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Linear regression solved example pdf

Linear regression is the most basic and commonly used predictive analysis. One variable is considered an explanatory variable and the other is considered a dependent variable. For example, a modeler might want to link individual scales to their heights using a linear regression model. There are several linear regression analyses available to the researcher. Simple linear regression One dependent variable (interval or ratio) One independent variable (interval or ratio or dichotomous) Multiple linear regression One dependent variable (interval or ratio) Two or more independent variables (interval or ratio or dichotomous) Logistic regression One dependent variable (binary Two or more independent variables) (interval or ratio or dichotomous) dichotomous) Ordinal regression One dependent variable (ordinal) One or more independent variables (nominal or dichotomous) Multinomic regression One dependent variable (nominal) One or more independent variables (intervals) (interval or ratio or dichotomous) Discriminatory analysis One dependent variable (nominal) One or more independent variables of multiple independent variables (interval or ratio) The formula for the linear regression equation is given: \[\large y=a+bx\] and b are given by the following formulas: \(\large and \left(intercept\right)=\frac{\sum x^{2} – \sum x x xy}{(\sum x^{2}) - (\sum x)^{2}}\) \(\large b\left(slope\right)=\frac{n\sum xy-\left(\sum x\right)\left(\sum y\right)}{n\sum x^{2}-\left(\ sum x\right)^{2}}\) Where, x, and y are two variables on the regression line. b = Line slope. a = y-capture line. x = Values of the first set of data. y = Values of the second set of data. Solved Examples Question: Find linear regression equations for the following two sets of data: Solution: Build the following table: x y x2 xy 2 3 4 4 4 7 16 28 6 5 36 30 8 10 64 80 $\sum x$ = 20 $\sum y = $25\sum x^{2}$ = $120\sum xy$ = 144 b = $\frac{n\sum xy-(\sum x)(\sum y)}{n\sum x^{2}-(\sum x)^{2}}$ b = $\frac{4\times 144 - 20 \times 25}{4 \times 120 - 400}$ b = 0.95 \ (a=\frac{\sum y \sum x^{2} - \sum x xy} {n(\sum x^{2}) - (sum\x)^{2}}\) \} (a=\frac{25\times 120 - 20\times 144} {4(120) - 400}\) and = 1.5 Linear regression is given : y = a + bx y = 1.5 + 0.95 x In order to continue using our site , we ask you to confirm your identity as a person. Thank you very much for your cooperation. Photo Roman Mager at Unsplash learn a lot of interesting and useful concepts at school, but sometimes it's not very clear how we can use them in real life. One concept/tool that could be widely underestimated is linear regression. Say you are planning a trip to Las Vegas with two of your bes friends. You start in San Francisco and you know it's going to be a ~9h drive. While your friends are in charge of party operations, you're in charge of all the logistics. You can Plan every detail: plan when to stop and where, make sure you get there on time... So, what's the first thing you do? You sneakily disappear from the face of the earth and stop answering your friends' calls because they're going to have fun while you're party police?! No, hand over a blank sheet of paper and start planning! The first item on your checklist? Budget! It's a 9h - approximately 1200 miles - fun ride, making a total of 18h on the road. Follow-up question: How much money should I set aside for gas? That's a very important question. You don't want to stop in the middle of the freeway and maybe walk a few miles just because you're out of gas! How much money should you allocate to gas? You approach this problem with a scientifically oriented mindset and think that there must be a way to estimate the amount of money needed based on the distance you travel. First, you look at some data. You've been laboriously monitoring the efficiency of your car over the past year – because who doesn't! - so somewhere in the computer is this tableBeauty of fictitious data 😄In this point, they are just numbers. It's not too easy to get some valuable information from this table. However, handed down like this it is clear that there is some connection between how far you can drive without filling the tank. Not that you don't already know, but now - with the data - it's clear. What you really want to find out isIf I drive for 1,200 miles, how much will I pay for gas? To answer this question, you'll use the data you've collected so far to predict how much you'll spend. The idea is that you can estimate the future – your trip to Vegas – based on past data – data points that you have laboriously recorded. You end up with a mathematical model that describes the relationship between miles spent and money spent filling the tank. Once this model is defined, you can provide new information - how many miles you drive from San Francisco to Las Vegas - and the model predicts how much money you'll need. An example of rendering a dataset (data from the past) and your predictions (dates from the future)The model uses data from the past to determine what is the relationship between the total mileage and the total amount paid for gas. When he introduced a new data point of how many miles you drove from San Francisco to Las Vegas, the model will use the knowledge he has gained from all past data and provide his best guess - prediction, ie. Looking back at your data you can see that usually, the more you spend on gas, the longer you can drive before running dry – provided the gas price remains constant. If you would best describe or explain this relationship, above, it would look somewhat like thisClearly there is a linear relationship between mileage and total paid for gas. Since this relationship is linear, if you spend less/more money – for example, half vs a full tank – you will be able to drive fewer/more miles. And because this relationship is linear and you know how long your journey from San Francisco to Las Vegas is, using a linear model will help you predict how much you'll budget for gas. Linear regression modelType, which best describes the relationship between the total mileage and the total number paid for gas, is the linear regression model. The regression bit is there because what you are trying to predict is a numeric value. There are a few concepts to unpack here: Dependent VariableIndependent Variable(s) InterceptCoefficients The amount of money you have to budget for gas depends on how many miles you drive, in this case, going from San Francisco to Las Vegas. The total amount paid for gas is therefore a dependent variable in the model. On the other hand, Las Vegas is going nowhere, so how many miles you need to drive from San Francisco to Las Vegas is independent of the amount you pay at the gas station - mileage is an independent variable in the model. Let's assume for a moment that the price of gas remains constant. Since we are dealing with only one independent variable, the model can be specified as:This is a simple version of a linear combination where there is only one variable. If you would like to be stricter in your calculations, you can also add the price of a barrel of oil as an independent variable in this model because it affects the price of gas. With all the necessary pieces of the model in place, the only question that remains is: what about B0, B1 and B2? B0, read Beta 0, is to capture the model, which means that is the value that your independent variable takes if each dependent variable is zero. You can visualize it as a straight point that passes through the beginning of the wask. The different capture values for the linear model: y = Beta0+ 2xBeta 1 and Beta 2 are called coefficients. You have one coefficient per independent variable in the model. They specify the slope of the regression line, the lines describing your model. Taking the above example, the model specified y = Beta0 + Beta1x, and playing with different Values Of Beta 1, we have something likeDifferent coefficient values for a linear model: y = 1 + Beta1x Coefficients explain the rate of change of the dependent variable, the amount you pay in gas, because each independent variable varies by one unit. So, in the case of the above blue line, the dependent y value changes by a factor of 1, each time the independent variable x changes the unit. Therefore, for the green line, that effect is 4 times the unit changes in the dependent variable x.At this point we discussed model and even experimenting with attaching different values for both capture and coefficient. However, to find out how much you pay for gas on the way to Las Vegas, we need a mechanism to estimate these values. There are different techniques for estimating model parameters. One of the most popular is ordinary smallest squares (OLS). A prerequisite for the Ordinary Smallest Squares method is to minimize the sum of the model remnant squares. Which is the difference, I mean, the distance between the predicted values and the actual values in the dataset . In this way, the model is calculating the best parameters so that each point in the regression line is as close as possible to the dataset. At the end of a budget exercise that has model parameters, you can connect the total number of miles you expect to drive and estimate how much you'll need to allocate to the gas. Great, now you know you'd have a budget of $114.5 per gas!* You'll notice we don't have the Beta 0 parameter in our model. In our case, using it to capture - or constant value when our dependent variable is equal to zero - doesn't make much sense. For this particular model, we are forcing you to go through origin, because if you are not driving, you will not spend any money on gas. The next time you find yourself in a situation where you have to estimate the quantity based on a number of factors that can be described in a straight line, you know that you can use the linear regression model. Thanks for reading! Reading!

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