

# How can I calculate the weighted standard deviation using Python?

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## RECOMMENDED CITATION

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Calculating the weighted standard deviation is a statistical method used to measure the variation of a set of data, taking into account the relative importance of each data point. In Python, this can be achieved by first assigning weights to each data point and then using a specific formula to calculate the weighted average and standard deviation. This process involves multiplying each data point by its respective weight, finding the sum of these products, and then dividing by the sum of the weights. The resulting value is then used in the formula to calculate the weighted standard deviation. By utilizing this method in Python, one can accurately measure the variability of a data set while considering the significance of each individual data point.

## Calculate Weighted Standard Deviation in Python

The weighted standard deviation is a useful way to measure of values in a dataset when some values in the dataset have higher weights than others.

The formula to calculate a weighted standard deviation is:

$$\sqrt{\frac{\sum_{i=1}^N w_i (x_i - \bar{x}^*)^2}{\frac{(M-1)}{M} \sum_{i=1}^N w_i}},$$

where:

**N:** The total number of  
**M:** The number of non-zero weights  
**w<sub>i</sub>:** A vector of weights  
**x<sub>i</sub>:** A vector of data values  
**x̄:** The weighted mean

The easiest way to calculate a weighted standard deviation in Python is to use the function from the statsmodels package:

`DescrStatsW(values, weights=weights, ddof=1).std`

The following example shows how to use this function in practice.

Example: Weighted Standard Deviation in Python

Suppose we have the following array of data values and corresponding weights:

```
#define data values
```

```
values =
```

```
#define weights
```

```
weights =
```

The following code shows how to calculate the weighted standard deviation for this array of data values:

```
from statsmodels.stats.weightstats import DescrStatsW
```

```
#calculate weighted standard deviation  
DescrStatsW(values, weights=weights, ddof=1).std  
  
8.570050878426773
```

**The weighted standard deviation turns out to be 8.57.**

**Note that we can also use var to quickly calculate the weighted variance as well:**

```
from statsmodels.stats.weightstats import DescrStatsW  
  
#calculate weighted variance  
DescrStatsW(values, weights=weights, ddof=1).var  
  
73.44577205882352
```

**The weighted variance turns out to be 73.446.**

#### **Additional Resources**

**The following tutorials explain how to calculate weighted standard deviation in other statistical software:**