Statistical Inference

Errors in Hypothesis Testing

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Type I and II errors

There are two kinds of errors that can be made in hypothesis testing:

(1) a true null hypothesis can be incorrectly rejected

(2) a false null hypothesis can fail to be rejected.

Type I Error

- The first error is called a **Type I error** .
- The probability of Type I error is always equal to the level of significance α (alpha), which is used as the standard for rejecting the null hypothesis.
- The significance level is set so as to properly know the Type I error rate.

Type II Error

- The second error is called a **Type II error**
- The probability of a Type II error is designated by the Greek letter beta (β).
- Type II error is closely related to the **Power** of a hypothesis test.

Type II Error

- A Type II error is only an error in the sense that an opportunity to reject the null hypothesis correctly was lost.
- It is not an error in the sense that an incorrect conclusion was drawn since no conclusion is drawn when the null hypothesis is not rejected.

Types of Error

- A Type I error, on the other hand, is an error in every sense of the word. A conclusion is drawn that the null hypothesis is false when, in fact, it is true.
- Therefore, Type I errors are generally considered more serious than Type II errors.
- The probability of a Type I error (α) is set by the experimenter.
- There is a trade-off between Type I and Type II errors.
- The more an experimenter protects themself against Type I errors by choosing a low level, the greater the chance of a Type II error.

Types of Error

- Requiring very strong evidence to reject the null hypothesis makes it very unlikely that a true null hypothesis will be rejected.
- However, it increases the chance that a false null hypothesis will not be rejected, thus increasing the likelihood of Type II error.
- The Type I error rate is almost always set at 0.05 or at 0.01, the latter being more conservative since it requires stronger evidence to reject the null hypothesis at the 0.01 level then at the 0.05 level.

Type I and II errors

These two types of errors are defined in the table below.

	True State: H0 True	True State: H0 False
Decision: Reject H0	Type I error	Correct
Decision: Do not Reject H0	Correct	Type II error

END