



JOHNS HOPKINS

WHITING SCHOOL
of ENGINEERING

Algorithms for Data Science

Design of Experiments (DoE)

Module Learning Objectives

- 1. Define the key components of a well-designed experiment, including hypothesis, factors, levels, and ranges.**
- 2. Differentiate between t-tests, z-tests, ANOVA, and Mann-Whitney U tests based on their assumptions and appropriate use cases.**
- 3. Design a basic experiment using factorial principles to isolate treatment effects while controlling for confounding variables.**
- 4. Evaluate practical significance of findings using visualizations and hypothesis testing frameworks.**

Motivation

1. You have two different machine learning models, and you need to compare their performance on a data set.
2. Your company is considering a change to the product and needs to know if it improves the user experience.
3. You want to determine if a new advertising campaign results in higher sales.

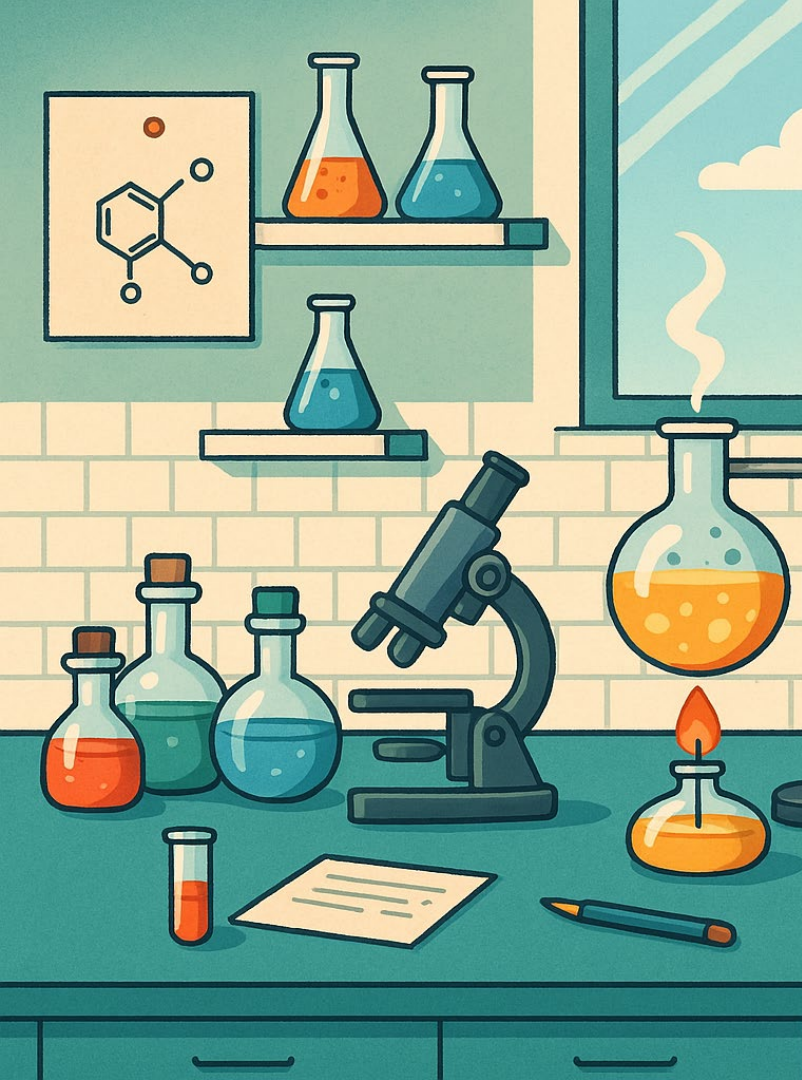


Design of Experiments

An experiment's conclusion is only as reliable as the methods used to conduct the experiment.

A well-designed experiment

- Has a founded, testable hypothesis that addresses the problem we care about
- Isolates the treatment (what we care about changing) from other (confounding) variables
- Uses statistical methods to quantify the effect of the treatment on the outcome



Guidelines

The key steps in designing an experiment are

1. Hypothesis definition
2. Factors, levels, and ranges
3. Experimental design
4. Experiment and gather data
5. Statistical data analysis
6. Conclusions and recommendations



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