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CIS 4526

27 October 2022

Machine Learning Midterm

1. For my paraphrase identification machine learning model, I had maximized my accuracy using a total of four features: . Here is the breakdown of what features I used: ['wordcount difference', 'sequence matcher', 'Overlapping ratio', 'synonym ratio']
    - ‘wordcount difference’

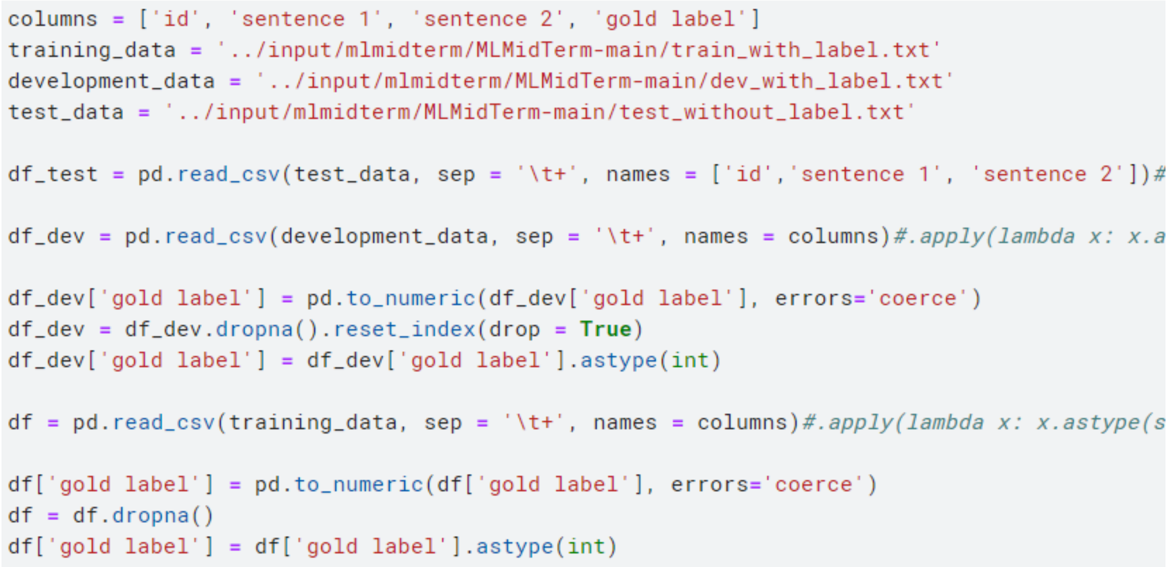
      Wordcount difference is the absolute value of the difference of the number of words between sentence 1 and sentence 2.
    - 'sequence matcher'

      Sequence matcher is a ratio that I had created by using the difflib package, which calculates the similarities of 2 phrases using gestalt pattern matching
    - ‘Overlapping ratio’

      To get the overlapping ratio, I got the total number of overlapping words between sentence 1 and sentence 2, and then divided this number by the number of words in the shorter sentence.
    - 'synonym ratio’

      To get the number of synonyms between the two sentences, I used the nltk package and imported wordnet to do this. With this, I created a function called getSynonyms and found the number of synonyms between sentence 1 and sentence 2. After getting this number, I divided it by the sentence with the lesser number of words. This gave me the ‘synonym ratio’.

2. Data preprocessing and feature preprocessing
    - For data preprocessing, I did not do much to the data. Perhaps this could have been where my accuracy could have improved in retrospect. What I did was separate the data as specified with a ‘\t+’, and then dropped any null values in the datasets. I also set the ‘gold label’ column in both the training set and the development set to an integer. Here is a screenshot on what I had done:



```
columns = ['id', 'sentence 1', 'sentence 2', 'gold label']
training_data = '../input/mlmidterm/MLMidTerm-main/train_with_label.txt'
development_data = '../input/mlmidterm/MLMidTerm-main/dev_with_label.txt'
test_data = '../input/mlmidterm/MLMidTerm-main/test_without_label.txt'

df_test = pd.read_csv(test_data, sep = '\t+', names = ['id','sentence 1', 'sentence 2'])#

df_dev = pd.read_csv(development_data, sep = '\t+', names = columns)#.apply(lambda x: x.a

df_dev['gold label'] = pd.to_numeric(df_dev['gold label'], errors='coerce')
df_dev = df_dev.dropna().reset_index(drop = True)
df_dev['gold label'] = df_dev['gold label'].astype(int)

df = pd.read_csv(training_data, sep = '\t+', names = columns)#.apply(lambda x: x.astype(s

df['gold label'] = pd.to_numeric(df['gold label'], errors='coerce')
df = df.dropna()
df['gold label'] = df['gold label'].astype(int)
```

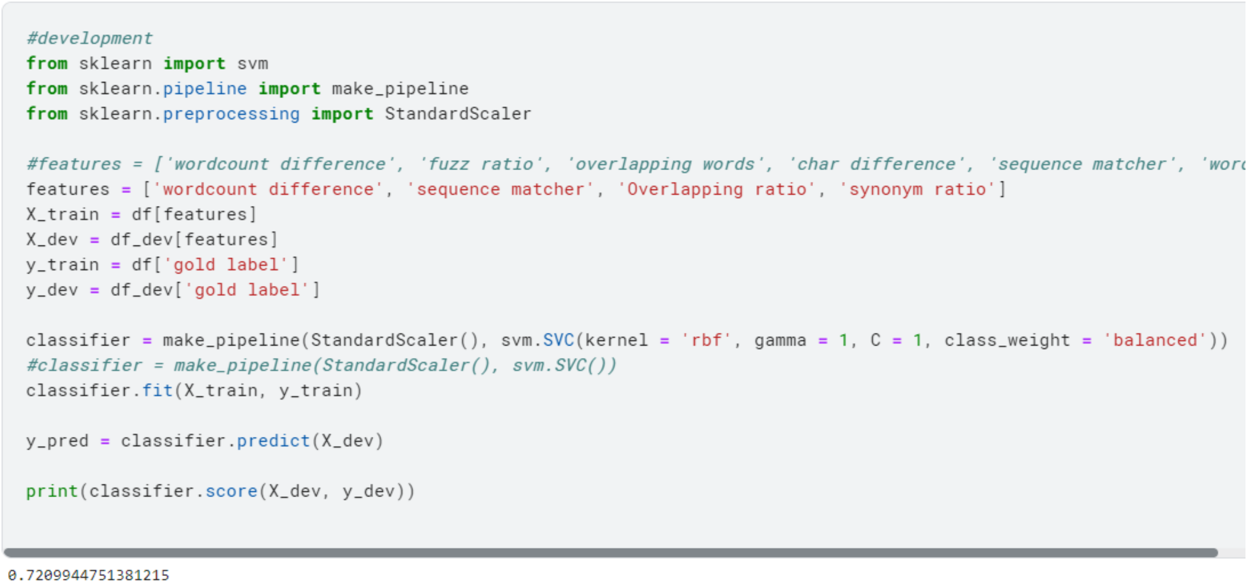
3. Algorithms and Libraries used
    - Numpy, Pandas, String, fuzzywuzzy (fuzz.ratio), difflib (SequenceMatcher), nltk (nltk.corpus, wordnet), matplotlib (pyplot), sklearn (svm, make_pipeline, StandardScaler, LogisticRegression)

4. Experiences and Lessons learned

- Doing this machine learning project has taught me a lot about machine learning and artificial intelligence. The research part on what features I can use for this project allowed me to learn many things such as the numerous packages that were available to me, how to create a machine learning model using svm or logistic regression, and also has allowed me to understand what deep learning is. After completing this project, I am now comfortable building a machine learning model for any data given to me and hope to delve into more of this topic in the future.

5. Results

- Here is the result of the SVM model with the above features mentioned on the development data and the accuracy:



```
#development
from sklearn import svm
from sklearn.pipeline import make_pipeline
from sklearn.preprocessing import StandardScaler

#features = ['wordcount difference', 'fuzz ratio', 'overlapping words', 'char difference', 'sequence matcher', 'wor
features = ['wordcount difference', 'sequence matcher', 'Overlapping ratio', 'synonym ratio']
X_train = df[features]
X_dev = df_dev[features]
y_train = df['gold label']
y_dev = df_dev['gold label']

classifier = make_pipeline(StandardScaler(), svm.SVC(kernel = 'rbf', gamma = 1, C = 1, class_weight = 'balanced'))
#classifier = make_pipeline(StandardScaler(), svm.SVC())
classifier.fit(X_train, y_train)

y_pred = classifier.predict(X_dev)

print(classifier.score(X_dev, y_dev))
```

```
0.7209944751381215
```

- The accuracy as shown above for the SVM model is at: 0.7209944