In [1]:
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import os

from sklearn import svm, tree, linear_model, neighbors, naive_bayes, ensemble, discriminant_analysis, g
aussian_process
import tensorflow as tf
from tensorflow import keras

from sklearn import metrics
from sklearn.preprocessing import OneHotEncoder
from sklearn.compose import make_column_transformer

from sklearn.model_selection import cross_val_score
from sklearn.model_selection import train_test_split
from sklearn.model_selection import KFold
from sklearn.model_selection import ShuffleSplit
from sklearn import model_selection

from sklearn.feature_selection import SelectKBest
from sklearn.feature_selection import f_classif
```

In [3]:
```
os.getcwd()
```
Out[3]:
```
'C:\\Users\\robtu'
```

In [2]:
```
os.chdir(r"C:\Users\robtu\Kaggle Competitions")
```

In [3]:
```
train_df = pd.read_csv("train.csv")
test_df = pd.read_csv("test.csv")
train_df.head()
```
Out[3]:

	id	cat0	cat1	cat2	cat3	cat4	cat5	cat6	cat7	cat8	...	cont2	cont3	cont4	cont5	cont6	cont7	cont8
0	0	A	I	A	B	B	BI	A	S	Q	...	0.759439	0.795549	0.681917	0.621672	0.592184	0.791921	0.815254
1	1	A	I	A	A	E	BI	K	W	AD	...	0.386385	0.541366	0.388982	0.357778	0.600044	0.406701	0.399353
2	2	A	K	A	A	E	BI	A	E	BM	...	0.343255	0.616352	0.790687	0.552877	0.352113	0.388835	0.412303
3	3	A	K	A	C	E	BI	A	Y	AD	...	0.831147	0.807807	0.800032	0.619147	0.221789	0.897617	0.633669
4	4	A	I	G	B	E	BI	C	G	Q	...	0.338818	0.277306	0.815078	0.128291	0.578764	0.279167	0.351103

5 rows × 32 columns

In [4]:
```
df = pd.concat([train_df.drop(columns=['target']), test_df], ignore_index = True)
y_train = train_df['target']
test_ids = test_df['id']
```

Data Exploration

In [12]:
```
#train_df.info()
```

In [29]:
```
df.shape
```
Out[29]:
```
(500000, 31)
```

In [4]:
```
#df.info()
```

In [4]:
```
#test_df.info()
```

Feature Engineering

In [28]:
```
df_dummies = pd.get_dummies(df).drop(columns='id')
df_dummies.head()
```
Out[28]:

	cont0	cont1	cont2	cont3	cont4	cont5	cont6	cont7	cont8	cont9	...	cat16_C	cat16_D	cat17_A	c
0	0.629858	0.855349	0.759439	0.795549	0.681917	0.621672	0.592184	0.791921	0.815254	0.965006	...	0	1	0	
1	0.370727	0.328929	0.386385	0.541366	0.388982	0.357778	0.600044	0.406701	0.399353	0.927406	...	0	0	0	
2	0.502272	0.322749	0.343255	0.616352	0.790687	0.552877	0.352113	0.388835	0.412303	0.292696	...	0	1	0	
3	0.934242	0.707603	0.831147	0.807807	0.800032	0.619147	0.221789	0.897617	0.633669	0.760318	...	0	1	0	
4	0.254427	0.274514	0.338818	0.277308	0.815078	0.128291	0.578764	0.279167	0.351103	0.357084	...	0	0	0	

5 rows × 642 columns

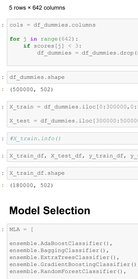
In [29]:
```
X_train = df_dummies.iloc[0:300000,0:642]

X_test = df_dummies.iloc[300000:500000,0:642]
```

In [30]:
```
selector = SelectKBest(f_classif, k=10)
selected_features = selector.fit_transform(X_train, y_train)

scores = selector.scores_
```
```
C:\ProgramData\Anaconda3\lib\site-packages\sklearn\feature_selection\_univariate_selection.py:114: Un
erRanging: features [346 348 352 381 410 528 544 552] are constant.
  warnings.warn("Features %s are constant." % constant_features_idx,
C:\ProgramData\Anaconda3\lib\site-packages\sklearn\feature_selection\_univariate_selection.py:116: Ru
ntimeWarning: invalid value encountered in true_divide
  f = msb / msw
```

In [18]:
```
plt.plot(scores)
plt.show()
```



In [9]:
```
f_score_indexes = (-selector.scores_).argsort()[:50]
f_score_indexes
```
Out[9]:
```
array([631, 633, 629, 627, 639, 625, 624, 641, 618, 619,  11,  12, 637,
       640, 636,   5,  43, 622, 623,  21, 279,  24,   6,   9,  64,   1,
       186, 292,  67, 164,   3,  40,  28,   2,  19,  20, 635, 296,  68,
       260, 355,  42, 168, 189, 237,  13,  30, 170, 208, 171], dtype=int64)
```

In [13]:
```
df_dummies.head()
```
Out[13]:

	cont0	cont1	cont2	cont3	cont4	cont5	cont6	cont7	cont8	cont9	...	cat16_C	cat16_D	cat17_A	c
0	0.629858	0.855349	0.759439	0.795549	0.681917	0.621672	0.592184	0.791921	0.815254	0.965006	...	0	1	0	
1	0.370727	0.328929	0.386385	0.541366	0.388982	0.357778	0.600044	0.406701	0.399353	0.927406	...	0	0	0	
2	0.502272	0.322749	0.343255	0.616352	0.790687	0.552877	0.352113	0.388835	0.412303	0.292696	...	0	1	0	
3	0.934242	0.707603	0.831147	0.807807	0.800032	0.619147	0.221789	0.897617	0.633669	0.760318	...	0	1	0	
4	0.254427	0.274514	0.338818	0.277308	0.815078	0.128291	0.578764	0.279167	0.351103	0.357084	...	0	0	0	

5 rows × 642 columns

In [31]:
```
cols = df_dummies.columns

for i in range(642):
    if scores[i] < 3:
        df_dummies = df_dummies.drop(cols[i], axis=1)
```

In [32]:
```
df_dummies.shape
```
Out[32]:
```
(500000, 502)
```

In [33]:
```
X_train = df_dummies.iloc[0:300000,0:502]

X_test = df_dummies.iloc[300000:500000,0:502]
```

In [5]:
```
#X_train.info()
```

In [34]:
```
X_train_df, X_test_df, y_train_df, y_test_df = train_test_split(X_train, y_train, test_size=0.4)
```

In [35]:
```
X_train_df.shape
```
Out[35]:
```
(180000, 502)
```

Model Selection

In [98]:
```
MLA = [

ensemble.AdaBoostClassifier(),
ensemble.BaggingClassifier(),
ensemble.ExtraTreesClassifier(),
ensemble.GradientBoostingClassifier(),
ensemble.RandomForestClassifier(),

linear_model.LogisticRegressionCV(),
linear_model.PassiveAggressiveClassifier(),
linear_model.RidgeClassifierCV(),
linear_model.SGDClassifier(),
linear_model.Perceptron(),

naive_bayes.BernoulliNB(),
naive_bayes.GaussianNB(),

neighbors.KNeighborsClassifier(),

svm.SVC(probability=True),
svm.NuSVC(probability=True),
svm.LinearSVC(),

tree.DecisionTreeClassifier(),
tree.ExtraTreeClassifier(),

discriminant_analysis.LinearDiscriminantAnalysis(),
discriminant_analysis.QuadraticDiscriminantAnalysis(),

#XGBClassifier()

]
```

In [48]:
```
model = Adamodel.fit(X_train,y_train)
```

In [56]:
```
formod = forest.fit(X_train, y_train)
```

In [23]:
```
logmod = log.fit(X_train, y_train)
```

In [39]:
```
nbmod = nb.fit(X_train, y_train)
```

Model Testing

In [99]:
```
def MLA_test(X_initial, y_initial, f, t, verbose=0):
    X = X_initial[f:t]
    y = y_initial[f:t]

    #split dataset in cross-validation with this splitter class: http://scikit-learn.org/stable/module
s/generated/sklearn.model_selection.ShuffleSplit.html#sklearn.model_selection.ShuffleSplit
    #note: this is an alternative to train_test_split
    cv_split = model_selection.ShuffleSplit(n_splits = 10, test_size = .3, train_size = .6, random_stat
e = 0 ) # run model 10x with 60/30 split intentionally leaving out 10%

    #create table to compare MLA metrics
    MLA_columns = ['MLA Name', 'MLA Parameters','MLA Train Accuracy Mean', 'MLA Test Accuracy Mean', 'M
LA Test Accuracy 3*STD' , 'MLA Time']
    MLA_compare = pd.DataFrame(columns = MLA_columns)

    #index through MLA and save performance to table
    row_index = 0
    for alg in MLA:
        #set name and parameters
        MLA_name = alg.__class__.__name__
        MLA_compare.loc[row_index, 'MLA Name'] = MLA_name
        MLA_compare.loc[row_index, 'MLA Parameters'] = str(alg.get_params())
        #score model with cross validation: http://scikit-learn.org/stable/modules/generated/sklearn.mo
del_selection.cross_validate.html#sklearn.model_selection.cross_validate
        cv_results = model_selection.cross_validate(alg, X, y, cv  = cv_split, n_jobs=-1, verbose=0, re
turn_train_score=True)

        training_score = cv_results['train_score'].mean()
        test_score = cv_results['test_score'].mean()
        if verbose == 1:
            print("{}/{}".format(row_index+1, len(MLA)), MLA_name, " - ", training_score, test_score)
        MLA_compare.loc[row_index, 'MLA Time'] = cv_results['fit_time'].mean()
        MLA_compare.loc[row_index, 'MLA Train Accuracy Mean'] = training_score
        MLA_compare.loc[row_index, 'MLA Test Accuracy Mean'] = test_score
        #if this is a non-bias random sample, then +/-3 standard deviations (std) from the mean, should
 statistically capture 99.7% of the subsets
        MLA_compare.loc[row_index, 'MLA Test Accuracy 3*STD'] = cv_results['test_score'].std()*3   #le
t's know the worst that can happen!

        #save MLA predictions - see section 6 for usage
        #alg.fit(data1[data1_x_bin], df[Target])
        #MLA_predict[MLA_name] = alg.predict(df[data1_x_bin])

        row_index+=1

    #print and sort table: https://pandas.pydata.org/pandas-docs/stable/generated/pandas.DataFrame.sort
_values.html
    MLA_compare.sort_values(by = ['MLA Test Accuracy Mean'], ascending = False, inplace = True)


    return MLA_compare
```

In [1]:
```
#MLA_compare = MLA_test(X_train, y_train, 0, 10000, verbose=1)
#MLA_compare
```

TensorFlow Model

In [34]:
```
df_dummies.shape
```
Out[34]:
```
(500000, 502)
```

In [37]:
```
y_train.shape
```
Out[37]:
```
(300000,)
```

In [38]:
```
f = 0
t = 180000
X = X_train_df[f:t]
y = y_train_df[f:t]
```

In [39]:
```
X_train_df.shape
```
Out[39]:
```
(180000, 502)
```

In [77]:
```
model = keras.Sequential([

    keras.layers.Dense(65, activation='relu', input_shape= (502,)),
    keras.layers.Dense(45, activation='relu'),
    keras.layers.Dense(35, activation='relu'),
    keras.layers.Dense(25, activation='relu'),
    keras.layers.Dense(15, activation='relu'),
    keras.layers.Dense(1, activation='relu')
])


model.compile(optimizer='adam', loss='mse', metrics=['accuracy'])
history = model.fit(X, y, epochs=2, validation_split=0.3, shuffle=True)

#best model: layers: 50-25-10-1  502 features 'adam' 'mse' 2 epochs
```
```
Epoch 1/2
3938/3938 [==============================] - 17s 4ms/step - loss: 0.1257 - accuracy: 0.8326 - val_los
s: 0.1125 - val_accuracy: 0.8455
Epoch 2/2
3938/3938 [==============================] - 15s 4ms/step - loss: 0.1116 - accuracy: 0.8466 - val_los
s: 0.1109 - val_accuracy: 0.8478
```

In [78]:
```
test_loss, test_acc = model.evaluate(X_test_df, y_test_df, verbose=1)

print('Test accuracy:', test_acc)
```
```
3750/3750 [==============================] - 12s 3ms/step - loss: 0.1113 - accuracy: 0.8470
Test accuracy: 0.8470083475112915
```

In [62]:
```
y_pred = model.predict(X_test)
```

In [63]:
```
y_pred.shape
```
Out[63]:
```
(200000, 1)
```

In [65]:
```
df_results = pd.DataFrame({'id':test_ids, 'target':y_pred.reshape(y_pred.shape[0])})
df_results.head()
```
Out[65]:

	id	target
0	5	0.139930
1	6	0.434369
2	8	0.050198
3	9	0.119325
4	11	0.116143

In [66]:
```
compression_opts = dict(method='zip',
                        archive_name='results9.csv')

df_results.to_csv('results9.zip', index=False,
          compression=compression_opts)
```

In [ ]:
```

```