

STA 3180 Statistical Modelling: Hypothesis Testing

Hypothesis Testing (STA 3180 Statistical Modelling)

Introduction

Hypothesis testing is a statistical method used to determine whether a certain hypothesis about a population parameter is true or false. It is used to make decisions based on observed data from a sample. The goal of hypothesis testing is to draw conclusions about a population based on a sample.

Key Concepts

* Null Hypothesis: This is the initial assumption that is made about a population parameter. It is usually denoted by H_0 .

* Alternative Hypothesis: This is the opposite of the null hypothesis and is usually denoted by H_1 .

* Test Statistic: This is a statistic used to measure the difference between the null hypothesis and the alternative hypothesis.

* Significance Level: This is the probability of making a Type I error, which is rejecting the null hypothesis when it is actually true. It is usually denoted by alpha (α).

Types of Hypothesis Tests

* One-Sample Test: This is used to compare a sample mean to a known population mean.

* Two-Sample Test: This is used to compare two sample means to each other.

* Chi-Square Test: This is used to test the association between two categorical variables.

Steps in Hypothesis Testing

1. State the null and alternative hypotheses.
2. Select a significance level (alpha).
3. Calculate the test statistic.
4. Compare the test statistic to the critical value.
5. Make a decision about the null hypothesis.

Coding Example

Start of Code

```

# One-Sample Test
# Step 1: State the null and alternative hypotheses
H0:  $\mu = 10$ 
H1:  $\mu \neq 10$ 
# Step 2: Select a significance level
 $\alpha = 0.05$ 
# Step 3: Calculate the test statistic
# Calculate the sample mean
sample_mean = np.mean(sample)
# Calculate the standard error
standard_error = np.std(sample)/np.sqrt(len(sample))
# Calculate the test statistic
test_statistic = (sample_mean - 10)/standard_error
# Step 4: Compare the test statistic to the critical value
# Calculate the critical value
critical_value = stats.t.ppf(1- $\alpha$ , df=len(sample)-1)
# Compare the test statistic to the critical value
if test_statistic > critical_value:
    print("Reject the null hypothesis")
else:
    print("Fail to reject the null hypothesis")
End of Code

```

Practice Multiple Choice Questions

Q1. What is the goal of hypothesis testing?

- A. To draw conclusions about a population based on a sample.
- B. To make decisions based on observed data from a sample.
- C. To determine whether a certain hypothesis about a population parameter is true or false.
- D. All of the above.

Answer: D. All of the above.