Conversion Rates from Control and Treatment Groups

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Abstract

The present study seeks to determine if changing the landing page will affect the conversion rate from the control group and the treatment group. In addition, the study aims to determine if there is a relationship between the variable Group and variable Converted from the A/B testing dataset. It was found that there is no relationship based on statistical tests and there were no differences between the control group.

Introduction

The field of marketing has expanded over the last decade and the rise of data analytics to accompany this industry has brought new insights. One of the main areas in marketing is a landing page, this is a standalone web page that brings the user to a new page once they click a link to an ad; these are created specifically for advertising campaigns (Ash et. al, 2012). Another term that is critical in marketing is the conversion rate. This is the number of visitors on a website that completes the desired action, in most cases, this includes buying a product (Sharma et. al, 2008).

The following study takes a dataset from a website containing conversion action, group, and landing page status. The variable group includes the control group and the treatment group, and the variable landing page includes the old landing page and the new landing page. An A/B testing will be conducted to determine if changing the landing page to a new landing page will affect the rate of conversion. In addition, the study conducts two tests to determine the relationship between the variables that are being studied.

Dataset

The dataset was taken from the Kaggle website and contains conversion rates for a social media website. The attributes in the dataset are: user_id, timestamp, group, landing_page, and converted. The link to the dataset can be found in the appendix.

User_ID	Timestamp	Group	Landing_Page	Converted
851104	11:48.6	Control	Old_Page	0

804228	01:45.2	Control	Old_Page	0
661590	55:06.2	Treatment	New_Page	0

Table 1. First five records from AB testing dataset.

Ethical Issues

A number of ethical considerations should be considered for this study. The following issues are addressed:

- Consent
- Privacy
- Biases
- Discriminatory factors
- Acknowledgements

These ethical considerations were abundant throughout the study and should be analyzed carefully. Consent played a significant role as the website displayed information that was taken directly from the creators with their permission. A breach in this can cause a number of ethical issues including privacy concerns and any analytical findings would be disregarded as such.

Privacy is another key area when analyzing ethical issues. Making sure the individual's personal information is protected is widely considered one of the key areas in ethical research. Mishandling information can lead to lawsuits and hefty fines and can downgrade the authenticity of research significantly. The present paper did not mishandle consumer information as they were given special ID numbers as shown in Table 1. This ensured privacy and at the same time noted transactions that could be indexed appropriately.

The bias in research is a critical area that poses ethical dilemmas. Due to the amount of unspecified information in the data, it can be said that there are no signs of bias in the research. However, in the case of bias being present, it would be noted as bias brings into question the validity of the research.

The discriminatory factors in research are another critical aspect. Any study that causes potential harm or presents visible minorities in a way that is discriminatory would be unsuitable for a publication. The present research does not present any discriminatory factors as ethnic groups, genders, and overall identities are concealed.

The study did not present any acknowledgments. The dataset failed to mention or provide credit to anyone and it is presumed that the data was created by the individual that uploaded it. These details are vague and bring questions as to any true authors in the research.

Weaknesses

The key drawback for this research is the individuals in the A/B testing research being the same for the control and treatment groups. The present dataset does not confirm whether or not the treatment and control groups have the same individuals which brings into question the validity of the A/B testing. It is assumed in the study that the individuals are the same for each group however, the source of data should confirm this assumption moving forward.

Another drawback of this research is the anonymous information presented. The dataset took privacy issues seriously, however, it failed to mention details about the website. This involved further research by the authors in order to extract information on the experiments performed to obtain the data. Another difficulty from the dataset was the details in the treatment group attribute from Table 1. By denoting more of the details, the paper would be able to provide specific information on the groups. Table 1. also provided another attribute known as Timestamp but failed to mention specific dates. Had the researchers mentioned the date, readers would have my information regarding the conversion rates.

Discussion

As we are interested in finding the conversion rate difference from the control group and the treatment group, we decided to use the A/B testing method to see whether there is a significant difference between these two groups. The treatment in our case is having a new landing page on the website. Our assumption before the test is that the new landing page will increase the conversion rate. But before we start running the test, we wanted to ensure that the control group and treatment group are matched to the old page and new page respectively. We used filter function to select all the rows with the correct match and assign them as the accurate dataframe. After cleaning the dataset we then created a table, shown as Table 2, which consists of the groups as row and conversion as a column.

	0	**1**
control	127785	17489
treatment	128047	17264

Table 2. Table between variable Group and variable Converted

Because we are interested in the difference in conversion rates between control and treatment groups, we used prop.test function, which tests the null hypothesis that the proportion of people who converted from the control group and treatment group are the same. And the results are as shown below:

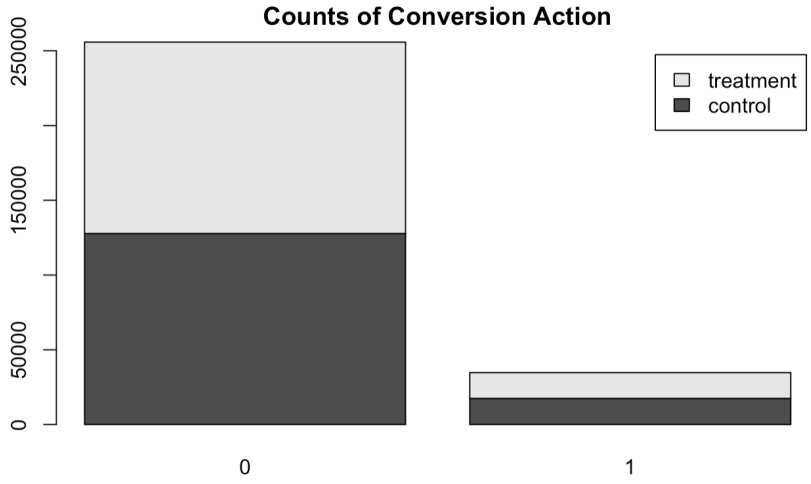
X-squared	df	p-value
1.7054	1	0.1916

Prop of control group conversion	Prop of treatment group conversion
0.1203863	0.1188072

Table 3. 2-sample test for equality of proportions with continuity correction

In Figure 3, the proportion of conversion from the control group is around 12 percent, and the proportion of conversion from the treatment group is also close to 12 percent. In order to reject the null hypothesis, we must have a p-value that is lower than the critical value 0.05. However, the p-value is 0.1916, which is more than 0.05. Therefore, we failed to reject the null hypothesis and concluded that the proportions of conversion from the control group and treatment group are the same.

To further understand our dataset, we created a bar plot that contains conversion action from control and treatment groups.



Bar Plot.1

As the Bar Plot.1 showed, the control group and treatment group share seemingly the same proportion for both none converted and converted action in our dataset. This is probably the reason why we failed to reject the null hypothesis mentioned before.

In order to further testify our A/B test results, we decided to run the Chi-square test of independence to determine if there is a significant relationship between the variable Group and variable Converted. As shown in Table 4, the p-value from the test is 0.2182, which is more than the critical value of 0.05. Thus, we cannot reject the null hypothesis, which states that there is no relationship between the variable Group and variable Converted. In other words, the conversion action from a person will not be affected whether that person receives treatment or not.

X-squared	df	p-value
1.516	1	0.2182

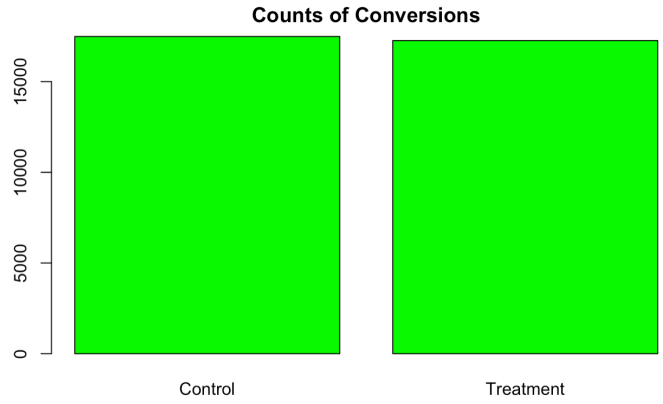
Table 4. Pearson's Chi-squared test with Yates' continuity correction

Furthermore, we ran a Fisher's exact test of independence on our variables with the assumption that our variables are independent. As shown in Table 5, the p-value is still more than the critical value 0.05. Thus, we further concluded that the probability for a person to make the conversion is the same whether the person sees the old landing page or the new landing page.

p-value	Odds ratio
0.2179	0.9860505

Table 5. Fisher's Exact Test for Count Data

Lastly, we plotted the frequency of conversion for two groups. From the bar plot, we can see the frequencies are almost the same for the control group and the treatment group.



Bar plot. 2

In the end, A/B testing is a good testing method for data analysts who want to find out whether a treatment is effective. But unfortunately, it did not provide us with more insights in terms of the effectiveness of the treatment, and thus we cannot conclude a result which can explain causality between treatment and the action desired. As for the disadvantages of A/B testing, it requires that the control and treatment groups are the same, which makes it harder to collect data as the data collector needs to keep track of the same group before and after the treatment. Another disadvantage of A/B testing is that it could only test for one treatment each time. Data analysts need to repeat A/B testing for different treatments and none of the previous outcomes can be used again when conducting new A/B testing. In terms of suggestions for how to proceed A/B testing, the initial phase is to clean the dataset first and make sure that all the rows have the correct combination of values. Also, constructing tables between variables will make running hypothesis tests easier.

Appendix

The link to the dataset can be found here: https://www.kaggle.com/zhangluyuan/ab-testing.

The link for the code is found here: https://github.com/Mustafa-barez/Treatment-Groups-in-R/blob/master/Conversion%20Rates.Rmd.

References

Ash, T., Ginty, M., & Page, R. (2012). *Landing page optimization: The definitive guide to testing and tuning for conversions*. John Wiley & Sons.

RStudio Team (2019). RStudio: Integrated Development for R. RStudio, Inc., Boston, MA URL http://www.rstudio.com/

Sharma, A., Chen, K., Kniaz, R., & Heilig, J. (2008). *U.S. Patent Application No. 12/025,642*.