PRE-CALC & TRIG

Day 67

From Last Time

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11.7 Standard Deviation

Objective: To find and apply the standard deviation and variance of a set of values

Measure of variation: describes how data is spread out (example: range)

Standard Deviation: $\boldsymbol{\sigma}\ (\boldsymbol{sigma})$ measure of how much the values in a data set vary ,or deviate, from the mean (x bar)

Variance: $\boldsymbol{\sigma^2}\ (\boldsymbol{sigma\ squared})$ the square of the standard deviation

*in other words, standard deviation is the square root of the variance

Steps to finding Variance/Standard Deviation

1. Find the mean of the values in the data set
2. Find the difference $(x - \bar{x})$, between each value x and the mean
3. Square each difference $(x - \bar{x})^2$
4. Find the average of these squares ←variance
5. Take the square root of the variance (step 4) ← standard dev

Formulas

Variance: $\boldsymbol{\sigma^2} = \frac{\sum (x - \bar{x})^{\mathbf{2}}}{\boldsymbol{n}}$

Standard Deviation: $\boldsymbol{\sigma} = \sqrt{\frac{\sum (x - \bar{x})^{\mathbf{2}}}{\boldsymbol{n}}}$

Example:

What is the mean, variance and standard deviation of the following values?

8, 12, 10, 13, 9, 20

Solution

Mean: 72/6=12

Variance:

$$\frac{(\mathbf{8}-\mathbf{12})^{\mathbf{2}}+(\mathbf{12}-\mathbf{12})^{\mathbf{2}}+(\mathbf{10}-\mathbf{12})^{\mathbf{2}}+(\mathbf{13}-\mathbf{12})^{\mathbf{2}}+(\mathbf{9}-\mathbf{12})^{\mathbf{2}}+(\mathbf{20}-\mathbf{12})^{\mathbf{2}}}{\mathbf{6}}$$

$$Variance=\frac{\mathbf{16+0+4+1+9+64}}{\mathbf{6}}=\frac{\mathbf{94}}{\mathbf{6}}=\mathbf{15.666666666666}\ldots$$

$$\text{Standard deviation}=\sqrt{\mathbf{15.66666}\ldots}=\mathbf{3.958114}\ldots$$

Compare the data:

<u>-3SD</u>	<u>-2SD</u>	<u>-1SD</u>
0.486	4.084	8.042

Mean

12

<u>+1SD</u>	<u>+2SD</u>	<u>+3SD</u>
15.958	19.916	23.514

What does this all mean?!

We can see that the 20 is the one that is different than the rest because all other numbers are right around 1 standard deviation of the mean and the 20 is beyond the 2^{nd} standard deviation. It is important to note that all data falls within 3 standard deviations of the mean however. We'll explore that in 11.10 and how this all can be applied to real life situations.

For Next Time

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