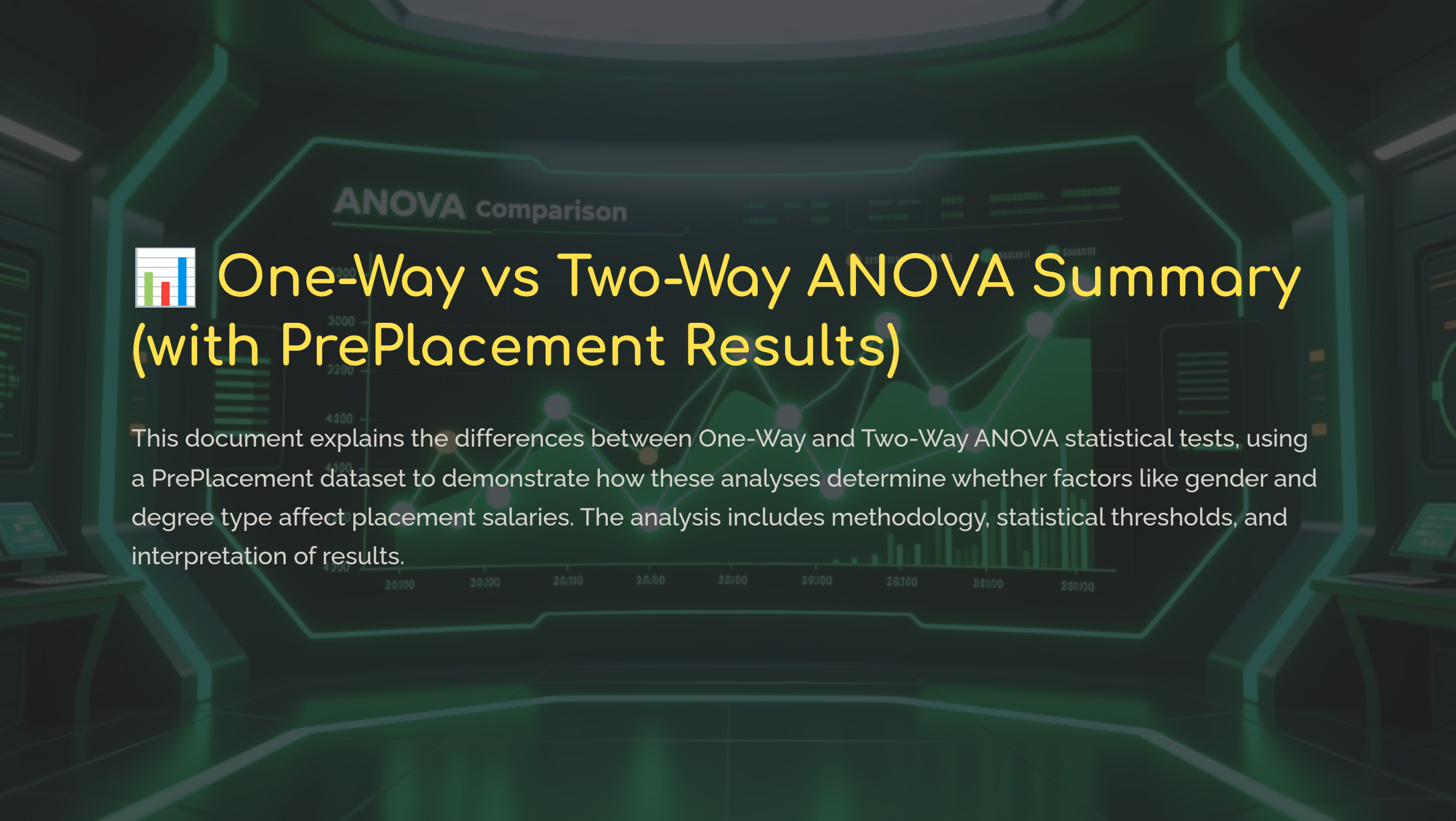

📊 One-Way vs Two-Way ANOVA Summary (with PrePlacement Results)

This document explains the differences between One-Way and Two-Way ANOVA statistical tests, using a PrePlacement dataset to demonstrate how these analyses determine whether factors like gender and degree type affect placement salaries. The analysis includes methodology, statistical thresholds, and interpretation of results.

🔹 Dataset Context (PrePlacement.csv)

The PrePlacement dataset contains comprehensive student records including academic performance metrics (SSC, HSC, and degree percentages) and placement outcomes. This data allows us to examine whether placement salaries differ significantly based on student characteristics.

Key Variables

- Academic metrics (ssc_p, hsc_p, degree_p)
- Demographics (gender)
- Education (degree_t, specialisation)
- Outcome (salary)

ANOVA (Analysis of Variance)

ANOVA is a statistical method that tests whether the means of different groups are significantly different from each other. It works by comparing the variance between groups to the variance within groups.

Between-Group Variance

Measures differences due to the effect of factors being tested

Within-Group Variance

Measures differences due to random error or individual variation

Statistical Output

F-statistic (ratio of variances) and p-value (probability under null hypothesis)

🔹 Threshold vs Actual

Threshold (α)

Set at 0.05 (5% significance level)

This is our predetermined cutoff for statistical significance

Actual (p-value)

Computed from ANOVA test

Represents probability of observing results if null hypothesis is true

ⓘ Decision Rule

- If $p < \alpha \rightarrow$ ✅ Reject H_0 (significant difference exists)
- If $p \geq \alpha \rightarrow$ ❌ Accept H_0 (no significant difference)

🔹 One-Way ANOVA

One-Way ANOVA examines the effect of a single factor (independent variable) on an outcome. In our dataset example, we can test whether salary differs based on gender alone.

> **Null Hypothesis (H_0):** Mean salaries are equal across all gender groups.
>
> **Alternative Hypothesis (H_1):** At least one gender group has a different mean salary.

🔷 Two-Way ANOVA

Two-Way ANOVA extends the analysis to examine the effects of two factors simultaneously, plus their potential interaction. Using our PrePlacement dataset, we analyze how both gender and degree type affect salary outcomes.

Gender Effect

$H_o(1)$: No effect of gender on salary

Degree Type Effect

$H_o(2)$: No effect of degree type on salary

Interaction Effect

$H_o(3)$: No interaction between gender and degree type

🔹 Actual Results (from dataset)

Effect	F-Statistic	p-value	Decision
Gender	3.60	0.059	❌ **Accept H_0** (no significant effect)
Degree Type	1.44	0.239	❌ **Accept H_0** (no significant effect)
Gender × Degree (Int.)	2.31	0.102	❌ **Accept H_0** (no significant interaction)

Note that the gender effect ($p = 0.059$) is very close to our significance threshold of 0.05, but still falls short of statistical significance by conventional standards.

🔹 Decision Interpretation

Based on our analysis of the PrePlacement dataset, none of the tested factors reached statistical significance at the conventional $p < 0.05$ level:

Gender Effect

With $p = 0.059$, gender does not significantly affect salary outcomes, though it's very close to significance.

Degree Type Effect

With $p = 0.239$, degree type does not significantly affect salary outcomes.

Interaction Effect

With $p = 0.102$, there is no significant interaction between gender and degree type.

> **Conclusion:** In this dataset, salary outcomes are statistically similar across gender and degree type categories.