Predict the Criminal with Bagging

Bagging is an abbreviation for "bootstrap aggregating". It'a meta-algorithm, which takes M subsamples (with replacement) from the initial dataset and trains the predictive model on those subsamples. The final model is obtained by averaging the "bootstrapped" models and usually yields better results.

Import Libraries

In [2]:
```
import matplotlib.pyplot as plt
import pandas as pd
import numpy as np
import seaborn as sns
from tqdm import tqdm_notebook
%matplotlib inline
```

Get the Data

In [3]:
```
train = pd.read_csv('criminal_train.csv')
test = pd.read_csv('criminal_test.csv')
```

In [4]:
```
train.head()
```

Out[4]:

	PERID	IFATHER	NRCH17_2	IRHHSIZ2	IIHHSIZ2	IRKI17_2	IIKI17_2	IRHH65_2	I
0	25095143	4	2	4	1	3	1	1	1
1	13005143	4	1	3	1	2	1	1	1
2	67415143	4	1	2	1	2	1	1	1
3	70925143	4	0	2	1	1	1	1	1
4	75235143	1	0	6	1	4	1	1	1

5 rows × 72 columns

In [5]:
```
test.head()
```

Out[5]:

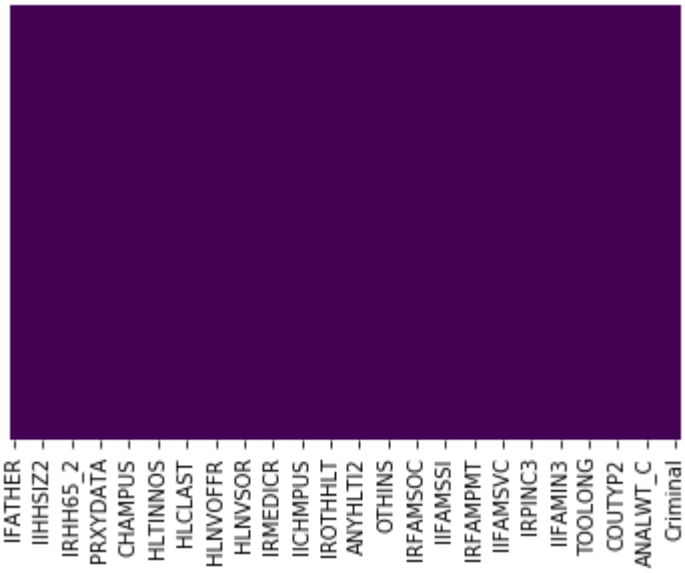
	PERID	IFATHER	NRCH17_2	IRHHSIZ2	IIHHSIZ2	IRKI17_2	IIKI17_2	IRHH65_2	I
0	66583679	4	0	4	1	2	1	1	1
1	35494679	4	0	4	1	1	1	1	1
2	79424679	2	0	3	1	2	1	1	1
3	11744679	4	0	6	1	2	1	1	1
4	31554679	1	0	4	1	3	1	1	1

5 rows × 71 columns

Exploratory Data Analysis

In [20]:
```
sns.heatmap(train.isnull(),yticklabels=False,cbar=False,cmap='viridis')
```

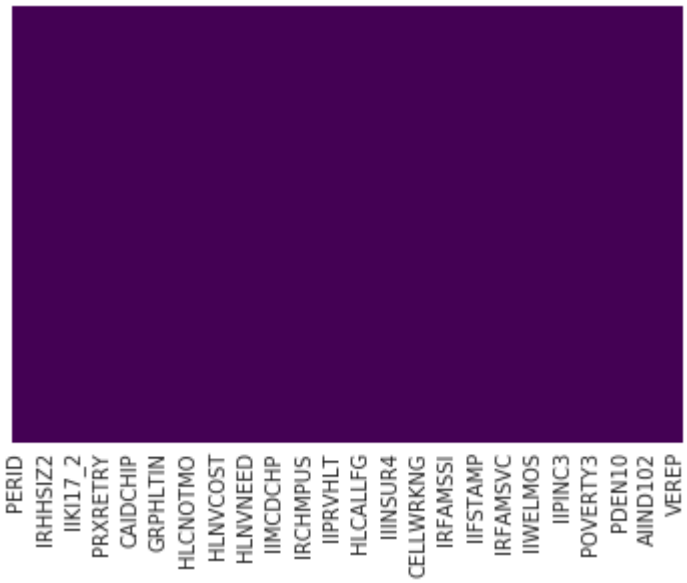
Out[20]: <matplotlib.axes._subplots.AxesSubplot at 0x7fa36c1196a0>



Train data do not have any Null values

In [30]:
```
sns.heatmap(test.isnull(),yticklabels=False,cbar=False,cmap='viridis'
)
```

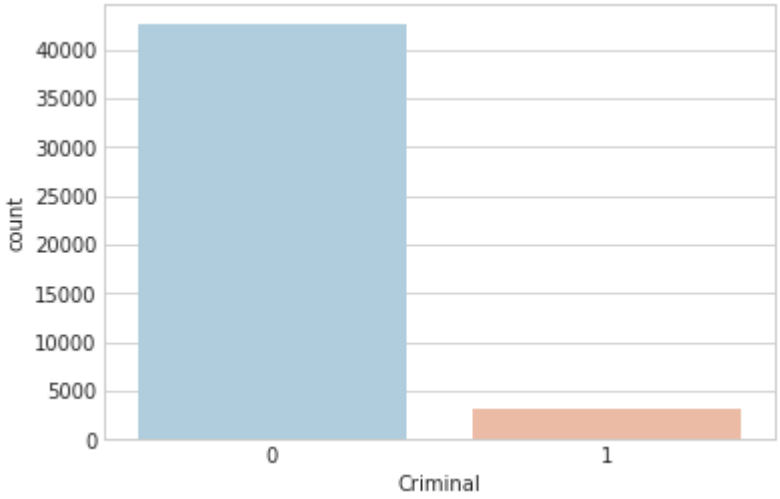
Out[30]: <matplotlib.axes._subplots.AxesSubplot at 0x7fa3685d84a8>



Test data do not have any Null values

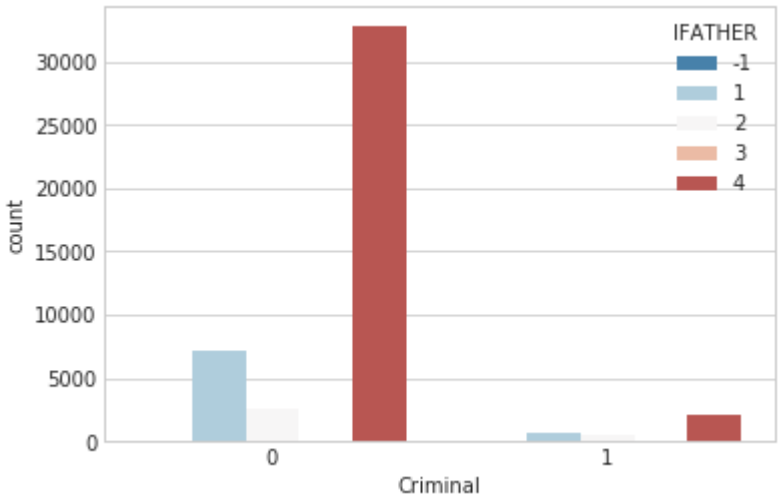
In [23]:
```
sns.set_style('whitegrid')
sns.countplot(x='Criminal',data=train,palette='RdBu_r')
```

Out[23]: <matplotlib.axes._subplots.AxesSubplot at 0x7fa36a9ddac8>



In [24]:
```
sns.set_style('whitegrid')
sns.countplot(x='Criminal',hue='IFATHER',data=train,palette='RdBu_r')
```

Out[24]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fa368588c18>
```



Count Unique features

In [31]:
```
feats_counts = train.nunique(dropna=False)
```

In [32]:
```
feats_counts.sort_values()[:10]
```

Out[32]:
```
Criminal    2
IIFAMSSI    3
IRFAMSSI    3
IIFAMSOC    3
IRFAMSOC    3
OTHINS      3
IRMCDCHP    3
IIMCDCHP    3
IRMEDICR    3
IIMEDICR    3
dtype: int64
```

Data Cleaning

For Duplicate Columns

In [8]:
```
train_enc = pd.DataFrame(index= train.index)
```

In [9]:
```
for col in tqdm_notebook(train.columns):
    train_enc[col] = train[col].factorize()[0]
```

In [10]:
```
dup_col = {}

for i, c1 in enumerate(tqdm_notebook(train_enc.columns)):
    for c2 in train_enc.columns[i+1 :]:
        if c2 not in dup_col and np.all(train_enc[c1] == train_enc[c2
]):
            dup_col[c2]=c1
```

In [11]:
```
dup_col
```

Out[11]:
```
{'HLCALL99': 'HLCALLFG'}
```

In [12]:
```
train.head()
```

Out[12]:

	PERID	IFATHER	NRCH17_2	IRHHSIZ2	IIHHSIZ2	IRKI17_2	IIKI17_2	IRHH65_2	I
0	25095143	4	2	4	1	3	1	1	1
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2	67415143	4	1	2	1	2	1	1	1
3	70925143	4	0	2	1	1	1	1	1
4	75235143	1	0	6	1	4	1	1	1

5 rows × 72 columns

Drop Duplicte Columns

In [ ]:
```
train.drop('PERID', axis=1,inplace=True)
```

In [16]:
```
train.drop("HLCALL99",axis=1,inplace=True)
test.drop("HLCALL99",axis=1, inplace=True)
```

In [17]:
```
train.shape
```

Out[17]:
```
(45718, 70)
```

In [18]:
```
test.shape
```

Out[18]:
```
(11430, 70)
```

In [19]:
```
nunique = train.nunique()
```

Building a Model

Train-Test Split

Split the data into Training testing set

In [33]:
```
train1 = train.drop('Criminal', axis=1)
y = train['Criminal']
test1 = test.drop('PERID', axis=1)
```

In [34]:
```
from sklearn.ensemble import AdaBoostClassifier
from xgboost import XGBClassifier
from sklearn.ensemble import RandomForestClassifier, RandomForestRegr
essor
from sklearn.linear_model import LinearRegression
from sklearn.linear_model import LogisticRegression
from sklearn.ensemble import GradientBoostingClassifier
from sklearn.ensemble import BaggingClassifier, BaggingRegressor
```

Bagged Predictions

Random Forest

Training and Predicting

We'll start training using Random Forest.

In [35]:
```
model = RandomForestClassifier()
```

In [36]:
```
bags = 10
seed = 1
```

In [37]:
```
bagged_predictions = np.zeros(test.shape[0])
```

In [38]:
```
for n in range (0, bags):
    model.set_params(random_state = seed+n)
    model.fit(train1,y)
    preds = model.predict(test1)
    bagged_predictions+=preds
```

In [39]:
```
bagged_predictions.astype(int)
```

Out[39]:
```
array([0, 0, 0, ..., 0, 0, 0])
```

In [40]:
```
for i in range (0, 11430):
    if (bagged_predictions[i] > 5):
        bagged_predictions[i] = 1

    else:
        bagged_predictions[i] = 0
```

In [41]:
```
print(bagged_predictions)
```

```
[ 0.  0.  0. ...,  0.  0.  0.]
```

In [42]:
```
model.score(train1, y)
```

Out[42]:
```
0.99634717179229193
```

Result file into .csv

In [36]:
```
submission = pd.DataFrame({
    "PERID": test["PERID"],
    "Criminal": bagged_predictions,
    })
submission.to_csv('Result3.csv', index=False, columns=['PERID', 'Crim
inal'])
```

In [37]:
```
bagged_predictions
```

Out[37]:
```
array([ 0.,  0.,  0., ...,  0.,  0.,  0.])
```

In [ ]:
```

```