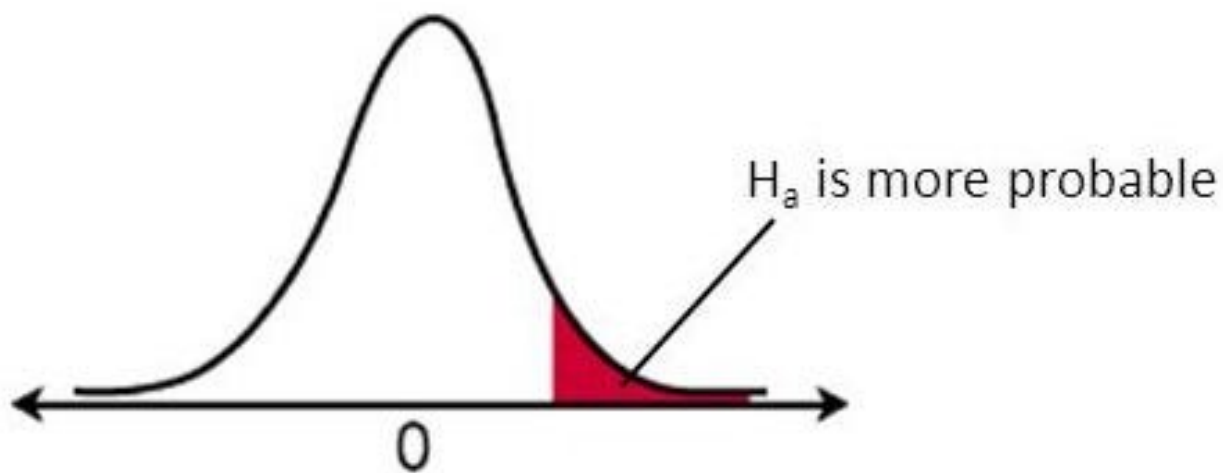
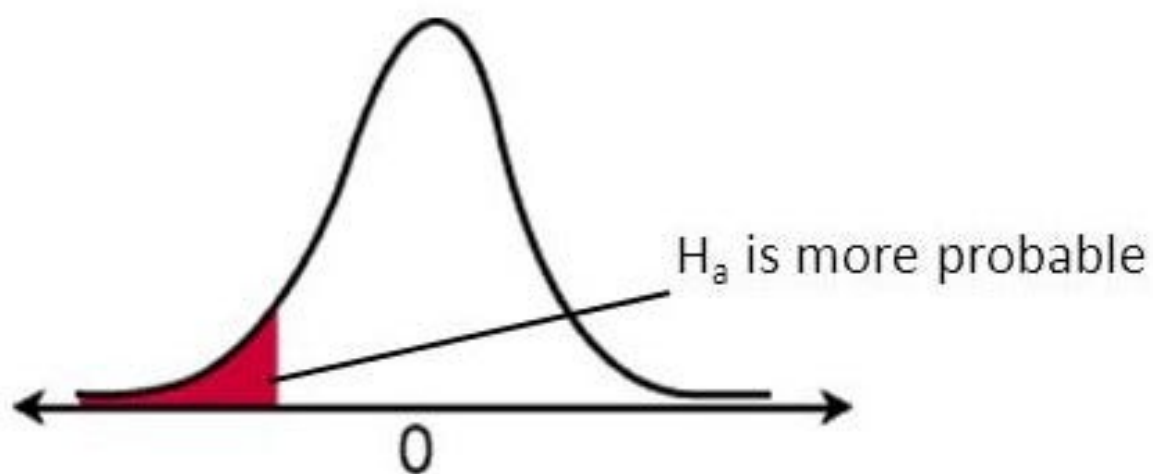


A Guide to Hypothesis Testing



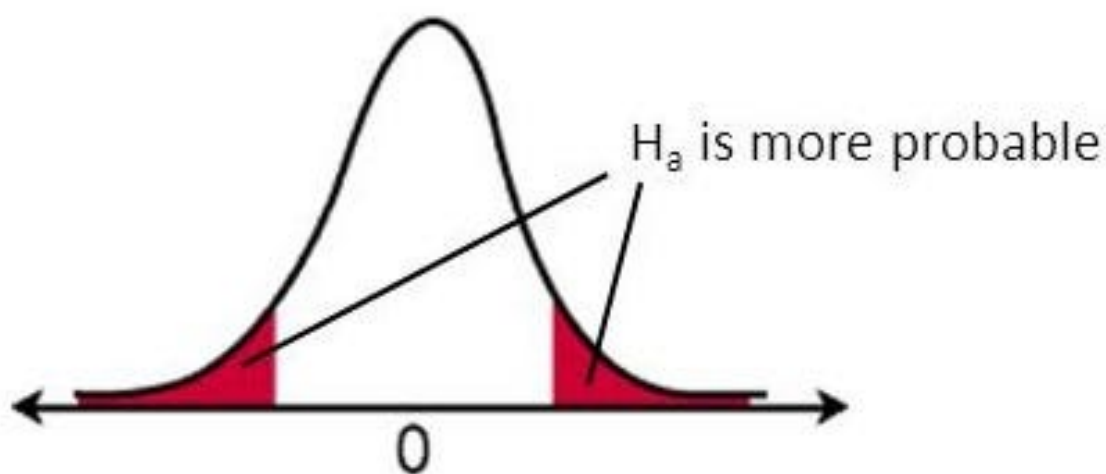
Right-tail test

$$H_a: \mu > \text{value}$$



Left-tail test

$$H_a: \mu < \text{value}$$



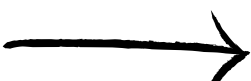
Two-tail test

$$H_a: \mu \neq \text{value}$$



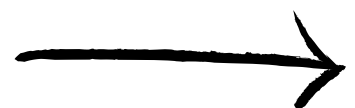
What is Hypothesis Testing?

- In its simplest form, hypothesis testing is a procedure used to determine if there is enough evidence in a sample of data to infer that a certain condition is true for the entire population.
 - **Null Hypothesis (H_0):** Represents a statement of no effect or no difference and is what you aim to reject.
 - **Alternative Hypothesis (H_1):** Represents what you want to prove.



Steps in Hypothesis Testing?

- **Set Up Hypotheses:** Define your H_0 and H_1 .
- **Choose Significance Level (α):** Commonly set at 0.05, this represents the probability of rejecting H_0 when it is true.
- **Select Test & Compute Test Statistic:** Depending on data and distribution, select appropriate tests like t-test, chi-square, etc.
- **Make a Decision:** If the p-value is less than α , reject the null hypothesis.



Common Test in Machine Learning

- **T-test:** Compares the means of two groups.
- **Chi-square test:** Tests relationships between categorical variables.
- **ANOVA** (Analysis of Variance): Compares means among more than two groups.
- **F-test:** Compares variances of two populations.



Python Code to Implement Hypothesis Testing using T - Test

```
# Import necessary libraries
import numpy as np
from scipy import stats

# Example data: scores of two groups of students
group_A = np.array([90, 85, 88, 78, 82, 80, 77, 92, 89, 84])
group_B = np.array([73, 70, 74, 65, 68, 66, 72, 71, 67, 69])

# Perform t-test
t_stat, p_value = stats.ttest_ind(group_A, group_B)

# Display results
print(f"t-statistic: {t_stat:.2f}")
print(f"p-value: {p_value:.4f}")

# Check significance
alpha = 0.05 # significance level
if p_value < alpha:
    print("Reject the null hypothesis: There's a significant difference
          between the means of the two groups.")
else:
    print("Fail to reject the null hypothesis: There's no significant
          difference between the means of the two groups.")
```