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## Feature Scaling - Normalization and Standardization

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## Normalization

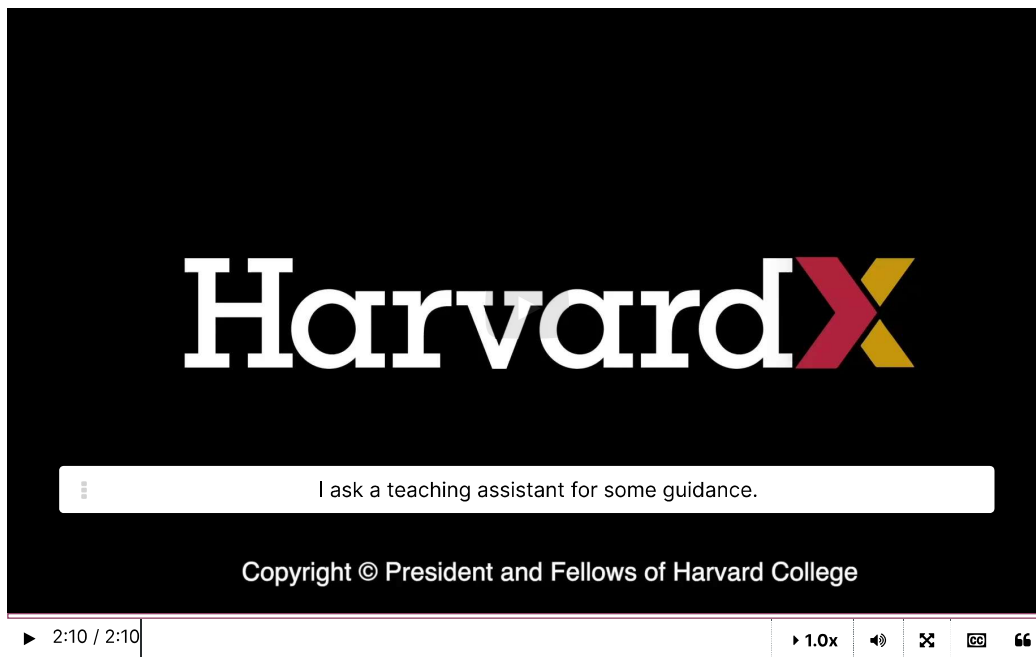
**Normalization**, sometimes called Min-Max scaling, transforms the features to a predefined range. Typically, we normalize to between 0 and 1. This sets 0 for the lowest value in our data for that variable, sets 1 for the highest, and all other values to be a proportional float between 0 and 1. The formula for normalization is as follows:

### NORMALIZATION

$$X^{norm} = \frac{X - X_{min}}{X_{max} - X_{min}}$$

Note that we can also use [sklearn's MinMaxScaler\(\)](#)  to normalize our data.

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## Standardization

**Standardization** transforms the features by subtracting the mean and dividing by the standard deviation. This sets the new mean to 0 with a standard deviation of 1.

### STANDARDIZATION


$$X^{stand} = \frac{X - \bar{X}}{\sigma_X}$$

Note that we can also use [sklearn's StandardScaler\(\)](#) to standardize our data.

### NORMALIZATION VS STANDARDIZATION

Standardization implies a Gaussian (or Normal) distribution. It can be more helpful when the data also follows a Gaussian distribution. Most data does follow a Gaussian distribution but this is not necessarily true. Standardization is also less impacted by outliers since there is no predefined range of features.

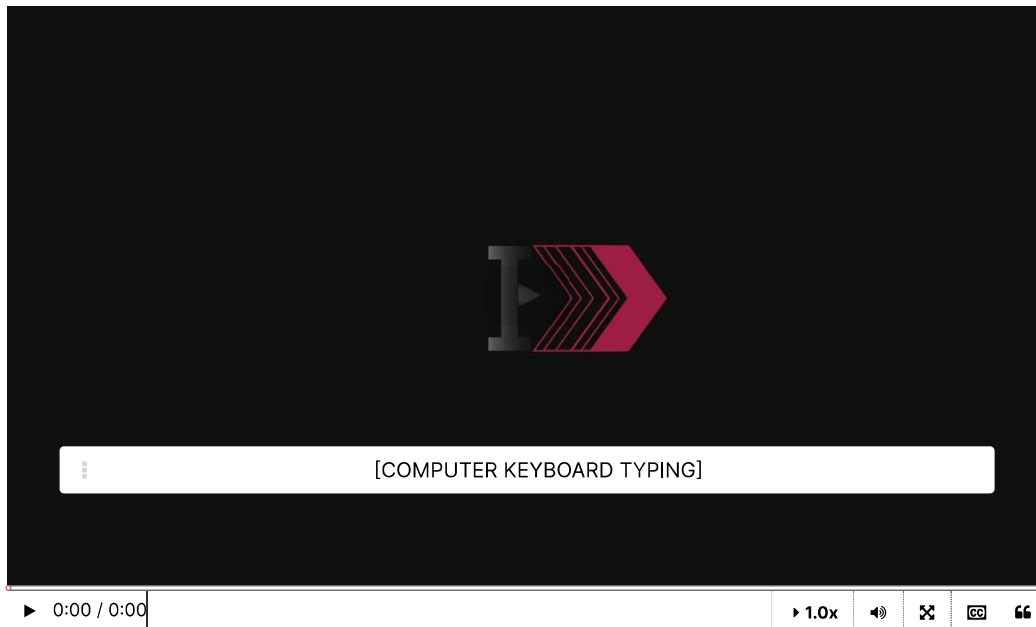
Normalization is recommended for data that already has a fixed range. Such as a survey.

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Normalization is recommended for data that already has a fixed range. Such as a survey question with values that can only be between 1 and 10. Data that does not follow a Gaussian distribution may work better with Normalization as well. Normalization is more vulnerable to outliers than standardization.

However, these are just rules of thumb to provided you with some intuition. It is often fine to simply try both and figure out what works best for your data.

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