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Project 1: Predicting Catalog Demand

Complete each section. When you are ready, save your file as a PDF document and submit it here: https://classroom.udacity.com/nanodegrees/nd008/parts/c0b53068-1239-4f01-82bf-24886872f48e/project

Step 1: Business and Data Understanding

Provide an explanation of the key decisions that need to be made. (500 word limit)

Key Decisions:

Answer these questions

1. What decisions needs to be made?

The business decision is whether the company should send catalogs to the 250 new customers?
To answer this question and make the right decision, consider the profit from these 250 new customers. If the profit is over $10,000, then send the catalogs, otherwise do not send.

: Awesome: Right! The main decision here is that the company wants to determine whether the expected profit from these customers exceeds $10,000 and then decide to send the catalog out to these customers or not.

2. What data is needed to inform those decisions?

p1-customers.xlsx contains related information of 2,300 customers. It will be used to train the linear regression model.
p1-mailinglist.xlsx contains information of the 250 new customers which will be used to calculate the predicted expected profit to make the business decision.

: Require Changes: In this answer you must explicitly list all the "data" that you will need to reach your main business decision as mentioned above.

For example :
-We need data on all of the customers and any data that can tell us whether they've bought something in the catalogue in the past, including not limited to:
(a). Bought an item from a past catalogue
(b). Average amount of items the customer buys from the company
(c). The total dollar amount that the customer spent ordering from our catalogues

Step 2: Analysis, Modeling, and Validation

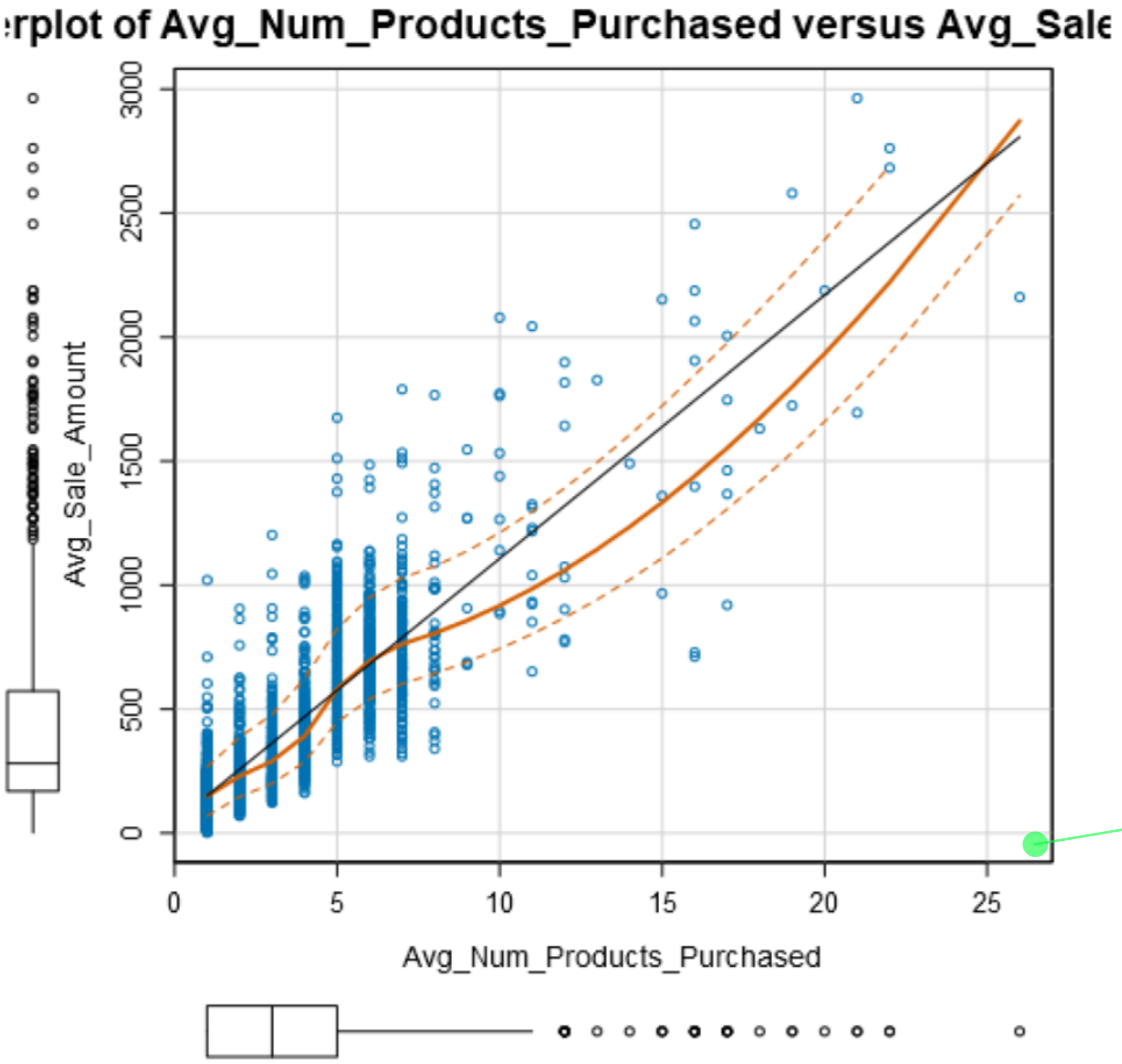
Provide a description of how you set up your linear regression model, what variables you used and why, and the results of the model. Visualizations are encouraged. (500 word limit)

Important: Use the p1-customers.xlsx to train your linear model.

At the minimum, answer these questions:

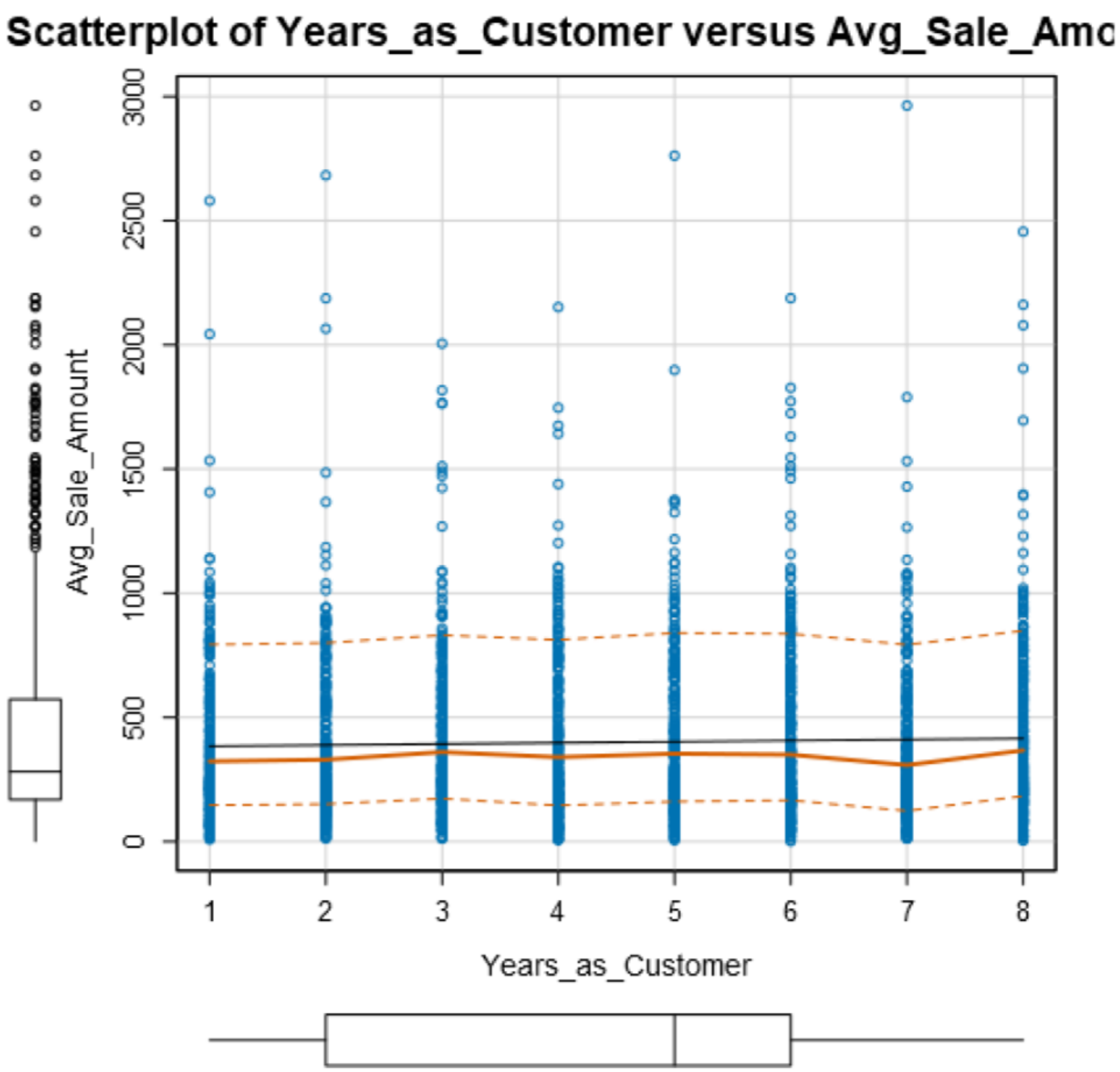
1. How and why did you select the predictor variables (see supplementary text) in your model? You must explain how your continuous predictor variables you've chosen have a linear relationship with the target variable. Please refer to this lesson to help you explore your data and use scatterplots to search for linear relationships. You must include scatterplots in your answer.

Avg_Num_Products_Purchased (continuous) and Customer_Segment (categorical) are chosen as the predictor variables. The following scatterplot shows the linear relationship between Avg_Num_Products_Purchased and Avg_Sale_Amount(gross revenue). So it is included.



: Awesome: As this plot depicts, average number of products purchase is linearly related to average sale amount.

Meanwhile, from the following scatterplot, we can see there is no linear relationship between Years_as_Customer and Avg_Sale_Amount, so Years_as_Customer is not included.



For all categorical features, we need to select each in the linear regression model for training, and only choose the ones with significant coefficients by looking for those with small (<0.05) p-values. After several tries, only the Customer_Segment feature is significant in the linear regression model with p-value < 2.2e-16 for all three segment types.

: Awesome: Correctly identified and justified all the variables required.

2. Explain why you believe your linear model is a good model. You must justify your reasoning using the statistical results that your regression model created. For each variable you selected, please justify how each variable is a good fit for your model by using the p-values and R-squared values that your model produced.

The R-squared for the linear model is

`Multiple R-squared: 0.8369, Adjusted R-Squared: 0.8366.`

This means that the two predictor variables explain about 83% of the variation in the Avg_Sale_Amount target variable. So it is a good prediction model.

Moreover, all the predictor variables: intercept, Customer_SegmentLoyalty Club Only, Customer_SegmentLoyalty Club and Credit Card, Customer_SegmentStore Mailing List, Avg_Num_Products_Purchased have p-value < 2.2e-16, so their coefficients are significant.

: Awesome: Good job using both R-squared and p-values to justify why your model is a good one! An r-squared of 0.8366 means that about 84% of the target variable is explained by the predictor variables. In general, when a model with R-squared above 0.7 is considered a good model.

3. What is the best linear regression equation based on the available data? Each coefficient should have no more than 2 digits after the decimal (ex: 1.28)

Score(predicted revenue) = 303.46 - 149.36 x (Customer_SegmentLoyalty Club Only)
+ 281.84 x (Customer_SegmentLoyalty Club and Credit Card) - 245.42 x (Customer_SegmentStore Mailing List) + 66.98 x (Avg_Num_Products_Purchased).

: Awesome: The linear equation is correct as it contains just the correct predictor variables with correct coefficients.

The three variables Customer_SegmentLoyalty Club Only, Customer_SegmentLoyalty Club and Credit Card, Customer_SegmentStore Mailing List from one-hot encoding of the categorical variable Customer_Segment take values 0 or 1.

Important: The regression equation should be in the form:

*Y = Intercept + b1 * Variable_1 + b2 * Variable_2 + b3 * Variable_3……*

For example: Y = 482.24 + 28.83 * Loan_Status – 159 * Income + 49 (If Type: Credit Card) – 90 (If Type: Mortgage) + 0 (If Type: Cash)

Note that we **must** include the 0 coefficient for the type Cash.

Note: For students using software other than Alteryx, if you decide to use Customer Segment as one of your predictor variables, please set the base case to Credit Card Only.

Step 3: Presentation/Visualization

Use your model results to provide a recommendation. (500 word limit)

At the minimum, answer these questions:

1. What is your recommendation? Should the company send the catalog to these 250 customers?

I recommend the company to send the catalogs.

2. How did you come up with your recommendation? (Please explain your process so reviewers can give you feedback on your process)

For each of the 250 new customers, compute the
Profit = Score * Score_Yes*0.5 - 6.5,
then sum up all individual profits to get the final total profit.

3. What is the expected profit from the new catalog (assuming the catalog is sent to these 250 customers)?

The total profit is $21, 987.44 which exceeds $10,000.

Before you Submit

Please check your answers against the requirements of the project dictated by the rubric here. Reviewers will use this rubric to grade your project.

: Require Changes: The explanation about the approach taken for calculating the expected profit do not look quite clear. It is better that you explain step by step the methodology that you have followed. For example, here are the steps that we need to follow :

- First, we have to calculate the Score of each customer. For this, we multiply [Score] * [Score_yes], being (Score-Yes) the probability that each customer makes a purchase.
- Then, to obtain the total sales for the 250 clients, we will make a summation of the Total Score that we have obtained [Sum_Score].
- To get the gross margin we have to multiply [Sum_Score] *.5, and to this result, we have to subtract the total expenses of sending the catalogs to the 250 clients [- (6.5 * 250)]. In this way we will obtain the benefits, which must be > $10,000.

: Awesome: The final expected profit is right!