Homework 1

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0.0.1 Importing data

```
In [1]: import numpy
        import urllib.request
        import scipy.optimize
        import random
        import matplotlib.pyplot as plt
        from sklearn.model_selection import train_test_split
        from sklearn import svm
```

```
In [2]: def parseData(fname):
          for l in urllib.request.urlopen(fname):
            yield eval(l)
```

```
In [3]: print ("Reading data...")
        data = list(parseData("http://jmcauley.ucsd.edu/cse190/data/beer/beer_50000.json"))
        print ("done")
```

```
Reading data...
done
```

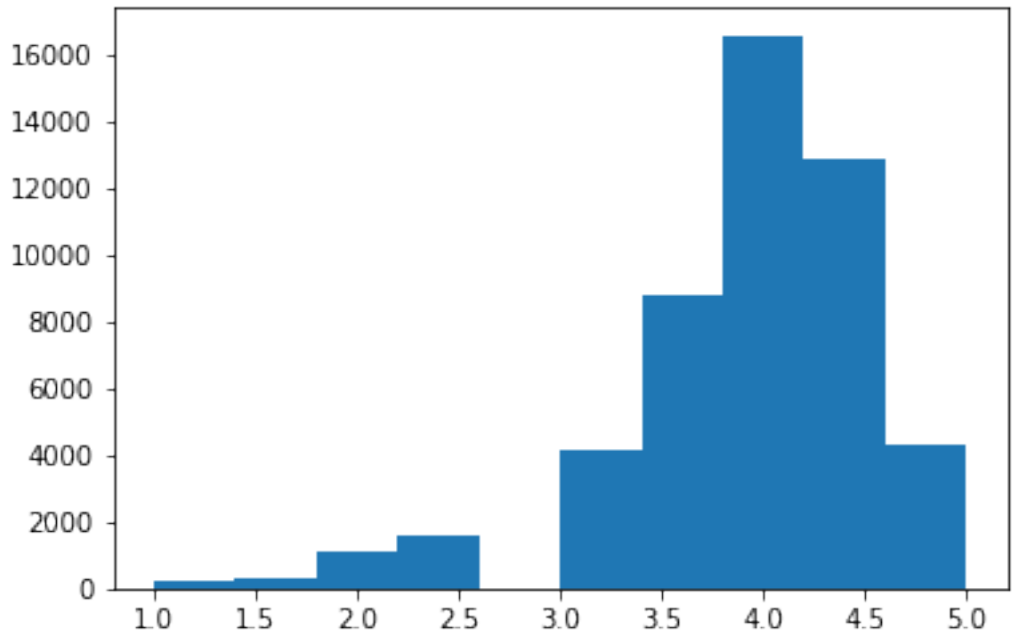
```
In [ ]: def feature(datum):
          feat = [1]
          return feat

        X = [feature(d) for d in data]
        y = [d['review/overall'] for d in data]
        theta,residuals,rank,s = numpy.linalg.lstsq(X, y)
```

0.1 Regression

0.1.1 Question 1

```
In [57]: taste = [d['review/taste'] for d in data]
```

```
In [205]: plt.hist(taste)
          plt.show()
          for i in range(1,6):
              print(str(i) + ' star(s):' + str(taste.count(i)))
```




```
1 star(s):211
2 star(s):1099
3 star(s):4137
4 star(s):16575
5 star(s):4331
```

0.2 Question 2

```
In [75]: beerNames = [d['beer/name'] for d in data]

In [84]: beers = [{'name': name, 'rating': 0} for name in beerNames if beerNames.count(name) >=

In [102]: for beer in beers:
              ratings = [d['review/overall'] for d in data if d['beer/name'] == beer['name']]
              beer['rating'] = sum(ratings)/len(ratings)

In [103]: max(beers, key=lambda x:x['rating'])

Out[103]: {'name': 'Wobbly Bob APA', 'rating': 4.714285714285714}
```

0.2.1 Question 3

```
In [112]: ### How tasty is a beer? ###

          data2 = [d for d in data if 'beer/style' in d and 'beer/ABV' in d]
```

```
def feature(datum):
  feat = [1]
  isHefeweizen = 1 if datum['beer/style'] == 'Hefeweizen' else 0
  feat.append(isHefeweizen)
  feat.append(datum['beer/ABV'])
  return feat

X = [feature(d) for d in data2]
y = [d['review/taste'] for d in data2]
theta,residuals,rank,s = numpy.linalg.lstsq(X, y)
```

```
In [117]: theta
```

```
Out[117]: array([ 3.11795084, -0.05637406,  0.10877902])
```

The values in theta array shows that the default taste rating is 3.11795084. It decreases by 0.05637406 if the beer is a Hefeweizen and increases by 0.10877902 for each 1 ABV the beer has.

0.2.2 Question 4

```
In [188]: ### How tasty is a beer? ###
          data2 = [d for d in data if 'beer/style' in d and 'beer/ABV' in d]
          train = data[:len(data2)//2]
          test = data[len(data2)//2:]

          def feature(datum):
            feat = [1]
            isHefeweizen = 1 if datum['beer/style'] == 'Hefeweizen' else 0
            feat.append(isHefeweizen)
            feat.append(datum['beer/ABV'])
            return feat

          X = [feature(d) for d in train]
          y = [d['review/taste'] for d in train]
          theta,residuals,rank,s = numpy.linalg.lstsq(X, y)
```

MSE for train

```
In [189]: X = numpy.matrix(X)
          y = numpy.matrix(y)
          theta = numpy.matrix(theta)

          mse = 0
          for i in range(0,len(y)):
              mse += (y.item(i) - X[i]*theta.T)**2
          mse = mse/len(y)
```

```
In [190]: mse
```

```
Out[190]: matrix([[4.18119268]])
```

MSE for test

```
In [191]: X = [feature(d) for d in test]
          y = [d['review/taste'] for d in test]
          X = numpy.matrix(X)
          y = numpy.matrix(y)

          mse = 0
          for i in range(0,len(y)):
              mse += (y.item(i) - X[i]*theta.T)**2
          mse = mse/len(y)

In [192]: mse

Out[192]: matrix([[0.05415694]])
```

0.2.3 Question 5

```
In [195]: ### How tasty is a beer? ###

          data2 = [d for d in data if 'beer/style' in d and 'beer/ABV' in d]
          y = [d['review/taste'] for d in data2]

          X_train, X_test, y_train, y_test = train_test_split(data2, y, test_size=0.50)

          def feature(datum):
            feat = [1]
            isHefeweizen = 1 if datum['beer/style'] == 'Hefeweizen' else 0
            feat.append(isHefeweizen)
            feat.append(datum['beer/ABV'])
            return feat

          X = [feature(d) for d in X_train]
          theta,residuals,rank,s = numpy.linalg.lstsq(X, y_train)
```

MSE for train

```
In [196]: X = numpy.matrix(X)
          y = numpy.matrix(y_train)
          theta = numpy.matrix(theta)

          mse = 0
          for i in range(0,len(y)):
              mse += (y.item(i) - X[i]*theta.T)**2
          mse = mse/len(y)

In [197]: mse

Out[197]: matrix([[0.02269626]])
```

MSE for test

```
In [198]: X = [feature(d) for d in X_test]
          X = numpy.matrix(X)
          y = numpy.matrix(y_test)

          mse = 0
          for i in range(0,len(y)):
              mse += (y.item(i) - X[i]*theta.T)**2
          mse = mse/len(y)

In [199]: mse

Out[199]: matrix([[0.25103963]])
```

In this case the train mse was lower and the test mse was higher than in the other experiment. This may be because the data was inittially ordered based in some feature, so when dividing the test and training sets, we have very different datasets. This way, the errors are very discrepant.

When we shuffle the data before splitting it, the two resultant datasets are more likely to be similar, resulting in similar mse's.

0.2.4 Question 6

```
In [18]: ### SVM -- "Is the beer a Hefeweizen?"
         data2 = [d for d in data if 'review/taste' in d and 'review/appearance' in d and 'revie
         X = [[d['review/taste'], d['review/appearance'], d['review/aroma'], d['review/palate'],
         y = ["Hefeweizen" in b['beer/style'] for b in data2]

         X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.50)

In [19]: # Create a support vector classifier object, with regularization parameter C = 1000
         clf = svm.SVC(C=1000, kernel='linear')
         clf.fit(X_train, y_train)

         train_predictions = clf.predict(X_train)
         test_predictions = clf.predict(X_test)

In [21]: train_accuracy = train_predictions == y_train
         train_accuracy = train_accuracy.sum()/train_accuracy.size
         print('Train accuracy with c=' + str(c) + ': ' + str(train_accuracy))

         test_accuracy = test_predictions == y_test
         test_accuracy = test_accuracy.sum()/test_accuracy.size
         print('Test accuracy with c=' + str(c) + ': ' + str(test_accuracy))

Train accuracy with c=1000: 0.98808
Test accuracy with c=1000: 0.9872
```

0.2.5 Question 7

For the new predictor I will use the following features vector:
['review/taste', 'review/appearance', 'review/aroma', 'review/palate', 'review/overall', 'user/gender']

```
In [22]: data2 = [d for d in data if 'review/taste' in d and 'review/appearance' in d and 'revie
         X = [[d['review/taste'], d['review/appearance'], d['review/aroma'], d['review/palate'],
         y = ["Hefeweizen" in b['beer/style'] for b in data2]

         X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.50)

In [23]: clf = svm.SVC(C=1000, kernel='linear')
         clf.fit(X_train, y_train)

         train_predictions = clf.predict(X_train)
         test_predictions = clf.predict(X_test)

In [24]: train_accuracy = train_predictions == y_train
         train_accuracy = train_accuracy.sum()/train_accuracy.size
         print('Train accuracy with c=' + str(c) + ': ' + str(train_accuracy))

         test_accuracy = test_predictions == y_test
         test_accuracy = test_accuracy.sum()/test_accuracy.size
         print('Test accuracy with c=' + str(c) + ': ' + str(test_accuracy))
```

```
Train accuracy with c=1000: 0.9887265954318204
Test accuracy with c=1000: 0.9888257204469711
```

0.2.6 Question 8

```
In [25]: for c in [0.1, 10, 1000, 100000]:
             clf = svm.SVC(C=c, kernel='linear')
             clf.fit(X_train, y_train)

             train_predictions = clf.predict(X_train)
             test_predictions = clf.predict(X_test)

             train_accuracy = train_predictions == y_train
             train_accuracy = train_accuracy.sum()/train_accuracy.size
             print('Train accuracy with c=' + str(c) + ': ' + str(train_accuracy))

             test_accuracy = test_predictions == y_test
             test_accuracy = test_accuracy.sum()/test_accuracy.size
             print('Test accuracy with c=' + str(c) + ': ' + str(test_accuracy))
```

```
Train accuracy with c=0.1: 0.9887265954318204
Test accuracy with c=0.1: 0.9888257204469711
```

```
Train accuracy with c=10: 0.9887265954318204
Test accuracy with c=10: 0.9888257204469711
Train accuracy with c=1000: 0.9887265954318204
Test accuracy with c=1000: 0.9888257204469711
Train accuracy with c=100000: 0.9887265954318204
Test accuracy with c=100000: 0.9888257204469711
```

The accuracy didn't increase significantly, but it took longer to compute the bigger the constant C was.