1. Introduction :

In an effort to reduce the frequency of car collisions in a community, an algorithm must be developed to predict the severity of an accident given the current weather, road conditions , visibility conditions and also based on the day of week(weekday or weekend). When conditions are bad, this model will alert drivers to remind them to be more careful.

2. Data understanding:

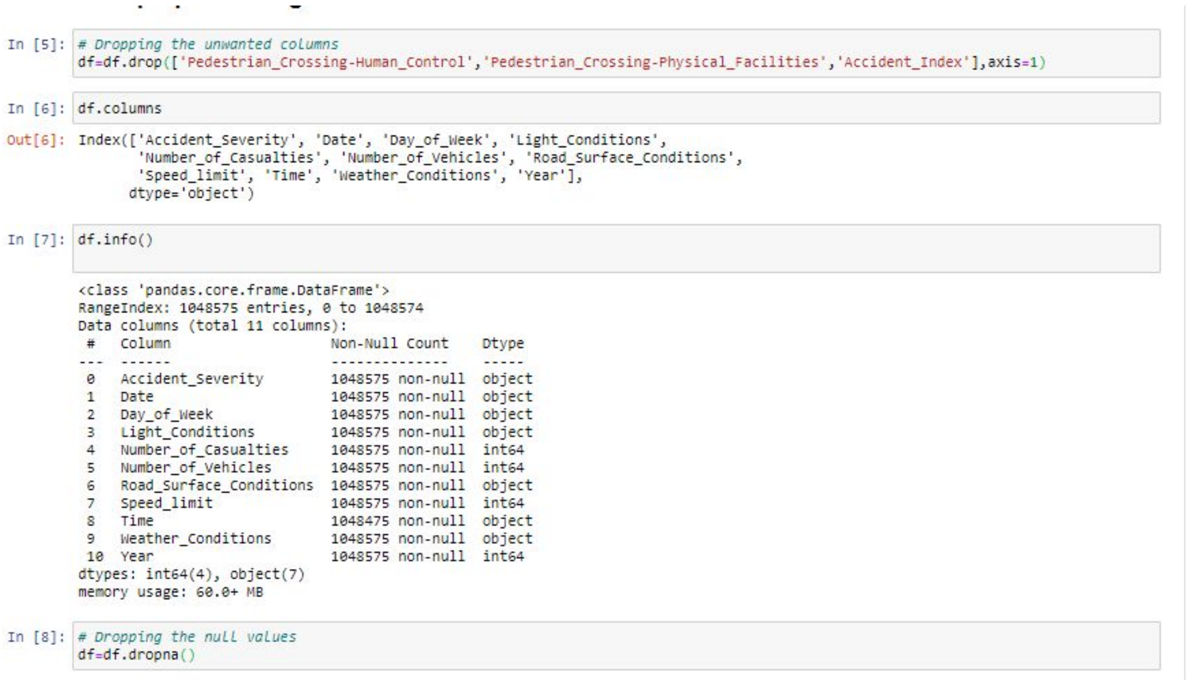
The data is the accident data for Great Britain , dated from 2005 to 2010 . This dataset was available on kaggle :-
https://www.kaggle.com/pachriisk/great-britain-road-accidents?select=uk-traffic-accidents-columns.csv
The different columns of the dataset like light conditions , road_surface_conditions , weather_conditions , day_of_week will help us to predict the feature - accident severity .
Accident severity are:-
Slight
Serious
Fatal

All the columns like weather conditions , light conditions , road conditions , severity can be encoded for using a classifier on it.

3. Methodology:

I have used the KNN classification for predicting the severity of the accident using the features like road conditions , weather conditions , light conditions and day of week.

Firstly we preprocess the data by dropping the irrelevant columns , dropping the null values and encoding the data.
Then we use the train_test_split for splitting the data for training and testing.



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In [5]: # Dropping the unwanted columns
        df=df.drop(['Pedestrian_Crossing-Human_Control','Pedestrian_Crossing-Physical_Facilities','Accident_Index'],axis=1)

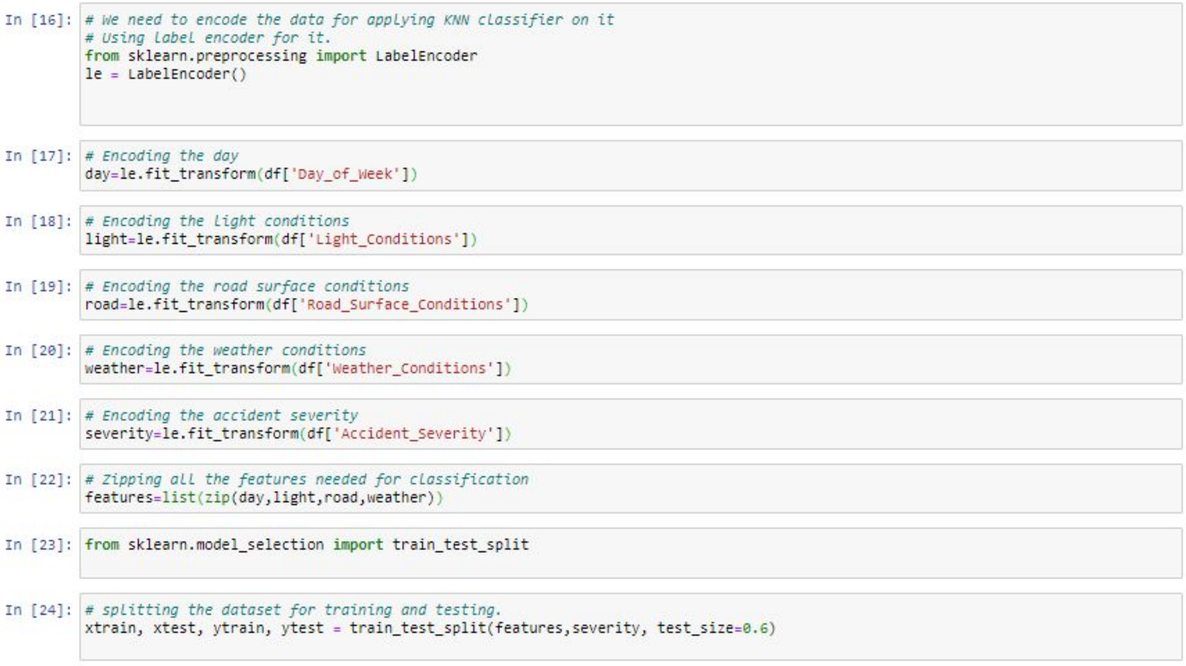
In [6]: df.columns

Out[6]: Index(['Accident_Severity', 'Date', 'Day_of_Week', 'Light_Conditions',
               'Number_of_Casualties', 'Number_of_Vehicles', 'Road_Surface_Conditions',
               'Speed_limit', 'Time', 'Weather_Conditions', 'Year'],
              dtype='object')

In [7]: df.info()

        <class 'pandas.core.frame.DataFrame'>
        RangeIndex: 1048575 entries, 0 to 1048574
        Data columns (total 11 columns):
         #   Column                   Non-Null Count    Dtype
        ---  ------                   --------------    -----
         0   Accident_Severity        1048575 non-null  object
         1   Date                     1048575 non-null  object
         2   Day_of_Week              1048575 non-null  object
         3   Light_Conditions         1048575 non-null  object
         4   Number_of_Casualties     1048575 non-null  int64
         5   Number_of_Vehicles       1048575 non-null  int64
         6   Road_Surface_Conditions  1048575 non-null  object
         7   Speed_limit              1048575 non-null  int64
         8   Time                     1048475 non-null  object
         9   Weather_Conditions       1048575 non-null  object
         10  Year                     1048575 non-null  int64
        dtypes: int64(4), object(7)
        memory usage: 60.0+ MB

In [8]: # Dropping the null values
        df=df.dropna()
```



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In [16]: # We need to encode the data for applying KNN classifier on it
         # Using label encoder for it.
         from sklearn.preprocessing import LabelEncoder
         le = LabelEncoder()

In [17]: # Encoding the day
         day=le.fit_transform(df['Day_of_Week'])

In [18]: # Encoding the light conditions
         light=le.fit_transform(df['Light_Conditions'])

In [19]: # Encoding the road surface conditions
         road=le.fit_transform(df['Road_Surface_Conditions'])

In [20]: # Encoding the weather conditions
         weather=le.fit_transform(df['Weather_Conditions'])

In [21]: # Encoding the accident severity
         severity=le.fit_transform(df['Accident_Severity'])

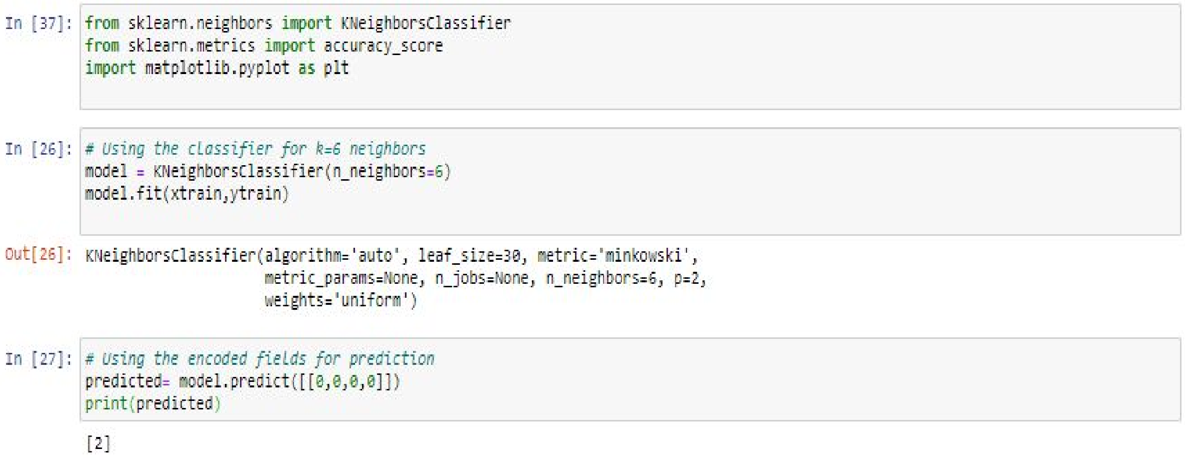
In [22]: # Zipping all the features needed for classification
         features=list(zip(day,light,road,weather))

In [23]: from sklearn.model_selection import train_test_split

In [24]: # splitting the dataset for training and testing.
         xtrain, xtest, ytrain, ytest = train_test_split(features,severity, test_size=0.6)
```

Creating the model:

Firstly , we try to create the knn model using the k=6 , we train the model using fit_transform and predict some values from it.



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In [37]: from sklearn.neighbors import KNeighborsClassifier
         from sklearn.metrics import accuracy_score
         import matplotlib.pyplot as plt

In [26]: # Using the classifier for k=6 neighbors
         model = KNeighborsClassifier(n_neighbors=6)
         model.fit(xtrain,ytrain)

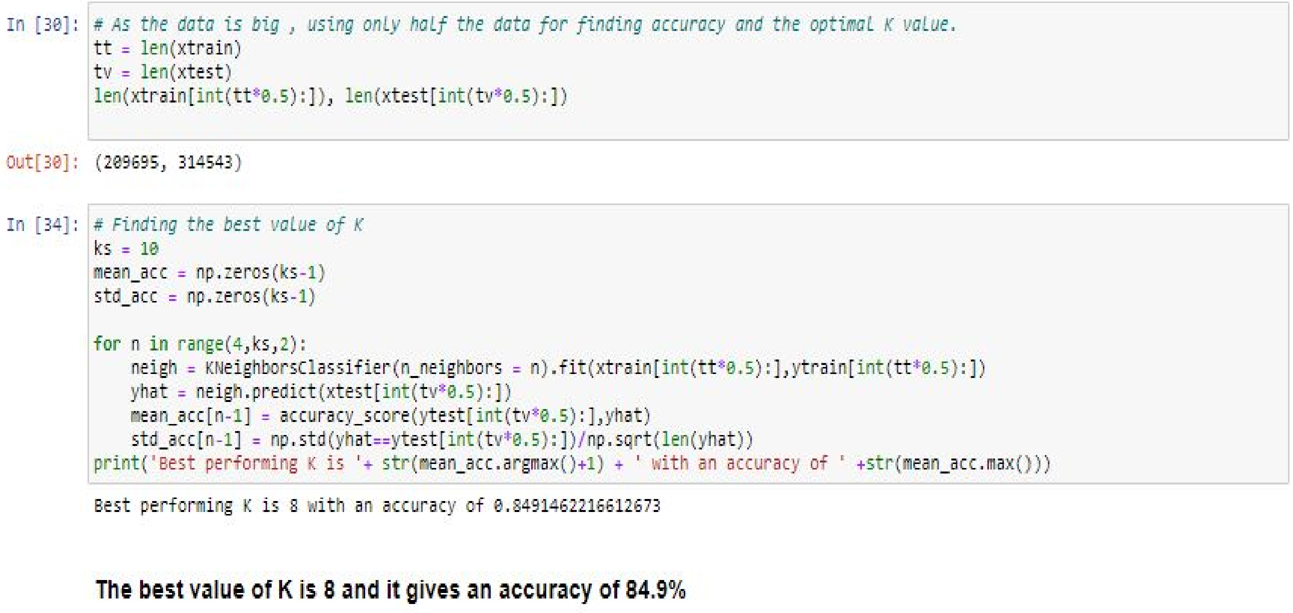
Out[26]: KNeighborsClassifier(algorithm='auto', leaf_size=30, metric='minkowski',
                              metric_params=None, n_jobs=None, n_neighbors=6, p=2,
                              weights='uniform')

In [27]: # Using the encoded fields for prediction
         predicted= model.predict([[0,0,0,0]])
         print(predicted)

         [2]
```

Finding the accuracy:

Now , we try to find the accuracy of the model by running it on the test data , and then finding the optimal K value for our classifier.



```
In [30]: # As the data is big , using only half the data for finding accuracy and the optimal K value.
         tt = len(xtrain)
         tv = len(xtest)
         len(xtrain[int(tt*0.5):]), len(xtest[int(tv*0.5):])

Out[30]: (209695, 314543)

In [34]: # Finding the best value of K
         ks = 10
         mean_acc = np.zeros(ks-1)
         std_acc = np.zeros(ks-1)

         for n in range(4,ks,2):
             neigh = KNeighborsClassifier(n_neighbors = n).fit(xtrain[int(tt*0.5):],ytrain[int(tt*0.5):])
             yhat = neigh.predict(xtest[int(tv*0.5):])
             mean_acc[n-1] = accuracy_score(ytest[int(tv*0.5):],yhat)
             std_acc[n-1] = np.std(yhat==ytest[int(tv*0.5):])/np.sqrt(len(yhat))
         print('Best performing K is '+ str(mean_acc.argmax()+1) + ' with an accuracy of ' +str(mean_acc.max()))

         Best performing K is 8 with an accuracy of 0.8491462216612673
```

The best value of K is 8 and it gives an accuracy of 84.9%

4.Results:

We have used KNN classifiers to predict the severity of an accident on the basis of various features . We have found the accuracy of the model which is around 85% and this accuracy is got when k=8.

Secondly, we have found that the KNN classifier is best for this problem statement because:-
Very simple implementation. Robust with regard to the search space; for instance, classes don't have to be linearly separable.

5.Conclusion:

Hence , we can predict the severity of any accident on the basis of the various features like light conditions , weather conditions ,etc and hence we can predict how much time the traffic would be stuck on the basis of severity of the accident.