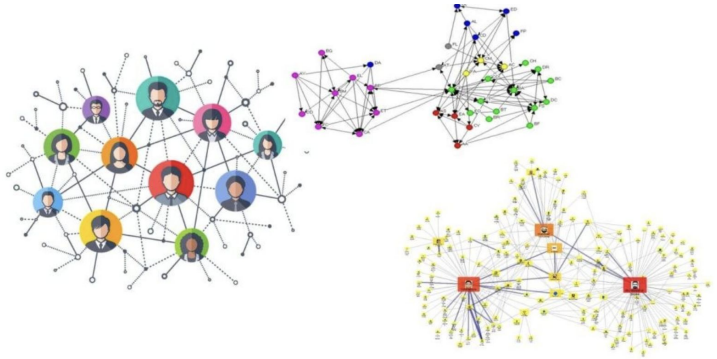

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