

To boldly go where no one has gone before....

Descriptive & Inferential Statistics

Introduction

In the 1960s Geography became a more academic and scientific subject and adopted more scientific approaches to research. This meant using statistical techniques to test hypotheses and theories quantitatively. Statistics allow Geographers to ascertain patterns, discover relationships and examine cause-effect links.

There are many types of statistics but the most basic are Descriptive Statistics that summarise data and the more advanced type are Inferential Statistics that look at the relationships between sets of data.



Descriptive Statistics

- 1. Types of Data: Nominal, Ordinal, Ratio and Interval
- 2. Measures of central tendency: mean, mode, and median
- 3. Measures of Dispersion: range, IQ ranges, standard deviation, variance, coefficient of variation and standard error of the mean.

Data Sets

- 1. Nominal - subjective data that has no ranking, but can be categorised, measured, organised and ordered or ranked but not analysed quantitatively and treated as a degree.
- 2. Ordinal - refers to data that can be placed in sequence or arranged in order of size, rank, weight, height, time.
- 3. Interval - refers to real numbers, such as IQ, temperature and weight, but does not have a true zero point.
- 4. Ratio - refers to real numbers that have a true zero point.

Measures of Central Tendency

- Mean
- Median
- Mode

Measures of Dispersion

- Range
- Standard Deviation
- Variance
- Coefficient of Variation

Measures of Association

- Correlation
- Covariance

Chi-Square Test

- Used to test the independence of two categorical variables.
- Used to test the goodness of fit of a theoretical distribution to observed data.
- Used to test the equality of proportions in two or more groups.

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Regional Migration

- Migration is the movement of people from one region to another.
- Regional migration is the movement of people from one region to another within a country.
- Regional migration is a key factor in the development of a region.

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Data Sets

- 4 Different types of data set
1. Nominal - refers to data that has no order or rank and can be categorical, qualitative, eg. gender, marital status or religious affiliations and countries or groups.
 2. Ordinal - refers to data that can be placed in ascending or descending order eg. city, class, village, farming, farms.
 3. Interval - refers to real numbers. 1000 - 1000 kg there is a real meaning in the number 0 eg. 1000 - 1000 = 0.
 4. Ratio - refers to real numbers. All 0 is possible in their own world, eg. possible to have no weight but not zero, negative weight.

Level of Accuracy

1. Accuracy - the closeness of a measurement to its true value.
2. Precision - the degree of detail or exactness of a measurement.
3. Reliability - the consistency of a measurement.

One-tailed and two-tailed tests

One-tailed test: The test is designed to detect a difference in one direction only. It is used when the researcher has a specific hypothesis about the direction of the effect.

Two-tailed test: The test is designed to detect a difference in either direction. It is used when the researcher does not have a specific hypothesis about the direction of the effect.

Chi-square test

The Chi-square test is used to determine if there is a significant difference between the observed frequencies and the expected frequencies. It is used for categorical data.

Formula: $\chi^2 = \sum \frac{(O - E)^2}{E}$

Where O = Observed frequency, E = Expected frequency.

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Nearest Neighbour

The Nearest Neighbour method is used to classify data points based on their proximity to the training set. It is a simple and intuitive method.

Formula: $d_i = \min_j d(x_i, x_j)$

Where d_i = distance from point x_i to its nearest neighbour, x_j = training set point.

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Data Sets

4 Different types of data set:

1. Nominal - refers to data that has names e.g. land-use can be commercial, residential, agricultural, industrial or rock types can be metamorphic, sedimentary or igneous.
2. Ordinal - refers to data that can be placed in ascending or descending order e.g. city, town, village, hamlet, farm.
3. Interval - refers to real numbers. With this type there is no real zero e.g. in temperature -7 & 32
4. Ratio - refers to real numbers but they do possess a true zero point, e.g. possible to have no rainfall but not have negative rainfall.

This is the basic
measurements
Mean, Mode and

1. Mean = the a
2. Median = mid
or descending o
3. Mode = the v

Central Tendency

This is the basic way of summarising data. There are three main measurements for central tendency: Mean, Mode and Median.

1. Mean = the average
2. Median = middle value when the values are placed in ascending or descending order.
3. Mode = the value that occurs most often in the data set.

Measures of Dispersion

Useful for showing how much figures differ from the average.

Range - Difference between max and min values

Inter-quartile range - the range of the middle half of the values

Standard Deviation - takes into account all values and is not affected by extreme values. It measures dispersion of figures around the mean. Large number in the deviation values are wide spread and a small number means values are grouped together around the mean.

Standard Deviation

$$\sigma = \sqrt{\frac{\sum (x - \bar{x})^2}{n}}$$

σ = standard deviation

\sum = sum of

x = each value in the data set

\bar{x} = mean of all values in the data set

n = number of value in the data set