

Problem Definition

Armenian Art Online Store

Problem Area

We are aiming to implement Bayesian A/B testing which is covered in our Marketing Analytics course.

Preliminary Research

According to Aptimonk article called "Bayesian A/B Testing Guide: Definition, Benefits & More" (<https://www.optimonk.com/mastering-bayesian-a-b-testing/>)

In Bayesian hypothesis testing, each variant's performance metric is considered as a random variable following a particular probability distribution, allowing the ongoing adjustment of beliefs as new data is collected.

This process starts with a prior distribution, which captures initial assumptions about the possible outcomes of the test.

As more data becomes available, this prior distribution gets updated, which starts to form a posterior distribution. This posterior represents updated beliefs about the most probable values for each option based on the new information.

Here are several use cases of Bayesian A/B testing:

- Adjusting the position of call-to-action buttons
- Revising website navigation
- Optimizing page load times
- Improving various content layouts
- Personalizing user experiences

Specific Problem

We are aiming to create a Bayesian A/B testing tool that will find the best website UI design for Art Marketplace webpages in terms of conversion rate, engagement rate, and time on page.

Solution with Methodology

1. Data Collection

We are planning to use the data of Etsy African Art as our base for Prior, here is the link: <https://www.kaggle.com/datasets/opeyemibabarinde/etsy-african-art> . Then, we are going to generate customer website usage data, including time spent on the website, their click journey and whether they buy any product or not.

2. Analytical Techniques

Define Success Metrics and Goals

- **Identify Primary Metrics:** Key performance indicators (KPIs) affected by UI changes are click-through rate (CTR), conversion rate, time on page, or bounce rate.
- **Secondary Metrics:** Track additional metrics that provide context, like page scroll depth or navigation paths.

Set Up Event Tracking

- **Page Views and Button Clicks:** Use event tracking for specific user actions that signal engagement (e.g., button clicks, form submissions).
- **Session Duration:** Record the length of time users spend on the page to see if the change affects retention.

Segment the Audience

- **Random Assignment:** Split traffic into control (A) and variant (B) groups to ensure unbiased results.

Data Collection Tools

- **Analytics Platforms:** Google Analytics, Mixpanel, or Adobe Analytics can log user interactions for A/B testing.
- **Tag Managers:** Google Tag Manager or Segment helps organize tracking events without directly altering website code.

Prepare and Structure Data

- Collect raw event data into a structured format (e.g., CSV, database) for analysis.
- **Time-Stamp Events:** Include timestamps for each event to help track interaction sequences or timing.
- **User IDs:** Use anonymized user identifiers to connect sessions without revealing personal data.

Use Bayesian Analysis Tools

- **Bayesian A/B Testing Libraries:** Use libraries like `PyMC3` or `scipy` in Python, or specialized tools like `Zylo Tech` that can handle Bayesian statistics.
- **Bayesian Metrics:** Focus on metrics like the probability of a variant being better than the control, as Bayesian methods allow for credible intervals rather than binary “yes/no” answers.

3. Implementation Plan

Translate Insights into Hypotheses and Strategic Actions

- **Hypothesize Causes:** For example, if the new version leads to higher conversions, hypothesize reasons (e.g., better navigation or more engaging visuals), therefore we need a bigger size call-for-action.

3. Segment the users

- **User Segmentation:** If different user segments respond uniquely (e.g., mobile vs. desktop), tailor interventions accordingly.

4. Establish Continuous Monitoring and Feedback Loops

- **Track Long-Term:** Continuously monitor the chosen metrics, updating Bayesian models to refine predictions over time.

5. Automate Insights and Interventions

- **Automated Testing and Updates:** Integrate automated testing tools to continually evaluate and adjust the UI based on live data.
- **Scalability for Future Tests:** Set up reusable data pipelines and workflows for future A/B tests, making insights more accessible and interventions faster to implement.

Expected Outcomes

A website that will automate the process of evaluating and recommending the best website version in terms of:

- **Improved User Engagement**
- **Increased Conversion Rates**
- **Bounce and Exit Rates**

Also, if resources would be enough we would like to automate some readable feedback for the Marketing people to be able to identify the key drivers of recommendation.

Evaluation Metrics

- **Accuracy and Consistency of Results** - The frequency of inaccurate predictions or false positives/negatives in the tool's Bayesian analysis. Low error rates indicate high reliability.
- **Impact on Conversion and Retention Metrics** - Percentage increase in conversions following insights implemented from the tool, showing its business impact.
- **Usability and User Satisfaction** - As this product is aimed to be used by non-technical people, we need to see the satisfaction of the end user by the simplicity and accuracy of the tool, might include CSAT and feedbacks.