28 March Assignment

June 18, 2023

[ ]: Q1. What is Ridge Regression, and how does it differ from ordinary least␣
     ↪squares regression?

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[ ]: Ridge regression is a type of linear regression that uses L2 regularization to␣
     ↪prevent overfitting. It differs from ordinary least squares
     regression in the following ways:

     1.Ridge regression produces a lower test mean squared error compared to least␣
       ↪squares regression when multicollinearity is present.
     2.Ridge regression uses a ridge estimator to estimate the coefficients, which␣
       ↪is biased but has lower variance than the OLS estimator.
     3.Ridge regression tries to find the coefficients that minimize the mean␣
       ↪squared error and wants the magnitude of coefficients to be as small
        as possible.
     4.Ridge regression adds just enough bias to make the estimates reasonably␣
       ↪reliable approximations to true population values.

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[ ]: Q2. What are the assumptions of Ridge Regression?

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[ ]: The assumptions of Ridge Regression are the same as that of linear regression:␣
     ↪linearity, constant variance, and independence.
     However, as ridge regression does not provide confidence limits, the␣
     ↪distribution of errors to be normal need not be assumeD.

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[ ]: Q3. How do you select the value of the tuning parameter (lambda) in Ridge␣
     ↪Regression?

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[ ]: The best value for lambda in ridge regression can be chosen by cross-validation.
     ↪ One can check a bunch of different values on training data
     and see which yields the best R2 on test data. Information criteria such as AIC
     ↪and BIC can also be used to select lambda.

     In ridge regression, we add a penalty by way of a tuning parameter called
     ↪lambda which is chosen using cross-validation. The idea is to
     make the fit small by making the residual sum or squares small plus adding a
     ↪shrinkage penalty.
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[ ]: Q4. Can Ridge Regression be used for feature selection? If yes, how?
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[ ]: Ridge Regression can be used for feature selection. Ridge regression is a
     ↪regularization technique that shrinks the regression coefficients
     towards zero. It can be used to reduce the impact of irrelevant features in the
     ↪model. The L2 penalty term in Ridge Regression helps in
     reducing the magnitude of the coefficients of the features that are not
     ↪important for the model. This way, Ridge Regression can be used for
     feature selection.

     In addition to Ridge Regression, there are other regularization techniques like
     ↪Lasso Regression and Elastic Net that can also be used for
     feature selection.
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[ ]: Q5. How does the Ridge Regression model perform in the presence of
     ↪multicollinearity?
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[ ]: Ridge regression is a model tuning method that is used to analyze any data that
     ↪suffers from multicollinearity. When the issue of
     multicollinearity occurs, least-squares are unbiased, and variances are large,
     ↪this results in predicted values being far away from the
     actual values. Ridge regression performs L2 regularization which adds a penalty
     ↪equal to the square of the magnitude of coefficients.
     This penalty term helps to reduce the coefficients of variables that are highly
     ↪correlated with other variables. This helps to reduce the
     variance of the estimates and thus improve the prediction accuracy of the model.

     In summary, Ridge regression is a useful technique for analyzing models
     ↪containing multicollinearity. It helps to reduce the variance of
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estimates and improve prediction accuracy.
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[ ]: Q6. Can Ridge Regression handle both categorical and continuous independent␣
     ↪variables?
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[ ]: Ridge regression is used for regression purpose only as it needs the dependent␣
     ↪variable to be continuous. So, Ridge regression can't be
     used with categorical variables. However, when the dependent variable is␣
     ↪categorical, you can state the problem as classification and use
     logistic regression instead.

     If you have more than one category, you can make them all binary. For example,␣
     ↪if you have apple, orange, pear, instead of saying 1,2,3
     say is_apple = [0,1] is_orange= [0,1] is_pear= [0,1].
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[ ]: Q7. How do you interpret the coefficients of Ridge Regression?
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[ ]: In Ridge Regression, the coefficients are shrunk towards zero by adding a␣
     ↪penalty term to the loss function. The penalty term is
     proportional to the square of the magnitude of the coefficients. The larger the␣
     ↪value of the penalty parameter, the greater the amount
     of shrinkage. The coefficients are shrunk towards zero but not exactly zero.␣
     ↪This means that Ridge Regression does not perform variable
     selection but rather it reduces the impact of less important variables on the␣
     ↪model.
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[ ]: Q8. Can Ridge Regression be used for time-series data analysis? If yes, how?
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[ ]: Yes, Ridge Regression can be used for time-series data analysis. In time series␣
     ↪regression, the dependent variable is a time series,
     and the independent variables can be other time series or non-time series␣
     ↪variables. Time series regression helps you understand the
     relationship between variables over time and forecast future values of the␣
     ↪dependent variable.
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Ridge regression is a regularized linear regression method that can be used to␣
 ↪analyze time-series data. It is used to prevent overfitting
in linear regression models by adding a penalty term to the loss function. The␣
 ↪penalty term is proportional to the square of the magnitude
of the coefficients.
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