Pandas: Descriptive Statistics

Descriptive Statistics

Descriptive statistics are used to describe the basic features of a dataset.

Quartiles

Quartiles divide a sequence of numbers into four equal parts. Grouping a dataset into quartiles helps us to find outliers, and provides the basis for the data in a boxplot.

Series

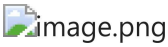
A **series** is a one-dimensional array that can hold any type of data. We'll generally use the term to refer to a column in a dataset that's arranged in a table. In fact, this is the reason why, in the library pandas, DataFrame columns are called `Series`. In a pandas Series, all items in the array must generally be the same data type.

The Mean

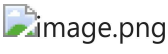
All the data points in a dataset can be added together and then divided by the total number of data points to find the *mean*. You might be used to calling this number an *average*; the two ideas are the same. Means help us to understand the central tendency of a dataset.

Skewed Distributions

For any given activity, there is a range of probable outcomes. All other things being equal, we would expect most of the outcomes to fall in the middle of the possible range, with the number of outcomes diminishing on either side of the peak. In statistics, this is known as a *normal distribution*, but you may have heard it called a *bell curve*, because it looks like a bell. Here's an example:

 image.png

A **skewed distribution** is a type of distribution where the peak of the curve is shifted, or *skewed*, either to the right or the left of the distribution. Here's an example:

 image.png

Standard Deviation

Standard deviation describes the proportion of records above or below the mean of a given distribution. In a normal distribution, 68% of the values fall within one standard deviation of the

mean, 95% of the values fall within two standard deviations from the mean, and 99.7% of the values fall within three standard deviations from the mean.

Outliers

An **outlier** is a value in a dataset that falls well beyond the dataset mean — more than three standard deviations. Depending on the analytical strategy, it might be useful to drop outliers from a dataset, because their extreme deviation from the mean can result in misleading conclusions.

Categorical Data

Categorical data is any type of data that can only be represented by distinct values. Eye color, handedness, and academic attainment are all categorical variables. Categorical variables are distinct from *continuous variables* in that their values can theoretically be infinite, and so require special attention in statistical analysis.

Location Data

Location data is information about a datapoint's location in space, and can be expressed in latitude/longitude pairs, street address, altitude, or any other place-specific identifiers.

Numerical Data

Numerical data is any information that can be represented by numbers.

Summary Statistics

Summary Statistics

Summary statistics are a set of simple calculations that help data scientists understand the broad strokes of their datasets.

Working with Summary Statistics

To calculate summary statistics in pandas, use the `describe` method. We can generate summary statistics for the `colombia-real-estate-1` dataset with code that looks like this:

In [ ]:
```
import pandas as pd

df1 = pd.read_csv("data/colombia-real-estate-1.csv")
df1.describe()
```

By default, the `describe` method will return `count`, `mean`, `standard deviations`, `minimum values` and `maximum values`. Also by default, the ignores ignores non-numerical columns.

Practice

Try it yourself! Using the `colombia-real-estate-2` dataset, create a DataFrame called `df2`, and print the resulting summary statistics.

In [ ]:
```
df2 = pd.read_csv("data/colombia-real-estate-2.csv")
```

Calculate the Quantiles for a Series

Quantiles allow you to summarize the distribution of numerical values in a series. The `n'th` quantile divides an ordered series into `n` portions, each with the same number of entries. The boundaries between these portions are known as quantiles. Let's load a dataset to see how this works in practice:

In [ ]:
```
mexico_city2 = pd.read_csv("./data/mexico-city-real-estate-2.csv")
mexico_city2.head
```

To examine quantiles, let's pick the price column

In [ ]:
```
price = mexico_city2["price"]
price
```

The median is the middle entry in the ordered list of prices:

In [ ]:
```
price.quantile(0.5)
```

Quartiles

A commonly used set of quantiles are the fourth quantiles known as quartiles. You can also find the minimum, first quartile, median, third quartile and maximum values in a series (which are typically the values used to create a boxplot):

In [ ]:
```
price.quantile([0, 0.25, 0.5, 0.75, 1])
```

Practice What's the 0.7 quantile in the price column of `mexico-city-real-estate-3.csv`?

In [ ]:
```
mexico_city3 = ...
price = ...
print(price.quantile(...))
```

Correlations

Correlations tell us about the relationship between two sets of data. When we calculate this relationship, the result is a **correlation coefficient**. Correlation coefficients can have any value

between -1 and 1. Values above 0 indicate a positive relationship (as one variable goes up, the other does too), and values below 0 indicate a negative relationship (as one variable goes up, the other goes down). The closer the coefficient's value is to either 1 or -1, the stronger the relationship is; the closer the coefficient's value is to 0, the weaker the relationship is. Coefficients equal to 0 indicate that there is no relationship between the two values, and are accordingly quite rare.

Let's run a correlation on some of the data from the `colombia-real-estate-2` dataset. We might suspect that there is some kind of relationship between the price of a property and the area it occupies, so we'll use the `Series.corr` method to figure it out. The code looks like this:

In [ ]:
```
area_m2 = df2["area_m2"]
price_cop = df2["price_cop"]
correlation = area_m2.corr(price_cop)
print(correlation)
```

The correlation coefficient here is about 0.519, which is a moderate, positive correlation. That is, as the area of a property goes up, so does the price. If the result had been a negative number, we would be able to say that as the area goes up, the price goes down.

Practice Try it yourself! Find the relationship between `"area_m2"` and `"price_usd"` in the `colombia-real-estate-3` dataset, and interpret the resulting coefficient.

In [ ]:
```
df3 = ...
print(correlation)
```

References & Further Reading

- Brief Descriptions of Central Tendency
- Pandas Documentation on Summary Statistics
- Pandas Documentation on Quantiles
- Background on Correlations

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