**PART A: Datacamp**

1. In the Datacamp Exercise Modelling Customer Lifetime Value with Linear Regression Ex. 6, we predicted the sales using linear regression. However, in the real word, we know that sales data mostly cannot explained with linear relation. For this purpose, there are other prediction methods like ARIMA and Holt-Winters which can use 3 aspect of time series; average, slope and seasonality. Why we use especially linear regression for this purpose?
2. In the DataCamp lecture (https://campus.datacamp.com/courses/machine-learning-for-marketing-analytics-in-r/modeling-customer-lifetime-value-with-linear-regression?ex=7), it is stated that variance inflation factors can be checked if there are any multicollinearity. If any variables have VIF more than 10, we can delete them from model. How do we know which variable to exclude? It mentions about variable pairs. How can we know these pairs without knowing the data?
3. Datacamp video 3:30. <https://campus.datacamp.com/courses/machine-learning-for-marketing-analytics-in-r/modeling-customer-lifetime-value-with-linear-regression?ex=4>. What does it mean “independence of errors” and “Constant variance of prediction errors”?
4. Datacamp video 2:40. <https://campus.datacamp.com/courses/machine-learning-for-marketing-analytics-in-r/modeling-customer-lifetime-value-with-linear-regression?ex=10>. Is it just right to use AIC in hyperparameter tuning in the same model or would it be right to use it for different models to compare each other?
5. In the first question of Datacamp course, it says “Sending customized ads to special segments of customers” is not a benefit of CLV. I do not understand why, I think we can use CLV analysis while sending special offers.
6. In Model validation, model fit, and prediction part of Datacamp course, it says getting a r2 value greater than 0.9 is really hard. If we get a really high r2 value, is it a sign of overfitting ?
7. On the DataCamp chapter at 2:56, it is understood that customer lifetime value is calculated yearly, and companies act according to this calculation. when an extraordinary situation which affects the company's sales occurs, how can we interpret customer lifetime value calculation? for example, the pandemic has affected several sectors harshly, and this ongoing.

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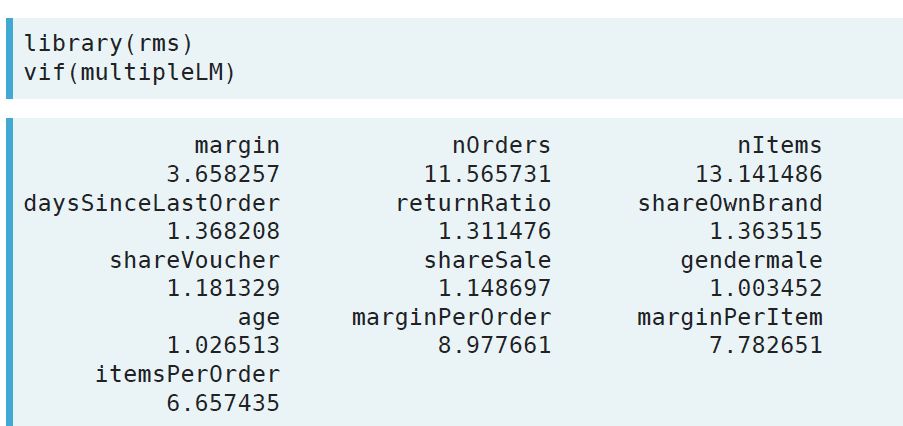
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1. On DataCamp [exercise 9](https://campus.datacamp.com/courses/machine-learning-for-marketing-analytics-in-r/modeling-customer-lifetime-value-with-linear-regression?ex=9), we are asked to determine relationship between features, especially with meanItemprice. When it comes to daysSinceLastPurch feature, is it still relevant that it contributes to sales of the month by interpreting its Pr and Estimate?

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# <https://www.datacamp.com/courses/marketing-analytics-in-r-statistical-modeling>.In the example which is studied whole chapter there are three years firstly the model is developed for predicting margin in year 2 by using first year’s data. Then year 3 is predicted by using year 2 data. When we have deeper historical data,for example 5 years, how the process should be?

1. In our datacamp course our lecturer explains that to systematically check all variables in a model for multicollinearity, we calculate the variance inflation factors (VIFs) using vif function from the rms package. These indicate the increase in the variance of an estimated coefficient due to multicollinearity. As i understand values with higher than 5 means that feature has relatively higher collinearity with others but can also features with close variance inflation factor values be evaluated as they have higher correlation with each other ?
2. (<https://campus.datacamp.com/courses/machine-learning-for-marketing-analytics-in-r/modeling-customer-lifetime-value-with-linear-regression?ex=7>) The video mention VIF() function, in our project we try to apply vif and aic function on our model but some features vif value is higher then 10 but we think they are usefull for model. Can we eliminate them or can we use even vif values are high?
3. Can we use CLV process as a cluster analysis? Does it help us to identify future non-promising customers which CLV values are low to target the increase their value by sending specified ads? The main aim is preventing the churn (Based on Datacamp Course: Modeling Lifetime Value With Linear Regression)

**PART B: Rpub/ Customer Lifetime Value**

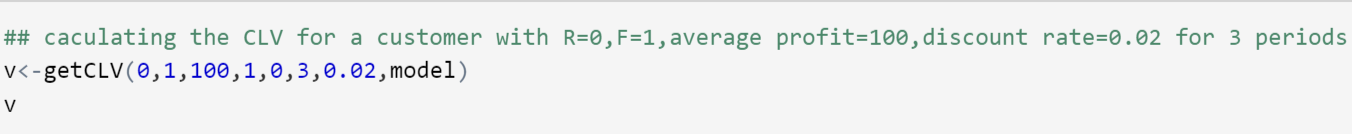
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   Description automatically generated(<https://rpubs.com/hoakevinquach/Customer-Lifetime-Value-CLV>) In article, mention about the difference CLV formulas, what is the other ones and why below formula is common one?
2. (<https://rpubs.com/hoakevinquach/Customer-Lifetime-Value-CLV>) In the code purchasing cycle defined as 60 days. Is it standard operation or can we set different according to our data know-how?
3. In our given web source, it is calculated that probability of purchasing ratio for every individual recency, frequency , monetary value. It is clearly seen that for every monetary value the probability of purchasing ratio doesn’t change that much. In the model preparation part, it is estimated whether the customer will buy for the next period, but the monetary values are not included in the model. Doesn't this cause loss of information in terms of model accuracy since there is no feature to evaluate the customer's spending amount habit? https://rpubs.com/hoakevinquach/Customer-Lifetime-Value-CLV

# <https://rpubs.com/hoakevinquach/Customer-Lifetime-Value-CLV>.As calculating the monetary $10 interval is given and break is calculated. Monetary is how much a customer has spent during a particular period of time, so how do we come to this calculation with the breaks?

# <https://rpubs.com/hoakevinquach/Customer-Lifetime-Value-CLV>. What is actually aimed by using getPercentages for R,F and M each?

1. On the activity of [CLV calculation with R](https://rpubs.com/hoakevinquach/Customer-Lifetime-Value-CLV), we finally calculate the CLV in the last action point. What does the output of *[1] 63.91906* reflect? Is it out of 100? How we can interpret this number? How we can optimize R, F and average profit for the best scenario in CLV and so on? Shall we still use getCLV? Are there better options for CLV calculation in R and/or Python?



1. RPubs: Customer Lifetime Value (CLV)

# A close up of a clock Description automatically generatedCan most commonly used formula above be used under any circumstances? Could this formula be sufficient as the problem becomes complex?

1. Probability of purchasing vs Recency graph are drawn as a linear function. But isn't it supposed be logarithmic based on the CLV function which is a power of time variable? (Based on (https://rpubs.com/hoakevinquach/Customer-Lifetime-Value-CLV))
2. (https://rpubs.com/hoakevinquach/Customer-Lifetime-Value-CLV) In the analysis, the author did a glm model using only recency and frequency variables but not monetary variable. Is there a specific reason behind not using the monetary variable? How did he determine the variables?
3. <https://rpubs.com/hoakevinquach/Customer-Lifetime-Value-CLV>. In the first plot, I saw an elbow plot, is it an elbow plot, and if it is why are we using elbow plot?
4. <https://rpubs.com/hoakevinquach/Customer-Lifetime-Value-CLV> In the final plot, there is an outlier in which the probability of purchasing is almost 100 a monetary more than 40. Do we need to look at this point?
5. In the paper CLV (<https://rpubs.com/hoakevinquach/Customer-Lifetime-Value-CLV>), family attribute of glm function defined as ‘guasibinomial(link=”logit”)’. Why we do this? How we can choose the family attribute for different cases?

# PART C: CLV Article

# CUSTOMER LIFETIME VALUE: MARKETING MODELS AND APPLICATIONS (Pdf Page – 4) Jackson (1985) groups industrial buyers into two major categories: lost-for-good, and always-a-share. Over the 35 years since these two categorizations have been made by Jackson, have there been new buyer groups?

# CLV.pdf / page 24 .The example given for case 3 is refered for case 4 stating there is one difference, cash flows are continuous. “Consider the case of a credit card company that expects its profit per newly acquired customer to accelerate over time.” In the case 4 we pass from a discrete function to a continuous function and use another formula. When we decide using those formulas in case 3 or case 4 should we just consider the cash flow is discrete or not?

# CUSTOMER LIFETIME VALUE: MARKETING MODELS AND APPLICATIONS (Pdf Page – 4)A customer is either totally committed to a vendor or totally lost and committed to some other vendor in lost for good model. Does the lost customer mean that the relationship between vendor and that customer is lost as well?

1. On Journey of Interative Marketing [material](https://www.dropbox.com/s/6metylo790g2qx9/CLV.pdf?dl=0), page 24, the numerical example related to a credit card company, I did not get the function below. Since our retention rate is .9% why we are assuming that it is an annual probability? I believe in real case it does not reflect the same. I also am having hard time understanding the solving steps. It would be really helpful if we can solve one problem in class.

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1. (PDF document: “CLV”) All cases an all CLV calculation approaches presented in the paper assumes that retention costs are always smaller than acquisition costs. This is presumed in several sections; for example on page 3, under “Types of Customer Behavior”, Reichheld and Sasser’s (1990) remark about retained customers generating accelerated profits, and on page 13, Figure 3 – “Trade-off between acquisition rates and retention rates”. Is this always true? Aren’t there any industries or cases where going for hunting every time you’re hungry is less costly than farming? Like when your target audience is massive, and your product is extremely fast moving or commodity with a noticeably short lifecycle. Wouldn’t it be wiser not to track and build strategies based on CLV and instead build a strong brand image and mass communicate for acquisition throughout?
2. According to the paper (PDF document: “CLV”), CLV doesn’t take acquisition costs into consideration and drop them from the CLV methods. (Page 11, last paragraph) This is understandable for historical CLV modelling. But, how about predictive CLV modelling? Shouldn’t we include CAC to the calculations if we’re to perform predictive CLV models?
3. At the pdf document on the dropbox link (the figure above page 29), can we say a higher acquisition cost causes lower retention rates?

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1. In the article it asks "Does it make sense to include or exclude super old customers" Is there an rule of a thumb to identify this "super old customers"?
2. At the pdf document on the dropbox link (the first paragraph of page 20), it is mentioned about existing customers would pay more expensive for the company's service after a certain point, because the company has a higher promotion cost for acquisition. I have also an experience some brands. Could we say that higher prices applied to old customers may cause loss of them?
3. <https://www.dropbox.com/s/6metylo790g2qx9/CLV.pdf?dl=0> (page: 24). How compounded retention rate does affect profit per customer?
4. In CUSTOMER LIFETIME VALUE: MARKETING MODELS AND APPLICATIONS article (pg.8), it says any change in retention rate has a greater effect on CLV in accelerating customer profit then constant profit. Can you give an example to this situation? What is the logit behind this statement?

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# PART D: Youtube

1. In the video ” Customer Lifetime Value” (<https://www.youtube.com/watch?v=cvt6ELswxHc>) 3:33, we see the application of machine learning algorithms for given analysis. We know that cross-sell analysis can be done with basket and association analysis. But how we can make the upsell analysis? Are there any general methods for doing it?
2. (Video – “Customer Lifetime Value”, timestamp: 0’30’’) The video describes the revenue in CLV calculation as “*all actual and potential revenue generated from sales of products and services*”. This description made me curious if there’s a similar concept for products or services in lieu of customers. Can’t we calculate a PLV (Product Lifetime Value) and see how our products contribute to our business similarly? We would then decide if we’d improve, replace or drop low value products and promote and match high value products to high value customer segments.

# PART E: Others

1. I found a good article about CLV. It says that Customer Acquisition Cost should be lower than the Customer Lifetime Value to know that our e-commerce business is in good shape. Is it risky to aim gain from demand by targeting too many customers in aim of gain from demand? Can we formulate this in addition of CLV?(Based on: <https://exponea.com/blog/customer-lifetime-value-guide/>)
2. Can we generally say that the customers which CLV values are like each other should participate in same cluster, or it does not give us an idea about clusters?
3. Let's say we calculated CLV scores of Customers for a 5-year period. Can we generally say that if we extend this period to 10 years CLV values will be proportionally similar?
4. As a goodness of fit measure, multiple R square provides the proportion of the dependent variables variance that is explained by the regression model, adjusted for the number of variables in the model. If the number of features which included in the model increases, the multiple R square value is punished by a certain amount based on how much the new added features describe the variation of response variable and a new value of adjusted R square is obtained. So is that mean an overfitting if we have higher difference between multiple and adjusted R square values in our model?
5. Should WACC be taken as discount rate?
6. Customers with low purchasing frequency may be present. How exactly do we determine churn? Do we use the same churn for every new customer?
7. The past CLV summarizes revenue per customer as well as my earnings from that customer. We try to estimate how much money our new customers will save us in the amount we expect. If we think that the use of past data does not mean much in periods like pandemic, what should we do in such an extrem situation? As a pandemic data analyst, which one should be more important to me?
8. What is the value of customer heterogeneity in accepting all customers as different? Can you give an example of which perspective our approach to CLV calculation should be related to?
9. What approach would you recommend to an analyst who needs special attention when using the CLV approach in digital marketing channels for a mobile application company and who manages the client's spending after performing the CLV calculations and wants to determine the marketing strategy?

# What does seq(0, round(max(history$Monetary)+9),by=10) actually do? I understood that we grouped monetary values ​​into decimals, but why do we add 9 to the maximum monetary value?

1. There is a mathematical formula of customer lifetime value and

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we are trying to predict the margin in models we will build (linear regression etc.). Do they have the same function and mean the same thing?