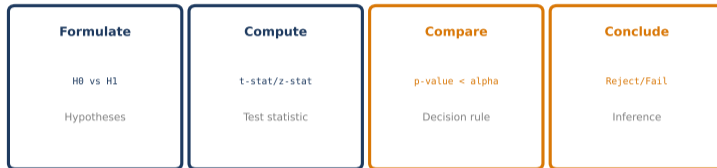


Lesson 15 Summary: Hypothesis Testing

Data Science with Python – Key Concepts

Data Science Program

Hypothesis Testing



Test Types:

t-test | F-test | chi-square | Jarque-Bera

p < 0.05 does not mean practical significance!

Hypothesis testing provides a framework for statistical inference

Null and Alternative Hypotheses

Formulating the test:

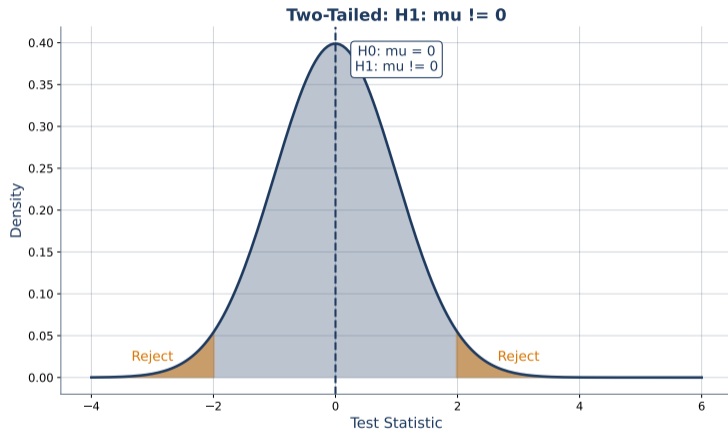
- **H0 (Null):** Default assumption (no effect)
- **H1 (Alternative):** What we're testing for
- Always assume H0 is true until evidence suggests otherwise

Example:

H0: $\mu = 0$ (no alpha)

H1: $\mu \neq 0$ (strategy has alpha)

We reject or fail to reject H0; never "accept"



Two-tailed tests detect any difference; one-tailed tests detect direction

Probability of observing data if H0 is true:

- $p < \alpha$: Reject H0 (result is significant)
- $p \geq \alpha$: Fail to reject H0
- Common α values: 0.05, 0.01

Important: p-value is NOT probability H0 is true!

Statistical significance does not imply practical importance

Type I and Type II Errors

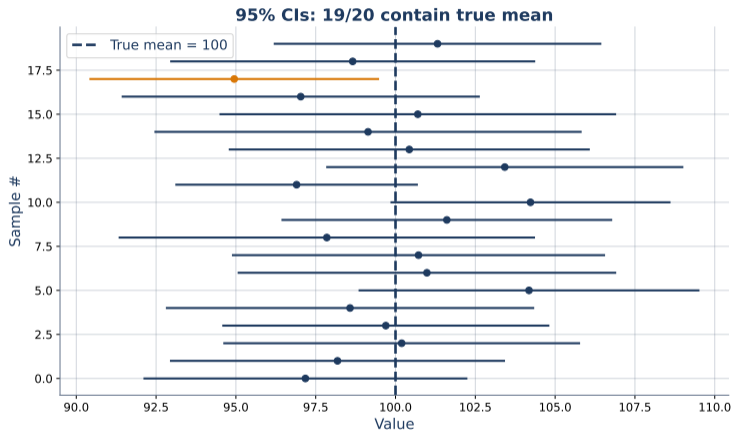
Two ways to make mistakes:

- **Type I (α):** Reject H_0 when it's true (false positive)
- **Type II (β):** Fail to reject H_0 when it's false (false negative)
- **Power:** $1 - \beta =$ probability of detecting true effect

Trade-off: Reducing one error increases the other

Choose alpha based on cost of false positives vs false negatives

Confidence Intervals



95% CI: Range where true parameter likely falls

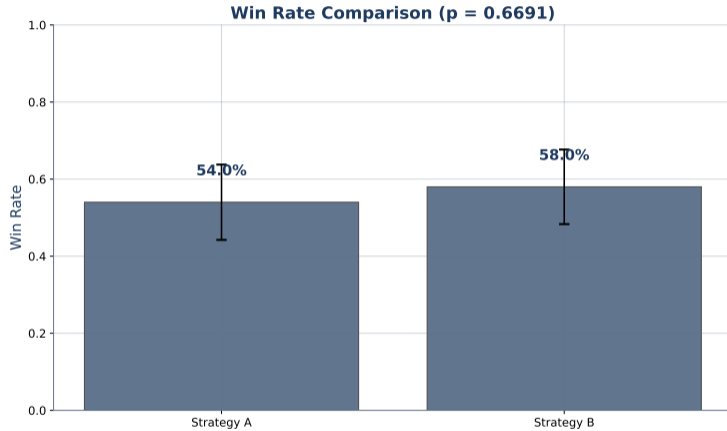
Choose test based on data and question:

- **t-test:** Compare means (one or two samples)
- **F-test:** Compare variances
- **Chi-square:** Categorical data independence
- **Jarque-Bera:** Test for normality

Python:

```
from scipy import stats
stats.ttest_1samp(data, 0)
```

Parametric tests assume normal distribution



Use binomial test to evaluate trading strategy significance

Essential Hypothesis Tests:

Test	scipy.stats
One-sample t	<code>ttest_1samp(data, mu)</code>
Two-sample t	<code>ttest_ind(a, b)</code>
Paired t	<code>ttest_rel(a, b)</code>
F-test (variance)	<code>levene(a, b)</code>
Normality	<code>jarque_bera(data)</code>
Chi-square	<code>chi2_contingency(table)</code>
Interpret	$p < 0.05 = \text{significant}$

Always consider practical significance alongside p-values