

DSE 2262 MACHINE LEARNING LABORATORY

SECTION B BATCH 3

WEEK 1 DATE: 14 MARCH 2022

Exercise 1

1. Write a user defined function 'myFnLinReg(x,y)' to perform Simple Linear Regression given one predictor attribute and one response attribute. The function should return the coefficients of the straight line.
2. Use mtcars data set and consider the attributes mpg and weight. Split data into train and test sets (80 %,20%). Put training data set to 'myFnLinReg(x,y)' to build a linear regression model to predict mpg given the weight of the car.
3. What is the mpg of a car, whose weight is 5.5?
4. Compute and print accuracy measures such as RMSE and R^2 for the test set.
5. Apply the stochastic gradient descent and mini batch gradient descent algorithms to enhance the accuracy and visualize the cost function.

Exercise 2

1. Use the boston.csv dataset and determine the best 5 features to predict 'MEDV'.
2. Using sklearn.linear_model, find the multiple regression model for the boston.csv dataset using the best 3 features. (from sklearn.linear_model import LinearRegression)
3. Find the accuracy of the model using appropriate metrics using 80, 20 split for training and test.

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SECTION B BATCH 4

WEEK 1 DATE: 18 MARCH 2022

Exercise 1

1. Write a user defined function 'myFnLinReg(x,y)' to perform Simple Linear Regression given one predictor attribute and one response attribute. The function should return the coefficients of the straight line.
2. Use mtcars data set and consider the attributes mpg and weight. Split data into train and test sets (70 %,30%). Put training data set to 'myFnLinReg(x,y)' to build a linear regression model to predict mpg given the weight of the car.
3. What is the mpg of a car, whose weight is 6.7?
4. Compute and print accuracy measures such as RMSE and R^2 for the test set.
5. Apply the stochastic gradient descent and mini batch gradient descent algorithms to enhance the accuracy and visualize the cost function.

Exercise 2

1. Use the boston.csv dataset and determine the best 5 features to predict 'MEDV'.
2. Using sklearn.linear_model, find the multiple regression model for the boston.csv dataset using the best 4 features. (from sklearn.linear_model import LinearRegression)
3. Find the accuracy of the model using appropriate metrics using 80, 20 split for training and test.

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WEEK 2 DATE: 21 MARCH 2022

EXER 1:

1. Use the “pima-indians-diabetes.csv” dataset and note down the meta information.
2. Compute mean & standard deviation , tabulate and visualize the age of the patients.
3. Analyze and tabulate the relationship of age, BMI of patients with respect to the class.
4. Tabulate the class label and comment on whether the classes are balanced.
5. Use the data set to build a logistic regression model (using sklearn) and predict the class label. Divide the dataset into training and test set (70,30) using train_test_split method in sklearn.
6. Use the test data set and evaluate the performance using a confusion matrix. Visualize the confusion matrix using a heat map.
7. Compute accuracy rate, true positive and true negative rate and comment on the performance.
8. Visualize the ROC curve, and comment on the performance of the classifier.

EXER 2:

1. For the IRIS data set write down the meta information.
2. Visualize the class label against the predictor variable using appropriate plots.
3. Use the IRIS data set to build a logistic regression model (using sklearn) and predict the class label ‘Species’. Divide the dataset into training and test set (70,30) using train_test_split method in sklearn.
4. Analysis and visualize the performance of the classifier using metrics, confusion matrix .
5. Use the IRIS data and KNeighborsClassifier (using sklearn) and predict the class label ‘Species’ for k value between 2 and 20. Divide the dataset into training and test set (70,30) using train_test_split method in sklearn.
6. Identify the best k (for k between 2 and 20) for the model built.
7. Comment on the classifier (Logistic Regression or KNeighborsClassifier) that has a better performance for the IRIS dataset.

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WEEK 2 DATE: 25 MARCH 2022

EXER 1:

9. Use the “pima-indians-diabetes.csv” dataset and note down the meta information.
10. Compute mean & standard deviation , tabulate and visualize the age of the patients.
11. Analyze and tabulate the relationship of age, BMI of patients with respect to the class.
12. Tabulate the class label and comment on whether the classes are balanced.
13. Use the data set to build a logistic regression model (using sklearn) and predict the class label. Divide the dataset into training and test set (70,30) using train_test_split method in sklearn.
14. Use the test data set and evaluate the performance using a confusion matrix. Visualize the confusion matrix using a heat map.
15. Compute accuracy rate, true positive and true negative rate and comment on the performance.
16. Visualize the ROC curve, and comment on the performance of the classifier.

EXER 2:

8. For the IRIS data set write down the meta information.
9. Visualize the class label against the predictor variable using appropriate plots.
10. Use the IRIS data set to build a logistic regression model (using sklearn) and predict the class label ‘Species’. Divide the dataset into training and test set (70,30) using train_test_split method in sklearn.
11. Analysis and visualize the performance of the classifier using metrics, confusion matrix .
12. Use the IRIS data and KNeighborsClassifier (using sklearn) and predict the class label ‘Species’ for k value between 2 and 20. Divide the dataset into training and test set (70,30) using train_test_split method in sklearn.
13. Identify the best k (for k between 2 and 20) for the model built.
14. Comment on the classifier (Logistic Regression or KNeighborsClassifier) that has a better performance for the IRIS dataset.

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WEEK 3 DATE: 28 MARCH 2022

EXER 1

1. Use the titanic data set, perform preprocessing by deal with missing values, drop irrelevant attributes.
2. Use the scikit learn pipelines to perform the preprocessing - standardizing, encoding and model fitting in one step.
3. Perform Bayes classification using cross validation.
4. Tabulate using relevant measures of accuracy , precision, recall.
5. Visualize the ROC curve and comment on performance

EXER 2

Download the "Womens Clothing E-Commerce Reviews.zip" file and answer the following:

1. Preprocessing Pipeline:
 - a. Find any null values are present or not, If present remove those data.
 - b. Remove the data that have less than 5 reviews.
 - c. Clean the data and remove the special characters and replace the contractions with its expansion. Convert the uppercase character to lower case. Also, remove the punctuations.
2. Separate the columns into dependent and independent variables (or features and labels). Then you split those variables into train and test sets (80:20).
3. Apply the Naïve Bayes Classification Algorithm on Sentiment category to predict if item is recommended
4. Tabulate accuracy in terms of precision recall and F1 score.

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SECTION B BATCH 4

WEEK 3 DATE: 31 MARCH 2022

EXER 1

6. Use the titanic data set, perform preprocessing by deal with missing values, drop irrelevant attributes.
7. Use the scikit learn pipelines to perform the preprocessing - standardizing, encoding and model fitting in one step.
8. Perform Bayes classification using cross validation.
9. Tabulate using relevant measures of accuracy , precision, recall.
10. Visualize the ROC curve and comment on performance

EXER 2

Download the "Womens Clothing E-Commerce Reviews.zip" file and answer the following:

5. Preprocessing Pipeline:
 - a. Find any null values are present or not, If present remove those data.
 - b. Remove the data that have less than 5 reviews.
 - c. Clean the data and remove the special characters and replace the contractions with its expansion. Convert the uppercase character to lower case. Also, remove the punctuations.
6. Separate the columns into dependent and independent variables (or features and labels). Then you split those variables into train and test sets (80:20).
7. Apply the Naïve Bayes Classification Algorithm on Sentiment category to predict if item is recommended
8. Tabulate accuracy in terms of precision recall and F1 score.

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SECTION B BATCH 3

WEEK 4 DATE: 04 APRIL 2022

EXER 1

1. Use the German credit rating dataset “German Credit Data.csv” , Decision tree classifier to predict good or bad credit. Use “sklearn.model_selection” and GridSearchCV to search the hyperparameter values and report the most optimal one. Configure the grid search to search for optimal parameters:
 - Splitting criteria: gini or entropy.
 - Maximum depth of decision tree ranging from 2 to 10.
 - The searching of optimal parameter will be validated using 10-fold cross validation and the most optimal parameter will be chosen based on ROC AUC score.
2. Visualize the tree using graphviz software.
3. Display the text representation of the rules learnt.

EXER 2

Download fuel consumption dataset "FuelConsumption.csv", which contains model-specific fuel consumption ratings and estimated carbon dioxide emissions.

- Select the features 'ENGINE SIZE', 'CYLINDERS', 'FUELCONSUMPTION_COMB', 'CO2EMISSIONS' to use for building the model. Plot Emission values with respect to Engine size.
- split the data into training and test sets (70:30) to create a model using training set, evaluate the model using test set, and use model to predict unknown value.
- Try to use a polynomial regression with the dataset of cubic degree and verify the accuracy by calculating Mean absolute error, Residual sum of squares, R2-score.

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SECTION B BATCH 4

WEEK 4 DATE: 08 APRIL 2022

EXER 1

2. Use the German credit rating dataset “German Credit Data.csv” , Decision tree classifier to predict good or bad credit. Use “sklearn.model_selection” and GridSearchCV to search the hyperparameter values and report the most optimal one. Configure the grid search to search for optimal parameters:
 - Splitting criteria: gini or entropy.
 - Maximum depth of decision tree ranging from 2 to 10.
 - The searching of optimal parameter will be validated using 10-fold cross validation and the most optimal parameter will be chosen based on ROC AUC score.
2. Visualize the tree using graphviz software.
3. Display the text representation of the rules learnt.

EXER 2

Download fuel consumption dataset "FuelConsumption.csv", which contains model-specific fuel consumption ratings and estimated carbon dioxide emissions.

- Select the features 'ENGINE SIZE', 'CYLINDERS', 'FUELCONSUMPTION_COMB', 'CO2EMISSIONS' to use for building the model. Plot Emission values with respect to Engine size.
- split the data into training and test sets (70:30) to create a model using training set, evaluate the model using test set, and use model to predict unknown value.
- Try to use a polynomial regression with the dataset of degree 2, 3, 4, 5 and verify the accuracy by calculating Mean absolute error, Residual sum of squares, R2-score.

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SECTION B BATCH 3

WEEK 5 DATE: 11 APRIL 2022

EXER 1

Consider the dataset 'weatherAUS' called Rain in Australia. It describes the weather characteristics on different dates and locations. This dataset contains about 10 years of daily weather observations from many locations across Australia.

1. Preprocess the data, remove the attributes which were are not useful to predict rain. Also, remove rows with at least one missing value for each of them.
2. Calculate the Variance Inflation Factor (VIF) value. VIF is a number that determines whether a variable has multicollinearity or not (starts from 1, and it has no upper limit. If the number gets larger, it means the variable has huge multicollinearity on it.).
3. Remove multicollinearities by creating new features. Find the features that have paired values and create the new feature which is the difference value between those pairs.
4. Remove features that have a VIF value above 5.
5. Build a regression model to perform the Rain prediction. Also, tabulate accuracy of the prediction models, before and VIF computation.

EXER 2

Consider the 'HousePrice.csv' dataset which describes the features and sale price of a house. Build a regression model using regularization to predict the value of the properties.

1. Perform the preprocessing if required, scale the train and test data using standard scaler.
2. Split the dataset into train size of 70% and test size of 30% and Apply the Ridge and Lasso regression and fit the model containing all independent variables.
3. Make predictions on test data "HousePriceTest.csv" and tabulate performance of both models on unseen data.

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WEEK 5 DATE: 14 APRIL 2022

EXER 1

Consider the dataset 'weatherAUS' called Rain in Australia. It describes the weather characteristics on different dates and locations. This dataset contains about 10 years of daily weather observations from many locations across Australia.

6. Preprocess the data, remove the attributes which were are not useful to predict rain. Also, remove rows with at least one missing value for each of them.
7. Calculate the Variance Inflation Factor (VIF) value. VIF is a number that determines whether a variable has multicollinearity or not (starts from 1, and it has no upper limit. If the number gets larger, it means the variable has huge multicollinearity on it.).
8. Remove multicollinearities by creating new features. Find the features that have paired values and create the new feature which is the difference value between those pairs.
9. Remove features that have a VIF value above 5.
10. Build a regression model to perform the Rain prediction. Also, tabulate accuracy of the prediction models, before and VIF computation.

EXER 2

Consider the 'HousePrice.csv' dataset which describes the features and sale price of a house. Build a regression model using regularization to predict the value of the properties.

4. Perform the preprocessing if required, scale the train and test data using standard scaler.
5. Split the dataset into train size of 70% and test size of 30% and Apply the Ridge and Lasso regression and fit the model containing all independent variables.
6. Make predictions on test data "HousePriceTest.csv" and tabulate performance of both models on unseen data.

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WEEK 6 DATE: 18 APRIL 2022

EXER 1

1. Write down the meta information about the “wine.csv” data file available in the UCI repository, <https://archive.ics.uci.edu/ml/datasets/Wine>.
2. Tabulate and visualize the distribution of the numeric variables.
3. Perform the required preprocessing , 70,30 split and build a classifier using the Multi-Layer Perceptron Classifier model available in SciKit Learn. Use 3 layers with the same number of neurons as there are features along with 500 max iterations.
4. Tabulate the precision, recall and F1-score.
5. Display the MLP weights and biases after training your model.

EXER 2

1. Write down the meta information about the “cancer.csv” data set available in the UCI repository, <https://archive.ics.uci.edu/ml/datasets/Breast+Cancer+Wisconsin+%28Diagnostic%29>
2. Tabulate and visualize the distribution of the numeric variables.
3. Perform the required preprocessing , 70,30 split and build a classifier using the SVM model available in SciKit Learn.
4. Tune the hyperparameters of kernel (linear, polynomial, and radial basis), regularization and gamma. Tabulate the model performance and comment on the best model found for the given dataset.

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WEEK 6 DATE: 22 APRIL 2022

EXER 1

6. Write down the meta information about the “wine.csv” data file available in the UCI repository, <https://archive.ics.uci.edu/ml/datasets/Wine>.
7. Tabulate and visualize the distribution of the numeric variables.
8. Perform the required preprocessing , 70,30 split and build a classifier using the Multi-Layer Perceptron Classifier model available in SciKit Learn. Use 3 layers with the same number of neurons as there are features along with 500 max iterations.
9. Tabulate the precision, recall and F1-score.
10. Display the MLP weights and biases after training your model.

EXER 2

5. Write down the meta information about the “cancer.csv” data set available in the UCI repository, <https://archive.ics.uci.edu/ml/datasets/Breast+Cancer+Wisconsin+%28Diagnostic%29>
6. Tabulate and visualize the distribution of the numeric variables.
7. Perform the required preprocessing , 70,30 split and build a classifier using the SVM model available in SciKit Learn.
8. Tune the hyperparameters of kernel (linear, polynomial, and radial basis), regularization and gamma. Tabulate the model performance and comment on the best model found for the given dataset.

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WEEK 7 DATE: 25 APRIL 2022

Mini Project :

Dataset – Amazon reviews : <http://snap.stanford.edu/data/web-Amazon-links.html>

The overall objective of the project is to build an app with a simple UI. The app will allow the user to choose between 5 categories of products , for instance cell phones, clothing, shoes, software etc. On choosing the category of product, recommendations are displayed based on user based similarity .

PHASE 1 (Submission- 4th May 2022) – Submit a python notebook with the preliminary analysis of data and record the objective of the project, data sources, data preparation steps etc. Identify the tech stack for the app.

PHASE 2(Submision- 11th May 2022)- Write a python notebook to perform the recommendations and build an API using FastAPI. Demo of model, API and viva will be conducted in the lab on 9th May,2022.

PHASE 3(Submision- 25th May 2022)- - Orchestrate the training workflow assuming the training data is updated regularly. Draw a flowchart to show how the components interact with each other. Build a simple UI to display product category , on choosing the product category, make recommendations for the user. Record the feedback on the usefulness of the recommendation from the user. Demo of UI and viva will be conducted in the lab on 23th May,2022.

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WEEK 7 DATE: 29 APRIL 2022

Mini Project :

Dataset – <https://grouplens.org/datasets/movielens/> (ml-latest-small suggested)

The overall objective of the project is to build an app with a simple UI. The app will allow the user to search for movies and recommendations.

PHASE 1 (Submission- 7th May 2022) – Submit a python notebook with the preliminary analysis of data and record the objective of the project, data sources, data preparation steps etc. Identify the tech stack for the app.

PHASE 2 (Submission- 14th May 2022)- Write a python notebook to perform the recommendations and build an API for it. Demo of model, API and viva will be conducted in the lab on 13th May, 2022.

PHASE 3 (Submission- 29th May 2022)- - Orchestrate the training workflow assuming the training data is updated regularly. Draw a flowchart to show how the components interact with each other. Build a simple UI to display a search bar , on entering key words, make recommendations for the user. Allow users to provide feedback for the movies seen. Record the feedback on the usefulness of the recommendation from the user. Demo of UI and viva will be conducted in the lab on 27th May, 2022.