كلية التقنيات الطبية والصحية

قسم تقنيات البصريات

محاضرات التطبيقات الإحصائية 1

الكورس الأول

المحاضرة السادسة

المرحلة الثانية

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MEASURES OF DISPERSION

Mean Deviation (MD) / Mean Absolute Deviation

Mean deviation is used to compute how far the values in a data set are from the center point. Mean, median, and mode all from center points of the data set. In other words, the mean deviation is used to calculate the average of the absolute deviations of the data from the central point. Mean deviation can be calculated for both grouped and ungrouped data.

Mean deviation is a simpler measurement of variability as compared to standard deviation. When we want to find the average deviation from the data's center point, the mean deviation is used.

What is Mean Deviation?

Mean Deviation falls under average absolute deviation. The average absolute deviation can be defined as the average of the absolute deviations from the central point of the data. The central point can be computed by using either mean, median, or mode.

Mean Deviation Example

Suppose we have a set of observations given by {2, 7, 5, 10} and we want to calculate the mean deviation about the mean. We find the mean of the data given by 6. Then we subtract the mean from each value, take the absolute value of each result and add them up to get 10. Finally, we divide this value by the total number of observations (4) to get the mean deviation as 2.5.

Mean Deviation Formula

$$\text{Mean Deviation (MD)} = \frac{\sum|x_i - \bar{x}|}{n} \quad \text{about Mean}$$

$$\text{Mean Deviation (MD)} = \frac{\sum|x_i - \text{Median}|}{n} \quad \text{about Median}$$

$$\text{Mean Deviation (MD)} = \frac{\sum|x_i - \text{Mode}|}{n} \quad \text{about Mode}$$

Here,

x_i represents the ith observation, $\bar{x}$ represents the central point (mean, median, or mode), and 'n' is the number of observations in the data set.

Coefficient of the Mean Deviation

A relative measure of dispersion based on the mean deviation is called the coefficient of the mean deviation or the coefficient of dispersion. It is defined as the ratio of the mean deviation of the average used in the calculation of the mean deviation. Thus:

$$\text{Coefficient of } M.D \text{ (about mean)} = \frac{\text{Mean Deviation from Mean}}{\text{Mean}}$$

$$\text{Coefficient of } M.D \text{ (about median)} = \frac{\text{Mean Deviation from Median}}{\text{Median}}$$

$$\text{Coefficient of } M.D \text{ (about mode)} = \frac{\text{Mean Deviation from Mode}}{\text{Mode}}$$

Example 1

Determine the mean deviation for the data values 4,3,5,8,1,9.

Solution:

Given data values are 4,3,5,8,1,9

First, we will find the mean for the given data:

$$\bar{x} = \frac{\sum x_i}{n} = \frac{4+3+5+8+1+9}{6} = \frac{30}{6} = 5$$

Therefore, the mean value is 5.

Now, subtract each mean from the data value, and ignore the minus symbol

$$4-5=-1=1\text{(نأخذ المطلق)}$$

$$3-5=-2=2\text{(نأخذ المطلق)}$$

$$5-5=0$$

$$8-5=3$$

$$1-5=-4=4\text{(نأخذ المطلق)}$$

$$9-5=4$$

Now, the obtained data set is 1,2,0,3,4,4

Let us find the mean value for the obtained data set

Therefore, the mean deviation is

$$\textbf{Mean Deviation (MD)} = \frac{\sum|x_i - \bar{x}|}{n} = \frac{1+2+0+3+4+4}{6} = \frac{14}{6} = 2.3$$

Hence, the mean deviation for 4,3,5,8,1,9 is 2.3.

او نستخدم القانون الثاني باستخدام ***median***

Data: 4,3,5,8,1,9

Arrange the data: 1,3,4,5,8,9

$$\text{Median} = \frac{4+5}{2} = \frac{9}{2} = 4.5$$

Therefore, the Median value is 4.5.

Now, subtract each mean from the data value, and ignore the minus symbol

$$4 - 4.5 = -0.5 = 0.5(\text{نأخذ المطلق})$$

$$3 - 4.5 = -1.5 = 1.5(\text{نأخذ المطلق})$$

$$5 - 4.5 = 0.5$$

$$8 - 4.5 = 3.5$$

$$1 - 4.5 = -3.5 = 3.5(\text{نأخذ المطلق})$$

$$9 - 4.5 = 4.5$$

Now, the obtained data set is 0.5,1.5,0.5,3.5,3.5,4.5

Let us find the mean value for the obtained data set

Therefore, the mean deviation is

$$\textbf{Mean Deviation (MD)} = \frac{\sum|x_i - Median|}{n} = \frac{0.5+1.5+0.5+3.5+3.5+4.5}{6} = \frac{14}{6} = 2.3$$

Hence, the mean deviation for 4,3,5,8,1,9 is 2.3.

Example 2

Find the mean absolute deviation for the following data set: 302,140,352,563,455,215,213.

Solution:

Given data values are 302,140,352,563,455,215,213

First, we will find the mean for the given data:

$$\bar{\mathbf{x}} = \frac{\sum \mathbf{x_i}}{\mathbf{n}} = \frac{\mathbf{302 + 140 + 352 + 563 + 455 + 215 + 213}}{\mathbf{7}} = \mathbf{320}$$

Therefore, the mean value is 320.

Now, subtract each mean from the data value, and ignore the minus symbol

$$302 - 320 = -18 = 18(\text{نأخذ المطلق})$$

$$140 - 320 = -180 = 180(\text{نأخذ المطلق})$$

$$352 - 320 = 32$$

$$563 - 320 = 243$$

$$455 - 320 = 135$$

$$215 - 320 = -105 = 105\ (\text{نأخذ المطلق})$$

$$213 - 320 = -107 = 107\ (\text{نأخذ المطلق})$$

Now, the obtained data set is 18 , 180 , 32 , 243 , 135 , 105 , 107

Let us find the mean value for the obtained data set

Therefore, the mean deviation is

$$\textbf{Mean Deviation (MD)} = \frac{\sum |x_i - \bar{x}|}{\mathbf{n}} = \frac{\mathbf{18\ +\ 180\ + 32\ +\ 243 +\ 135\ +\ 105\ +\ 107}}{\mathbf{7}}$$

$$= \frac{\mathbf{14}}{\mathbf{6}} = \mathbf{117.14}$$

Hence, the mean deviation for 18 , 180 , 32 , 243 , 135 , 105 , 107 is 117.14