In [42]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
import numpy
import matplotlib.pyplot as plt


import warnings
warnings.filterwarnings('ignore')
```

In [43]:
```
data = pd.read_csv("./final_dataset.csv")
#data = data.drop(['Unnamed: 0'], axis=1)

data.head()
```

Out[43]:

	0.01534683855125844	0.071428571428571438	0	0.086956521739130432	0.1	0.2	0.3	
0	0.039902	0.090476	1	0.000000	0.000000	0.0	0.000000	0.(
1	0.069982	0.219048	1	0.130435	0.023256	0.0	0.333333	0.1
2	0.003683	0.033333	0	0.043478	0.000000	0.0	0.000000	0.(
3	0.026397	0.052381	0	0.043478	0.046512	0.0	0.000000	0.(
4	0.012277	0.095238	0	0.086957	0.023256	0.0	0.000000	0.(

5 rows × 34 columns

In [44]:
```
data.shape
```

Out[44]:
```
(11429, 34)
```

In [45]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 11429 entries, 0 to 11428
Data columns (total 34 columns):
 #   Column                Non-Null Count  Dtype
---  ------                --------------  -----
 0   0.01534683855125844   11429 non-null  float64
 1   0.071428571428571438  11429 non-null  float64
 2   0                     11429 non-null  int64
 3   0.086956521739130432  11429 non-null  float64
 4   0.1                   11429 non-null  float64
 5   0.2                   11429 non-null  float64
 6   0.3                   11429 non-null  float64
 7   0.4                   11429 non-null  float64
 8   0.5                   11429 non-null  int64
 9   0.6                   11429 non-null  float64
 10  0.7                   11429 non-null  float64
 11  0.8                   11429 non-null  int64
 12  0.9                   11429 non-null  float64
 13  0.10                  11429 non-null  int64
 14  0.11                  11429 non-null  float64
 15  0.12                  11429 non-null  float64
 16  0.13                  11429 non-null  float64
```

```
 17  0.14                  11429 non-null  float64
 18  0.15                  11429 non-null  float64
 19  0.5.1                 11429 non-null  float64
 20  0.16                  11429 non-null  float64
 21  0.17                  11429 non-null  int64
 22  0.18                  11429 non-null  float64
 23  1                     11429 non-null  int64
 24  0.19                  11429 non-null  int64
 25  0.20                  11429 non-null  int64
 26  0.21                  11429 non-null  int64
 27  0.22                  11429 non-null  int64
 28  0.23                  11429 non-null  int64
 29  0.24                  11429 non-null  int64
 30  1.1                   11429 non-null  float64
 31  0.027397260273972601  11429 non-null  float64
 32  0.25                  11429 non-null  int64
 33  0.26                  11429 non-null  int64
dtypes: float64(20), int64(14)
memory usage: 3.0 MB
```

In [46]:
```
from sklearn.model_selection import train_test_split

arr = data.values
X = arr[:,0:33]
Y = arr[:,33]

X_train, X_test, y_train, y_test = train_test_split(X, Y, test_size=0.30)
```

In [47]:
```
results = {
    "KNN": 0,
    "SVM": 0,
    "Naive Bayes": 0,
    "Decision Tree": 0,
}

cv = KFold(n_splits=10, random_state=1, shuffle=True)

from sklearn.metrics import classification_report, confusion_matrix

def report(y_test, y_pred, classifier):

    scores = cross_val_score(classifier, X, Y, scoring='accuracy', cv=cv, n_jobs

    avg_accuracy = sum(scores) / len(scores)

    return avg_accuracy
```

KNN Classifier

In [48]:
```
from sklearn.neighbors import KNeighborsClassifier

scores = []

for n in range(1, 25, 2):
    knn_classifier = KNeighborsClassifier(n_neighbors=n)

    knn_classifier.fit(X_train, y_train)
```

```
    y_pred = knn_classifier.predict(X_test)

    accuracy = report(y_test, y_pred, knn_classifier)

    scores.append((n, accuracy))
```

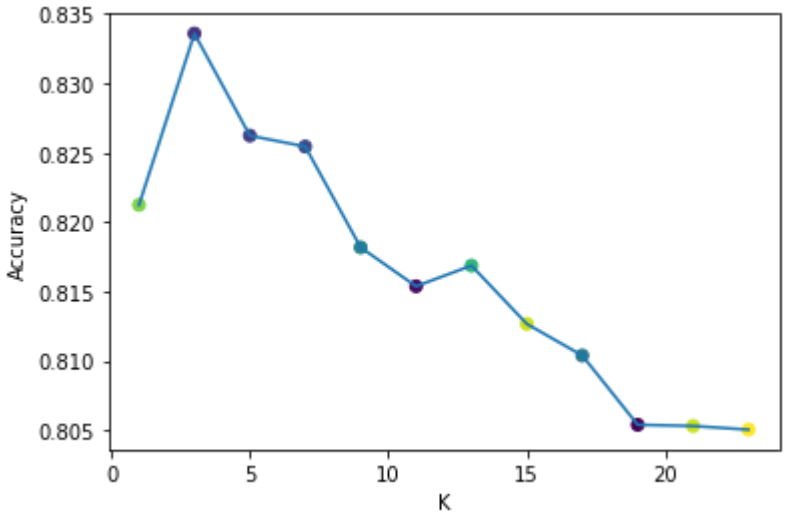
In [49]:
```
scores
```

Out[49]:
```
[(1, 0.8212444438315613),
 (3, 0.833582010654973),
 (5, 0.8262327760693662),
 (7, 0.825445374494563),
 (9, 0.8181830927001025),
 (11, 0.8153838257083015),
 (13, 0.8168716760667614),
 (15, 0.8126722776115333),
 (17, 0.8103969490678814),
 (19, 0.8054097659859067),
 (21, 0.8053219704804851),
 (23, 0.8050589670161633)]
```

In [50]:
```
max_perfomance = max(scores,key=lambda item:item[1])

best_k = max_perfomance[0]
score = max_perfomance[1]

results["KNN"] = score

print ("Best K:", best_k)
print ("KNN Accuracy Score:", score)
```

```
Best K: 3
KNN Accuracy Score: 0.833582010654973
```

In [51]:
```
x = [k for k, accuracy in scores]
y = [accuracy for k, accuracy in scores]

colors = np.random.rand(len(y))

plt.scatter(x, y, c=colors, alpha=1)
plt.xlabel('K')
plt.ylabel('Accuracy')
plt.plot(x, y)
plt.show()
```



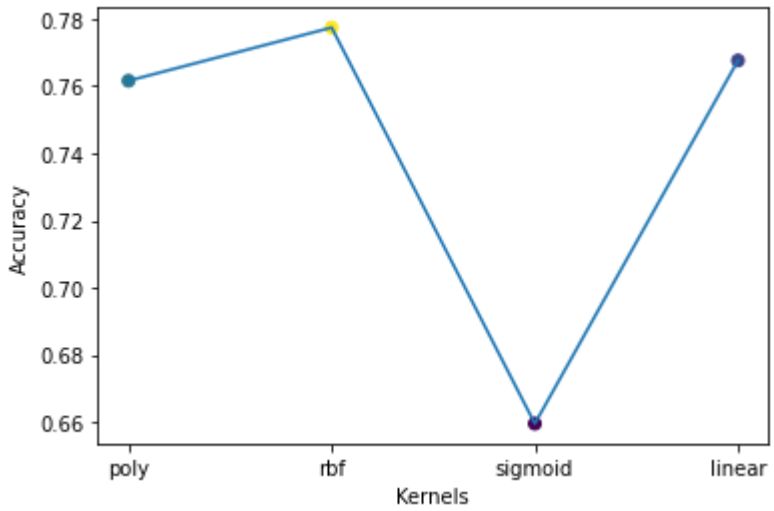
SVM

In [52]:
```
from sklearn import svm

kernels = ["poly", "rbf", "sigmoid", "linear"]
scores = []

for kernel in kernels:
    clf = svm.SVC(kernel=kernel)

    clf.fit(X_train, y_train)

    y_pred = clf.predict(X_test)

    accuracy = report(y_test, y_pred, clf)

    scores.append((kernel, accuracy))
```

In [53]:
```
scores
```

Out[53]:
```
[('poly', 0.7615748337937618),
 ('rbf', 0.7774086689251409),
 ('sigmoid', 0.6595510171561304),
 ('linear', 0.7676089744473711)]
```

In [54]:
```
x = [kernel for kernel, accuracy in scores]
y = [accuracy for kernel, accuracy in scores]

colors = np.random.rand(len(y))

plt.scatter(x, y, c=colors, alpha=1)
plt.xlabel('Kernels')
plt.ylabel('Accuracy')
plt.plot(x, y)
plt.show()
```



In [55]:
```
max_perfomance = max(scores,key=lambda item:item[1])

best_kernel = max_perfomance[0]
score = max_perfomance[1]

results["SVM"] = score

print ("Best Kernel :", best_kernel)
print ("SVM Accuracy Score :", score)
```

```
Best Kernel : rbf
SVM Accuracy Score : 0.7774086689251409
```

Naive Bayes

In [56]:
```
from sklearn.naive_bayes import GaussianNB

gnb = GaussianNB()

gnb.fit(X_train, y_train)

y_pred = gnb.predict(X_test)

accuracy = report(y_test, y_pred, gnb)

results["Naive Bayes"] = accuracy

print ("Avg. accuracy ", accuracy)

print (classification_report(y_test, y_pred))
```

```
Avg. accuracy  0.617988885364811
              precision    recall  f1-score   support

         0.0       0.58      0.97      0.72      1721
         1.0       0.91      0.28      0.42      1708

    accuracy                           0.63      3429
   macro avg       0.74      0.62      0.57      3429
weighted avg       0.74      0.63      0.57      3429
```

Decision Tree

In [57]:
```
from sklearn.tree import DecisionTreeClassifier

DTC = DecisionTreeClassifier()

DTC.fit(X_train,y_train)

y_pred = DTC.predict(X_test)

accuracy = report(y_test, y_pred, DTC)

results["Decision Tree"] = accuracy

print ("Decision Tree accuracy score: ", accuracy)

print (classification_report(y_test, y_pred))
```

```
Decision Tree accuracy score:  0.822819170370779
              precision    recall  f1-score   support

         0.0       0.82      0.83      0.83      1721
         1.0       0.83      0.82      0.83      1708

    accuracy                           0.83      3429
   macro avg       0.83      0.83      0.83      3429
weighted avg       0.83      0.83      0.83      3429
```

Logistic Regression

In [58]:
```
from sklearn.linear_model import LogisticRegression

logreg = LogisticRegression()

logreg.fit(X_train,y_train)

y_pred = logreg.predict(X_test)

accuracy = report(y_test, y_pred, logreg)

results["Logistic Regression"] = accuracy

print ("Avg. accuracy ", accuracy)

print (classification_report(y_test, y_pred))
```

```
Avg. accuracy  0.7785465630281329
              precision    recall  f1-score   support

         0.0       0.79      0.77      0.78      1721
         1.0       0.77      0.80      0.78      1708

    accuracy                           0.78      3429
   macro avg       0.78      0.78      0.78      3429
weighted avg       0.78      0.78      0.78      3429
```

Summarizing Results

In [59]:
```
results
```

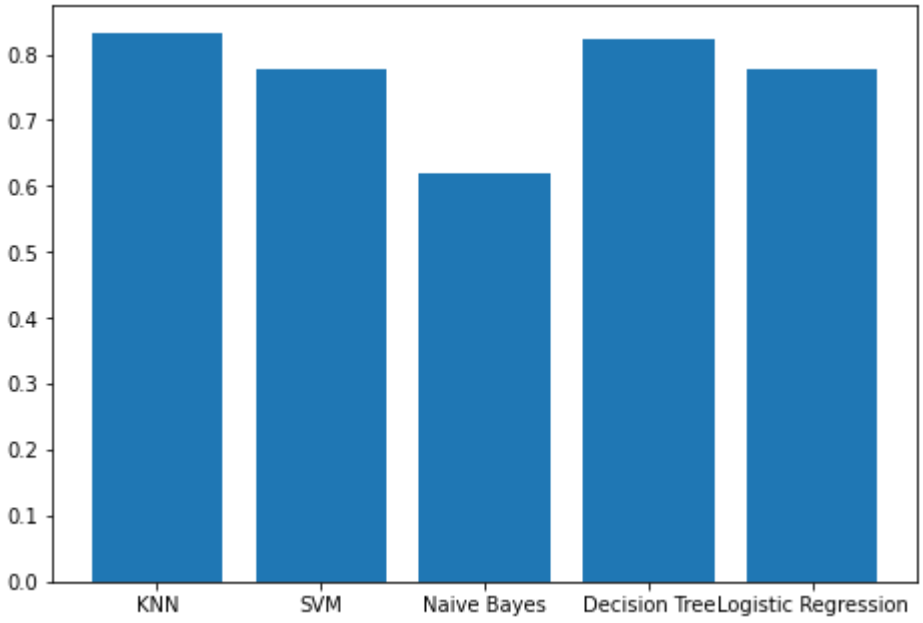
Out[59]:
```
{'KNN': 0.833582010654973,
 'SVM': 0.7774086689251409,
 'Naive Bayes': 0.617988885364811,
 'Decision Tree': 0.822819170370779,
 'Logistic Regression': 0.7785465630281329}
```

In [60]:
```
results.keys()
scores = [results[key] for key in results]
```

In [61]:
```
results
```

Out[61]:
```
{'KNN': 0.833582010654973,
 'SVM': 0.7774086689251409,
 'Naive Bayes': 0.617988885364811,
 'Decision Tree': 0.822819170370779,
 'Logistic Regression': 0.7785465630281329}
```

In [62]:
```
fig = plt.figure()
ax = fig.add_axes([1,0,1,1])

models = [model for model in results]
scores = [results[model] for model in results]
ax.bar(models,scores)
plt.show()
```



In [63]:
```
from sklearn.ensemble import RandomForestClassifier

#Create a Gaussian Classifier
clf=RandomForestClassifier(n_estimators=100)

#Train the model using the training sets y_pred=clf.predict(X_test)
clf.fit(X_train,y_train)

y_pred=clf.predict(X_test)
```

```
accuracy = report(y_test, y_pred, logreg)

print ("Avg. accuracy ", accuracy)

print (classification_report(y_test, y_pred))
```

```
Avg. accuracy  0.7785465630281329
              precision    recall  f1-score   support

         0.0       0.86      0.85      0.85      1721
         1.0       0.85      0.86      0.86      1708

    accuracy                           0.86      3429
   macro avg       0.86      0.86      0.86      3429
weighted avg       0.86      0.86      0.86      3429
```

In [64]:
```
print("Accuracy:",metrics.accuracy_score(y_test, y_pred))
```

```
Accuracy: 0.8556430446194225
```