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AI Effect on Customer Retention Report

Introduction

The primary objective of this research endeavor was to investigate how AI affects customer retention rates on an eCommerce site to solve efficiency and automation related business problems. It is important to solve these problems because the use of AI can impact customer retention based on customer satisfaction and efficient online customer service. The rise of AI raises many ethical questions in the use of private data and may make customer experiences less satisfactory as they might not be comfortable sharing information with AI tools. On the other hand, AI tools can analyze customer data and precisely market products to customers based on buying habits making engaging with an ecommerce site more efficient. Adoption of AI tools can save a business money and increase their readiness, better preparing the business for changes in the industry as well as changes in the business environment.

For this report, assume a survey was sent out to 100,000 customers to collect their thoughts on AI using a series of questions. Five questions were designed to collect customer demographic data and 8 survey questions were designed using the Likert scale to understand the customers feelings toward AI. Of the 100,000 customers, 1056 were randomly selected. This sample was calculated using a 95% level of confidence and a 3% margin of error. Originally, the aim was to collect survey questions and to test our null hypothesis: Customer Trust in AI solutions has no noticeable effect on long term customer loyalty. To test this an “AI Trust Score” would be calculated by summing the customers choices. The null hypothesis will be accepted (fail to reject) as no correlation was found between AI trust score and the survey questions answered implying with a reasonable certainty that the null hypothesis holds true.

Phase 1 Questions:

Demographics:

How much total combined money did all members of your household earn last year?

How many dependents live in your household?

Which category includes your age?

Would you purchase products again within the next year? (y/n)

How much was spent on our products in the last 3 months? (added in phase 2)

Survey:

I trust AI to help me make informed purchase decisions.

I trust AI to use my purchase data to help me shop faster.

I would rather wait to talk to a real human over an AI chat bot.

AI tools (I.E chatbots) solve my customer service issues efficiently.

I will purchase something on this site again in the near future.

I am willing to share only necessary business/shopping data (consumer habits).

AI benefits me as a customer.

AI makes repeating purchases convenient.

Hypothesis:

H_0: Customer Trust in AI solutions has no noticeable effect on long term customer loyalty.

H_a: Customer Trust in AI solutions has a noticeable effect on long term customer loyalty.

Regression hypothesis:

H_0: Customer retention alone is not a good predictor of AI trust score.

H_alt: Customer retention alone is a good predictor of AI trust score.

Q1 - Discuss the most appropriate data analysis method based on your research questions:

For this survey and research problem, two different data analysis methods felt appropriate in analyzing the survey's research questions, Regression and Anova.

Regression:

Understanding the intricate relationship between customer trust in AI solutions and long-term customer loyalty requires a multifaceted approach. Identifying the drivers behind AI adoption, encompassing economic and business readiness factors, is crucial. Once these factors are established, a comprehensive survey aimed at gauging perceptions of AI's impact on customer retention should be devised.

This analysis will rely on survey data that includes demographic information and Likert scale (1-5) survey questions to gauge individual customer sentiments toward AI. The sum responses from each customer will form an AI trust score (scale of 0-40 where 40 is a perfect score), providing a quantitative measure of trust levels.

Utilizing regression models exploring the linear relationship between retained customers and AI trust scores, will unravel the potential impact of trust in AI on customer loyalty. If a strong correlation exists additionally exploring the correlation between sales volume per customer (reflecting recent spending patterns) and AI trust scores can offer deeper insights into the dynamics of customer trust. This would allow for a more complex model to be built to better predict AI trust scores.

Anova:

Utilizing ANOVA aids in uncovering significant differences in mean AI trust scores among distinct customer groups. Specifically, this analysis allows for an in-depth examination of how age groups or income levels influence perceptions of AI trust. By scrutinizing the means of these demographic segments in relation to AI trust scores, it becomes possible to discern whether certain age groups or income brackets significantly differ in their levels of trust in AI solutions.

ANOVA enhances the comprehension of how customer demographics interplay with trust in AI solutions. It not only supplements the regression model by providing a finer-grained understanding of group differences but also contributes valuable insights into the potential variations in AI trust scores across diverse customers.

Q2 - Discuss how the survey will solve your client's problem:

Theoretically, we can use the analysis of our research questions to benefit the client. Predicting customer trust in AI and determining if there is significant difference between groups of customers' attitudes towards AI can help a client understand how to best utilize their AI tools. In addition, it can help a client assess if using AI tools is compatible with their business model. Understanding recent customer attitudes towards AI could have a big impact on the client's business. If the client's customer base is aware of their AI tools and it's causing dissatisfaction, then the client might lose sales. If we can predict whether a customer will trust the client's AI tools, we can assess to what extent we use those tools. For example, let's say the clients AI tools are not popular with their older customers. To solve this, simply segment the customers based on satisfaction with AI tools. Limit the AI and tailor the older customer's online shopping experience to rely less on AI tools. If a younger customer group is receptive to using AI tools to shop online, allow the AI to integrate consumption models and precision marketing based on individual shopping data. Segmenting customers and using AI tools in the right place could boost sales by analyzing behaviors and preventing lost sales by not pushing unpopular tools onto groups that don't prefer them. If the majority of the customer base is receptive or indifferent to AI tools then certain features could be kept for all customers, like chatbots. Other features could be limited to certain groups, but certain features could be used with others. The Survey data will enable the client to make the most informed choice for their eCommerce site. If trust in our AI solutions has no noticeable effect on customer loyalty, the client is at least free to implement solutions without the consequence of losing customers.

While the survey could give the client insights, in reality building a regression model and analyzing differences using Anova with the data that was observed was not capable of providing explanations for determining if AI trust would have any effects on loyalty. Analyzing the means in Age Range and Income revealed that there is no variance in means when using a two-way Anova statistical test[9]. Figure 2 shows a regression visualization that models AI Trust Score as a function of retained customers. The idea is that observed retained customers could help us predict AI Trust Scores. Customers were considered "retained" if they answered "yes" to Q4("would you shop with us again in the near future"). Originally, I attempted to predict retained customers using AI Trust Scores. This approach was flawed as it didn't match what was

being tested by the null hypothesis. This error can be seen in figure 1 as the variance is far greater in comparison to figure 2. Figure 3 depicts a regression model that attempts to predict AI Trust Score using amount spent by customer in the last 3 months. This question was added in phase 2 to see if Trust in AI had an effect on volume of sales per customer. All regression models show symptoms of linear regression assumption violations as there is no clear trend and several outliers are visibly apparent. Further analyzing the models in R leads to further disappointment. Using the cor function in R to analyze the correlation between Q13(amount spent in the last 3 months) and AI Trust Score observed (random data generated by qualtrics) is only -.06. Very Weak. Analyzing the correlation between X (retained customers) and the AI Trust Score observed reveals a correlation of -.06. Very weak. In both cases, technically there is an argument that there is a correlation because the correlation null hypothesis; true correlation is equal to 0, is rejected. Further analyzing our regression models will show that such a weak correlation is not statistically significant. Analyzing lm(AI Trust~Retained)[5] in R reveals that the regression model can only explain .2% of variations. The p-value is .124, which is greater than any reasonable alpha (.05). Fail to reject(accept) the null hypothesis that customer trust in AI alone is not a good indicator of long-term customer loyalty. Plotting our regression line reveals that our model is almost indistinguishable from the mean value of AI trust score[4], where the red line is the regression line, and the green line is the mean of AI trust score. The same conclusions can be drawn when Analyzing lm(AI trust score~amount spent)[7] in R. the regression model can only explain .2% of variations and p-value (.147) is greater than any reasonable alpha, fail to reject the null hypothesis. Plotting the regression (red) line is indigestible from the mean value of AI trust score (green line)[6]. Higher p-value indicates that lm(AI Trust~amount spent) is a worse model and in fact the adj. R-squared value was slightly lower than the other regression model (.0021[7] vs. .00261[5]). Simple models were not capable of predicting values better than the dependent variables intercept, but can a more complex model?

An analysis of a more complex model, lm(AI.Trust.Score~Q13+factor(Q1))[8], where Q13 is the amount spent in the last 3 months and factor(Q1) is the age range of customers, is not a better predictor than the dependent variables intercept. Perhaps the different age ranges of customers could assist in predicting AI Trust Scores, but the more complex model could only explain .06% of variations. Far less than what the simple models could explain. If the more complex model could a good number of variations (adj. R-squared value > .4) then predictions

would be made using training and test sets. Continueing with predictions would be pointless, so the analysis stops here.

Q3 - Delineate the key takeaways from the survey creation experience.

Key Takeaways:

- The survey questions may have been flawed.
    - DV and IV got flipped when creating questions in phase 1 which was corrected in phase 2.
- Regression failed to make adequate AI Trust Score Predictions.
- No statistically significant difference could be found between groups using Anova.
- Randomness in generated Qualtrics responses could've explained difficulty in analyzing data.
    - Results may have been different if observations were real and if there was access to actual sales data.
- Trust in our AI solutions will have no noticeable effect on customer loyalty.

With the observations generated by Qualtrics, a forward built multiple linear regression model was built in attempt to predict AI trust score and assess if a complex model was better than our simple models and to assess if complex or simple models did a better job of predicting AI trust scores than the independent variables intercept. An Anova statistical test was attempted to evaluate if there was a statistically significant difference in group means in age and income. In conclusion, it was not effective. The only thing that can be concluded is that an individual should fail to reject the null hypothesis, that customer trust in AI solutions has no noticeable effect on long term customer loyalty.

Linear regression assumption tests were not conducted, but it was anticipated that all models would violate multiple assumptions based on a miniscule correlation and poor explanation of variations (low adj. R-square values). An Anova statistical test evaluated that there is no statistically significant difference in group means in Age and Income when evaluating AI trust scores. The p-value of the Anova test was greater than any reasonable alpha, an individual should fail to reject the null hypothesis (accept), and the alternative hypothesis, that there is a statistically significant difference in group means, should be rejected.

The correlation in AI trust and different features such as retained customers and amount spent in the last 3 months was not statistically significant. Trust in AI could not be adequately predicted. A simple linear regression model nor a complex one could not better predict AI trust better than the mean value of AI trust score (independent variable intercept). Given our observations, reliable predictions on AI trust could not be provided to the client. If our observations can be replicated with responses from real humans (not randomly generated Qualtrics data) then it is safe to say with reasonable certainty that integrated AI solutions in CRM will have no noticeable effects on customer loyalty as there was no relationship between AI trust and the different features tested.

Figures and Code

Figure 1 – lm(retained~AI Trust Score)

Retained = sum of customers who would purchase something in the future

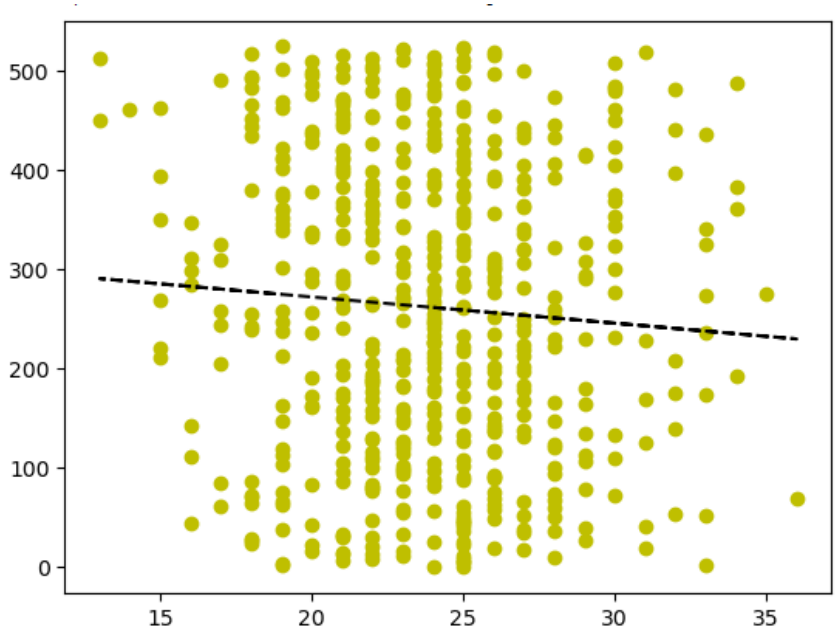

Figure 2 – lm(AI Trust Score ~ retained)

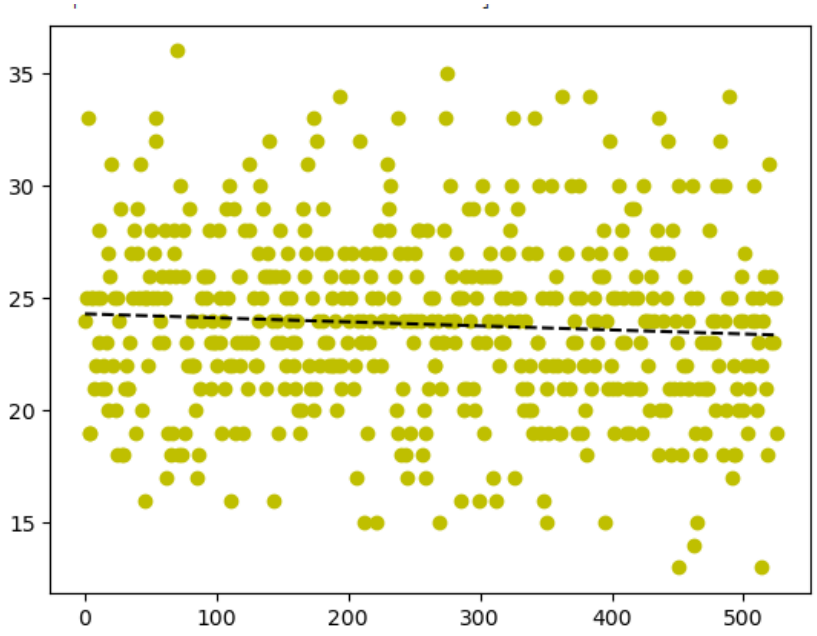

Figure 3 – lm(AI Trust Score ~ Q13)

Q13 = ‘How much have you spent on our products in the last 3 months?

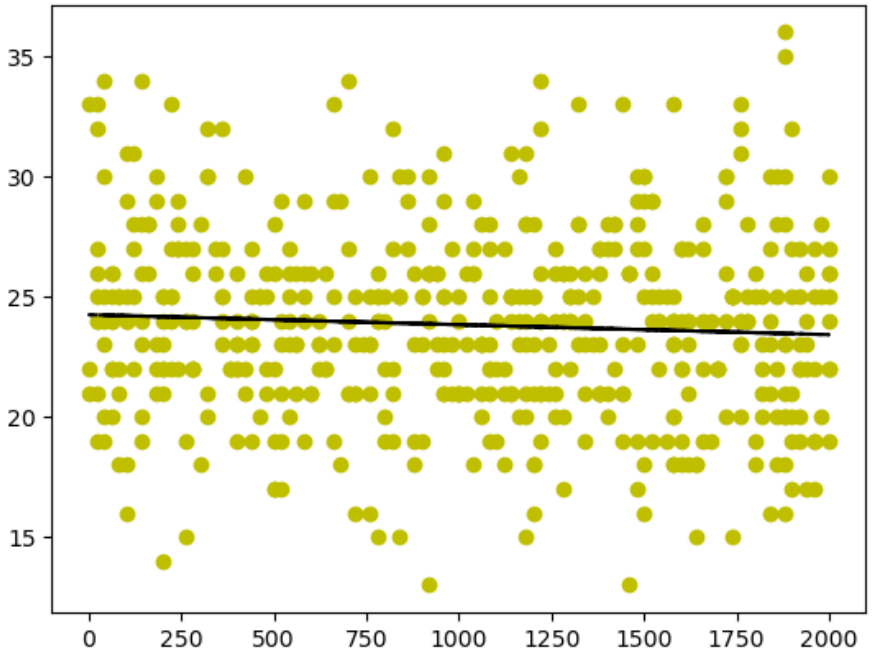

Figure 4 - lm(AI Trust~retained) in R

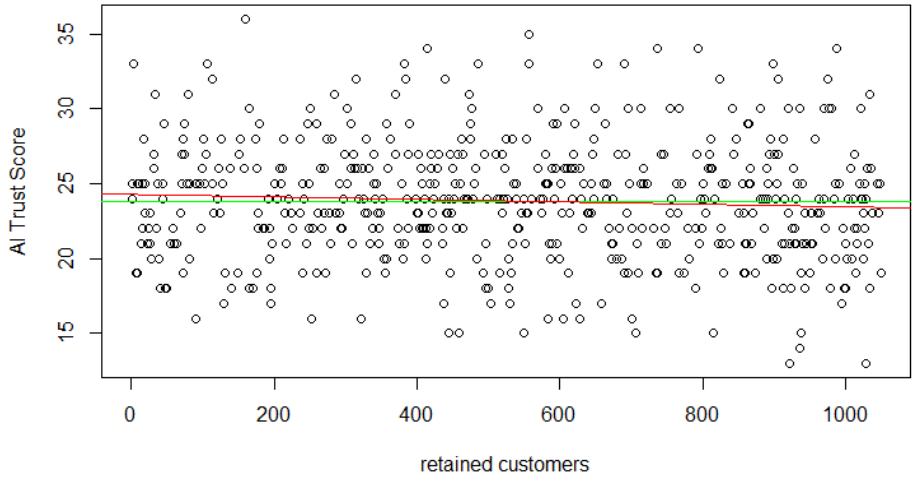

Figure 5 - lm(AI Trust~retained) summary in R

#X is the number of possible retained customers, based on response.

o_zero<-lm(AI.Trust.Score~X,data)

summary(o_zero)

#p-value = 0.124

#Multiple R-squared: 0.004509,Adjusted R-squared: 0.00261

Figure 6 – lm(AI Trust ~ Q13) in R

Q13 = ‘How much have you spent on our products in the last 3 months?

Figure 6 - lm(AI Trust~Q13) in R

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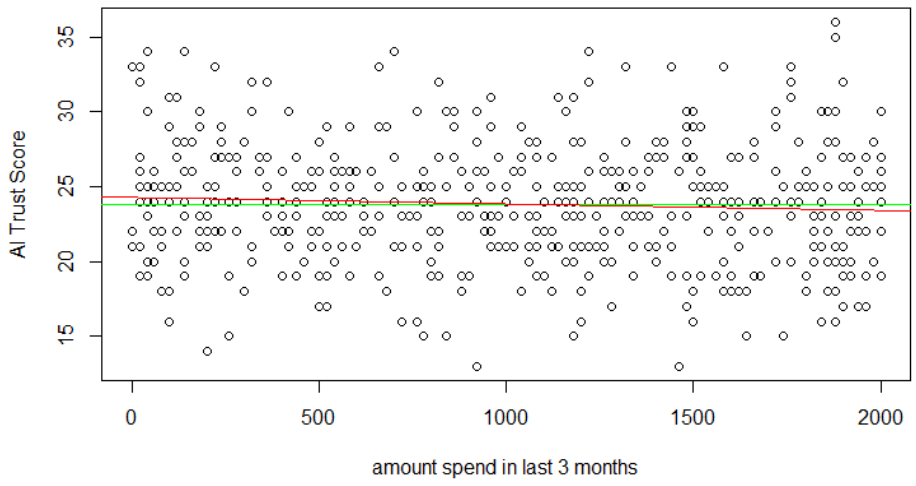

Figure 7 - lm(AI Trust~Q13) summary in R

```
#Q13 = how much was spent in the last 3 months.
o1<-lm(AI.Trust.Score~Q13, data)
summary(o1)
#p-value = 0.147
#Multiple R-squared:  0.004003,Adjusted R-squared:  0.002102
```

Figure 8 - Forward Built Linear Regression Model

```
f1<-lm(AI.Trust.Score~Q13+factor(Q1), data)
summary(f1)
#Multiple R-squared:  0.01401,  Adjusted R-squared:  0.0006812
#f1 model is not a better model than o_zero, o1, o2
#Does our model explain our data better than the mean of our data? No, not really.
```

Figure 9 – Anova Analysis in R

```
two_way <- aov(AI.Trust.Score ~ Age.Ranges+Income,data=data)
summary(two_way)
                Df Sum Sq  Mean Sq  F value  Pr(>F)
Age.Ranges    1     12      12.07       0.737    0.3908
Income          1      52      52.15       3.185    0.0746 .
Residuals       1047 17143 16.37
---
Signif. codes:
0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
p-values are greater than any reasonable alpha, fail to reject null hypothesis
```

that there is no variance in means.

Python Code:

The following are github links containing code written by me for this project.

Dataclean.py

Data_analysis.ipynb

Regression_analysis.R

Anova_analysis.R