**TOPIC 9**

**Measures of Spread**

How do we measure spreadiness. It is not as concise an idea as the center of a distribution. What does spreadiness mean?

Luckily, it is well defined. In fact, statistics is all about variation, so understanding the way we measure spread is key to understanding statistics. Even further, we measure spread the same way we measure mean.

**Physical Measures of Spread**

**Range :** Max – Min

* Not Resistant
* Not used very often

**Quartiles[[1]](#footnote-1) :** three points that divide the data set into four equal groups for a *ranked* set of data

**InterQuartile Range (IQR)** : data between the 1st and 3rd quartile

* Middle 50% of the data
* 25% on one side of the median, 25% of the other
* Can also be considered a measure of center



**Arithmetic Measures of Spread**

 **Mean Absolute Deviation (MAD)**

$$\frac{1}{n}\sum\_{i=1}^{n}\left|x\_{i}-\overbar{x}\right| $$

 **Sample Standard Deviation**

$$s= \sqrt{\frac{\sum\_{i=1}^{n}(x\_{i}-\overbar{x})^{2}}{n-1}}$$

The new parameter is **sigma**, or **σ**

The new statistic is **s**

So now we have

 Parameters: N, µ, π, σ, V

 Statistics: n, $\overbar{x}$, $\hat{p}$, *s, m2*

Notes:

*Another definition* for sample standard deviation is:

$$s= \sqrt{\frac{\sum\_{i=0}^{n}(x\_{i}-\overbar{x})^{2}}{n}}$$

However, this definition is *biased*, it underestimates the parameter, σ.

Sometimes we talk about the **sample Variance,** which is the square of the standard deviation

$$m\_{2}=s^{2}= \frac{1}{n-1}\sum\_{i=0}^{n}(x\_{i}-\overbar{x})^{2}$$

The **population** **parameters**

for **σ,** the **standard deviation**

$$σ= \sqrt{\frac{\sum\_{i=0}^{N}(x\_{i}-µ)^{2}}{N}}$$

and **V,**  the **Variance**:

$$V=σ^{2}= \frac{1}{N}\sum\_{i=0}^{N}(x\_{i}-µ)^{2}$$

1. Note that Quintiles with 4 points and 5 regions are also possible. In this case, one of the values is not the median [↑](#footnote-ref-1)