Worksheet 3 – Data Exploration and Preparation

Theory

Review the videos from week 3. Answer the following questions based on those lectures

1. What is meant by data exploration and why is it important?

Answer: Data exploration is concerned with understanding our dataset, to gain deep insights into its content and suitability for using in a machine learning application.

Recall that a dataset can come from a variety of sources. With such variety comes the risk that some instances may suffer from data quality issues such as missing values or invalid feature values through. When quality issues affect a significant proportion of the dataset, then this will inevitably impact the quality or even the viability of any machine learning model we train with this dataset.

1. What is the process of data cleaning and preparation? When and why do we carry out this activity?

Answer: The process of data cleaning and preparation is to get our data ready for machine learning training and testing.

We’ll do this before attempting to train the models. And the reason why we do this is that the quality and viability of the model is directly affected by the quality of the dataset.

1. What does covariance measure and why do we use it? What is an alternative measure and why might we use that instead?

Answer: Covariance is a function of the sample means of the variables in question and is defined as the weighted sum of the differences between the observed values for the feature pair and their respective population mean. It measures the degree of correlation between different variables.

A better approach would be to use a normalized measure such as correlation. Because the covariance measure only makes sense if the features being compared are measured in the same units.

1. What is a scatter plot matrix and what does it tell you about the features in a dataset?

Answer: A scatter plot matrix is the total set of pairwise plots of our dataset presented as one graph. It’s easy to see when two features are positively or negatively correlated though apparent linear relationships in the graphs. If we see any such suspected correlations, this would warrant further investigate and analysis of the impacted features such as calculating formal measures of this relationship.

1. What is the problem with including correlated features in a dataset when training a model?

Answer: Strongly correlated features can impact on many algorithms’ performance. Having two features contributing to the same information and learning process is both redundant and potentially error prone, especially if they are negatively correlated.

1. What is meant by dimensionality reduction?

Answer: Features which do not contribute any useful information or would actually impact the performance of our training or resultant model should be removed altogether.

1. Why might it be recommended to normalize a continuous feature?

Answer: Because having continuous features which are in different ranges and different measurement units can adversely impact the ability of many learning algorithms to infer useful information and relationships across these variables.

1. What is the purpose of binning? Explain how it works with an example.

Answer: A large cardinality for a feature may not be useful for some learning approaches, for example decision trees. One way to address this is to use a technique called binning. There are two kinds of binning commonly used. These are equal-width binning and equal-frequency binning.

Practice

Follow the tutorial videos from week 2 and carry out the following steps

1. Download the code archive and extract the file from the week 3 learning materials. Make sure that you can run the examples code as provided.
2. Write Python code to create summary report of each of the features in the **pima-indians-diabetes.data.csv** file, included in the code archive for this week.
3. Examine any pairwise correlations in the scatter matrix and compute covariance/correlation statistics for any pairs you suspect might be correlated
4. Prepare the final dataset for machine learning by removing any redundant columns
5. Build a classifier for the target variable using the decision tree or random forest model you build in week 2 and train and test this on the cleaned, split dataset.