

Community Recommendation Engine Experiment

Goal: Test the impact of communities on movie rentals

Hypothesis to test is that the users active on communities spend more on movie rentals.

μ_1 = Revenue per user of users active on communities

μ_2 = Revenue per user of users NOT active on communities

$H_0: \mu_1 = \mu_2$ OR $\mu_1 - \mu_2 = 0$ Communities have no impact on movie rentals

$H_1: \mu_1 \neq \mu_2$ OR $\mu_1 - \mu_2 \neq 0$ Communities have a significant impact on rentals

Note: In the above context Revenue is rental spend by the user.

Experiment Design Criteria

- **Unit of Randomization:** UserId
- **Metric:** Revenue per user
- **Level of Significance:** 0.05
- **Power:** 0.8
- **Practical Level of Significance:** δ (Depends on the business context)
- **Population variance:** σ (estimate using population variance for average revenue per user)
- **Time Duration of the experiment**
 - Since the holiday season is likely to impact user behavior, the impact of communities might be higher during the holiday and might result in False Positive result. Hence the holiday season should be avoided for data collection for the experiment.
 - The duration should be long of enough to include weekdays and weekend equally since users are likely to rent/watch movies over the weekends.
- **Sample Size for Control and Treatment (each):** $16\sigma^2/\delta^2$
 - σ is standard deviation. (estimated in the steps below)
 - δ is desired effect.

Choice of Test:

Since we want to compare average revenue per user, we need to conduct Two sample Test of means.

- Compute sample mean and variances. Determine if the 2 samples have similar variances or not.
- For sample size < 30:
 - Unequal variance: Welch's T-test
 - Similar variance: 2 sample T-test for means with equal variance
- For sample size > 30:
 - Unequal variance : Welch's Z-test
 - Similar variance: 2 sample Z-test for means with equal variance

Using the test above to compute Test Statistic Observed and Test Statistic Critical (based on the significance level chosen, and degree of freedom (for t-tests only))

Analyze the Results

Statistical Significance Check: We can **reject null hypothesis**, If Test Statistic Observed lies outside the Test Statistic Critical Range. And conclude that the communities do not have an impact on rentals.

Otherwise we fail to reject the null hypothesis and conclude that the communities do not have an impact on rentals.

Practical Significance Check: To check if the result is practically significant, calculate the Confidence Interval.

$$[\mu_1 - \mu_2 - TS * \sigma, \mu_1 - \mu_2 + TS * \sigma]$$

TS is the critical test statistic. σ the variance used in the chosen test above.

If the both ends of CI are greater than the practical significance level, the test is practically significant.