جامعة المستقبل

كلية التقنيات الطبية و الصحية

قسم تقنيات البصريات

الكورس الثاني

المحاضرة الاولى العملي

التطبيقات الاحصائية

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Central tendency is a measure of values in a sample that identifies the different central points in the data, often referred to colloquially as "averages." The most common measurements of central tendency are the mean, median, and mode. Identifying the central value allows other values to be compared to it, showing the spread or cluster of the sample, which is known as the dispersion or distribution. These measurements of dispersion are categorized in 2 groups: measures of dispersion based on percentiles and measures of dispersion based on the mean (which is commonly known as standard deviations). Analysis of data distribution determines whether the data have a strong or a weak central tendency based on their dispersion. When the data distribution is symmetrical and the mean = median = mode, the data are said to have a normal distribution. Other types of distributions are possible as well, and these are known as nonnormal distributions.

Definition

Measures of central tendency are single values that attempt to describe a data set by identifying the central or "typical" value for that data set. Colloquially described as "averages" Most common measures:

1. Mean
2. Median
3. Mode

Mean, Median, and Mode

Mean: The mean of a set of data is the sum of all values in a data set divided by the number of values in the set. It is also often referred to as an arithmetic average. The Greek letter μ("mu") is used as the symbol for the population mean and the symbol $\bar{x}$ is used to represent the mean of a sample. To determine the mean of a data set:

1. Add together all the data values.

2. Divide the sum from Step 1 by the number of data values in the set.

$$Mean = \frac{\sum x_i}{n} = \frac{x_1 + x_2 + \ldots\ldots + x_3}{n}$$

Example:

Consider the data set: 17, 10, 9, 14, 13, 17, 12, 20, 14

$$Mean = \frac{\sum x_i}{n} = \frac{17 + 10 + 9 + 14 + 13 + 17 + 12 + 20 + 14}{9} = \frac{126}{9} = 14$$

The mean of this data set is 14.

Example: Calculation of the mean – birthweights

Consider the following five birthweights in kilograms recorded to 1 decimal place selected randomly from the Simpson (2004) study of low birthweight babies.

1.2, 1.3, 1.4, 1.5, 2.1

$$Mean = \frac{\sum x_i}{n} = \frac{1.2 + 1.3 + 1.4 + 1.5 + 2.1}{5} = \frac{7.5}{5} = 1.50 \ Kg$$

It is usual to quote 1 more decimal place for the mean than the data recorded.

Median: The median of a set of data is the "middle element" when the data is arranged in ascending order. To determine the median:

1. Put the data in order from smallest to largest.

2. Determine the number in the exact center.

    i.   If there are an odd number of data points, the median will be the number in the absolute middle.

    ii.   If there is an even number of data points, the median is the mean of the two center data points, meaning the two center values should be added together and divided by 2.

Example:

Consider the data set: 17, 10, 9, 14, 13, 17, 12, 20, 14

Step 1: Put the data in order from smallest to largest.   9, 10, 12, 13, 14, 14, 17, 17, 20

Step 2: Determine the absolute middle of the data.   9, 10, 12, 13, 14, 14, 17, 17, 20

Note: Since the number of data points is odd, choose the one in the very middle.

The median of this data set is 14.

Example:

Calculation of the median ‒ birthweights Consider the following five birthweights in kilograms selected randomly from the Simpson (2004) study.

1.2, 1.3, 1.4, 1.5, 2.1

Rank order	Weight (kg)
1	1.2
2	1.3
3	1.4 ← median
4	1.5
5	2.1

If we had observed an additional value of 3.5 kg in the birthweight the median would be the average of the 3rd and the 4th observation in the ranking, namely the average of 1.4 and 1.5, which is 1.45 kg.

Mode: The mode is the most frequently occurring measurement in a data set. There may be one mode; multiple modes, if more than one number occurs most frequently; or no mode at all, if every number occurs only once. To determine the mode:

1. Put the data in order from smallest to largest, as you did to find your median.

2. Look for any value that occurs more than once.

3. Determine which of the values from Step 2 occurs most frequently.

Example:

Consider the data set: 17, 10, 9, 14, 13, 17, 12, 20, 14

Step 1: Put the data in order from smallest to largest. 9, 10, 12, 13, 14, 14, 17, 17, 20

Step 2: Look for any number that occurs more than once. 9, 10, 12, 13, 14, 14, 17, 17, 20

Step 3: Determine which of those occur most frequently. 14 and 17 both occur twice. The modes of this data set are 14 and 17.

Mean (Average)

The total of the numbers divided by how many numbers there are.

11 7 11 18 9 7 6 23 7

11+7+11+18+9+7+6+23+7=99

99 / 9 = 11

Mean: 11

Median (Middle)

The number which is in the middle or the middle value.

11 7 11 18 9 7 6 23 7

6 7 7 7 9 11 11 18 23

Median: 9

Mode (Most)

The number that appears the most.

11 7 11 18 9 7 6 23 7

6 7 7 7 9 11 11 18 23

Mode: 7

Exercises

1. The age (in years) of a sample of 20 motorcyclists killed in road traffic accidents is given below.

18 41 24 28 71 52 15 20 21 31
16 24 33 44 20 24 16 64 24 32

Calculate the mean, median and mode.