



# Principal Component Analysis (PCA)

Data Boot Camp

Lesson 19.3



# Class Objectives

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By the end of this lesson, you will be able to:



Explain PCA and how it can be used to reduce dimensionality in data.



Conceptualize how PCA relates to K-means and other applications in machine learning.



Use PCA to reduce the number of features in an unsupervised learning setting.

The background is a dark charcoal gray with a series of parallel diagonal lines running from the top-left to the bottom-right. Overlaid on this are several teal-colored geometric shapes: a large central triangle pointing right, a smaller triangle to its left, and a square to its right. Scattered around these shapes are various white line-art symbols, including a plus sign, a minus sign, a circle with a dot, a circle with a horizontal line, a circle with a vertical line, a circle with a diagonal line, a circle with a cross, a circle with a dot, a circle with a horizontal line, a circle with a vertical line, a circle with a diagonal line, a circle with a cross, a circle with a dot, a circle with a horizontal line, a circle with a vertical line, a circle with a diagonal line, and a circle with a cross.

**WELCOME**



## Activity: Warm-Up

In this activity, you will standardize global currency data, and then segment it into three clusters.

Suggested Time:

20 Minutes



Time's Up! Let's Review.

# Questions?



# Introduction to PCA



**Time For a Quick Video**

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[Visualizing High-Dimensional Space](#)

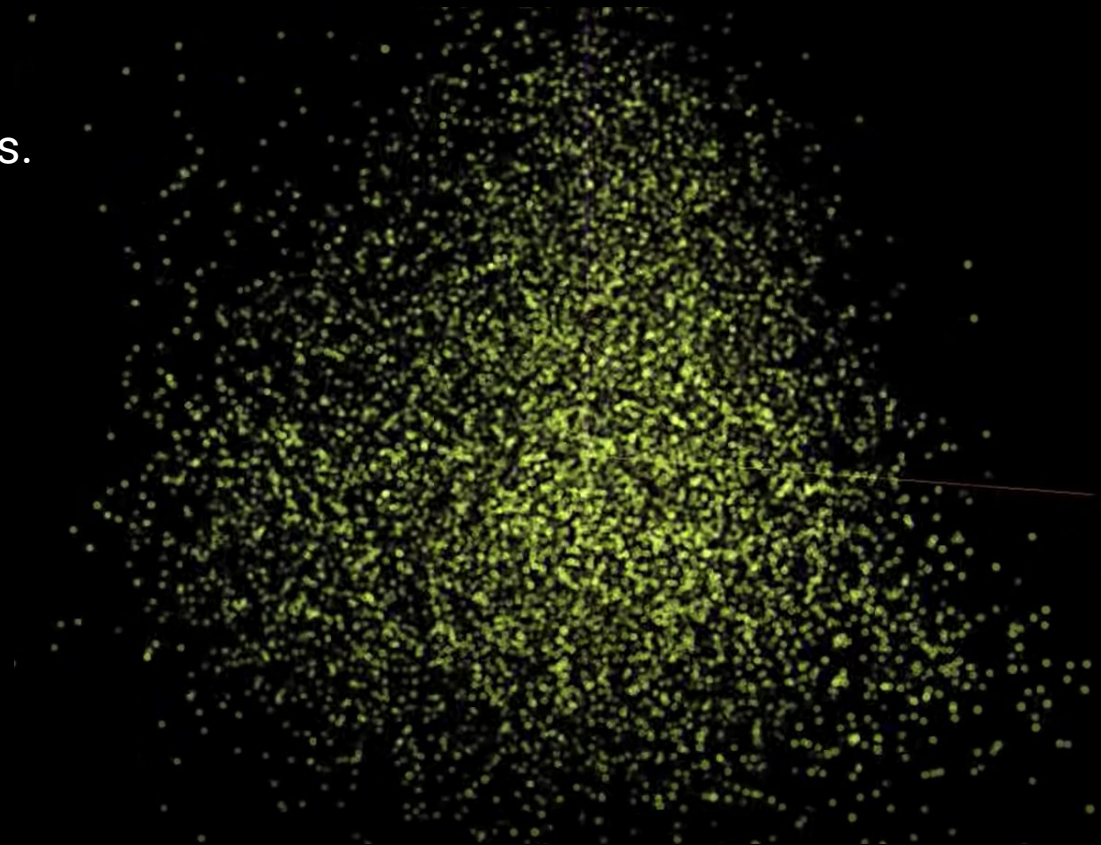


# Introduction to PCA

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Some of these datasets displayed are very large, with thousands (or more!) columns.

For some machine learning algorithms, this high dimensionality can become a problem.





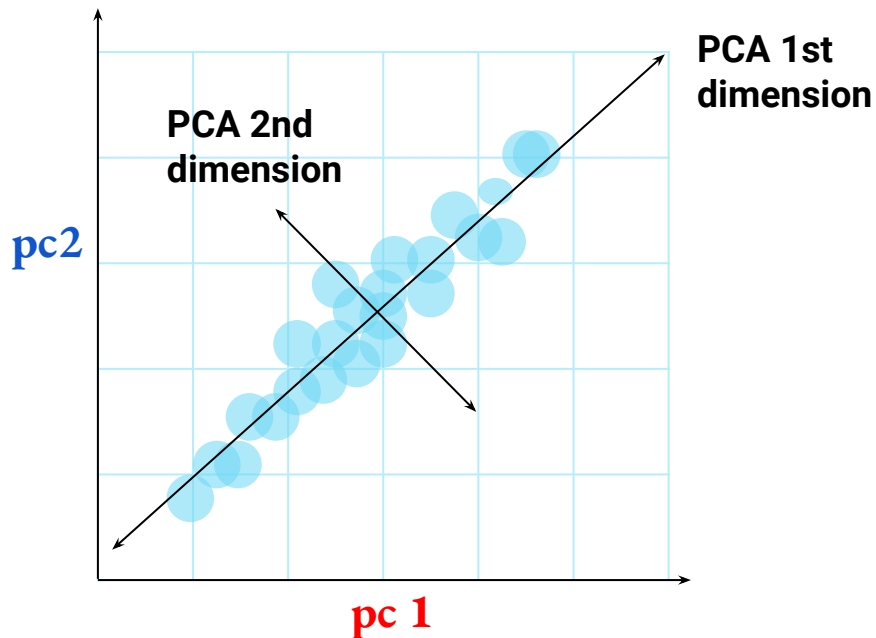
**What if we could reduce the size of the dataset while preserving as much useful information as possible?**

# Introduction to PCA

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The principal component analysis algorithm, or PCA, works because all data has **variability**; variation contains useful information.

By keeping only the most common variation across the dataset, we can reduce the size of our dataset but still maintain a variety of useful features.



# Introduction to PCA

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PCA is a statistical technique that we can use to streamline the machine learning process when too many factors exist in the data.



PCA reduces the number of factors by transforming a large set of features into a smaller one that contains MOST of the information of the original, larger dataset.



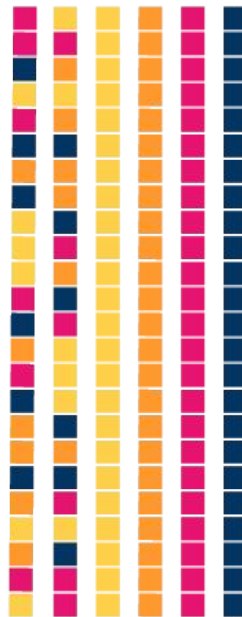
PCA is a dimensional-reduction method that looks at all the dimensions (or data columns) in a dataset, which:

- Analyzes the weight of their contribution to the variance in the dataset.
- Reduces variables to a smaller set of dimensions that still contains as much of the information, or the maximum variance, of the original dataset as possible.

# Introduction to PCA

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Reducing the number of factors, or **dimensional reduction**, comes at the expense of some accuracy, but the goal is to trade a little accuracy for simplicity.



## The goal of PCA is simple:

Reduce the number of factors in a dataset while preserving as much of the information from the original dataset as possible.





# Instructor Demonstration

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## Introduction to PCA

# Questions?







## Activity: Segmenting with PCA

In this activity, you will use your knowledge of PCA to reduce the dimensionality of the customers DataFrame from the previous activity, and then compare that result to the segmentation of the data by using all the factors.

Suggested Time:

25 Minutes

# Activity: Segmenting with PCA

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Using the [starter code](#) and the customer data provided, perform the following steps:



Reduce the factors to only two dimensions by using PCA.



Determine the optimal value for  $k$  by using the PCA DataFrame.



Segment the data by using the K-means algorithm and the optimal value for  $k$ .



Segment the preprocessed customer DataFrame by using the K-means algorithm and the same value for  $k$ .



Compare the segmentation results.



Time's Up! Let's Review.

# Questions?



A close-up, high-angle photograph of a computer keyboard. The central focus is a large, white, rectangular key with rounded corners. On this key, there is a dark blue icon of a coffee cup with three wavy lines above it representing steam. Below the icon, the word "Break" is printed in a dark blue, serif font. The key is set against a light-colored, textured keyboard surface. Other keys are visible in the background, including one with a double quote symbol and another with a dash/slash symbol, but they are out of focus.

Break



# Activity: Energize Your Stock Clustering

In this activity, you will:

- Strengthen your ability to reduce the number of features in your model by using PCA.
- Cluster both standardized data and principal components into various clustering algorithms, and then compare the results.

Suggested Time:

30 Minutes



Time's Up! Let's Review.

# Questions?





# Structured Review

*The  
End*