KNN Q1 (glass)

Prepare a model for glass classification using KNN

Data Description:

RI : refractive index

Na: Sodium (unit measurement: weight percent in corresponding oxide, as are attributes 4-10)

Mg: Magnesium

AI: Aluminum

Si: Silicon

K:Potassium

Ca: Calcium

Ba: Barium

Fe: Iron

Type: Type of glass: (class attribute)
1 -- building_windows_float_processed
2 --building_windows_non_float_processed
3 --vehicle_windows_float_processed
4 --vehicle_windows_non_float_processed (none in this database)
5 --containers
6 --tableware
7 --headlamps

1. Import Libs

In [1]:

```
import pandas as pd
import numpy as np
from matplotlib import pyplot as plt
import seaborn as sns

import warnings
warnings.filterwarnings('ignore')

from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import confusion_matrix
from sklearn.metrics import accuracy_score
from sklearn.model_selection import cross_val_score
from sklearn.preprocessing import StandardScaler
```

2. Import Data

In [2]:

```
glass = pd.read_csv('glass.csv')
glass
```

Out[2]:

	RI	Na	Mg	Al	Si	K	Ca	Ba	Fe	Type
0	1.52101	13.64	4.49	1.10	71.78	0.06	8.75	0.00	0.0	1
1	1.51761	13.89	3.60	1.36	72.73	0.48	7.83	0.00	0.0	1
2	1.51618	13.53	3.55	1.54	72.99	0.39	7.78	0.00	0.0	1
3	1.51766	13.21	3.69	1.29	72.61	0.57	8.22	0.00	0.0	1
4	1.51742	13.27	3.62	1.24	73.08	0.55	8.07	0.00	0.0	1
...	...	...	...	...	...	...	...	...	...	...
209	1.51623	14.14	0.00	2.88	72.61	0.08	9.18	1.06	0.0	7
210	1.51685	14.92	0.00	1.99	73.06	0.00	8.40	1.59	0.0	7
211	1.52065	14.36	0.00	2.02	73.42	0.00	8.44	1.64	0.0	7
212	1.51651	14.38	0.00	1.94	73.61	0.00	8.48	1.57	0.0	7
213	1.51711	14.23	0.00	2.08	73.36	0.00	8.62	1.67	0.0	7

214 rows × 10 columns

3. EDA

In [3]:

```
glass.describe()
```

Out[3]:

	RI	Na	Mg	Al	Si	K	Ca
count	214.000000	214.000000	214.000000	214.000000	214.000000	214.000000	214.000000
mean	1.518365	13.407850	2.684533	1.444907	72.650935	0.497056	8.956963
std	0.003037	0.816604	1.442408	0.499270	0.774546	0.652192	1.423153
min	1.511150	10.730000	0.000000	0.290000	69.810000	0.000000	5.430000
25%	1.516522	12.907500	2.115000	1.190000	72.280000	0.122500	8.240000
50%	1.517680	13.300000	3.480000	1.360000	72.790000	0.555000	8.600000
75%	1.519157	13.825000	3.600000	1.630000	73.087500	0.610000	9.172500
max	1.533930	17.380000	4.490000	3.500000	75.410000	6.210000	16.190000

In [4]:

```
glass.isna().sum()
```

Out[4]:

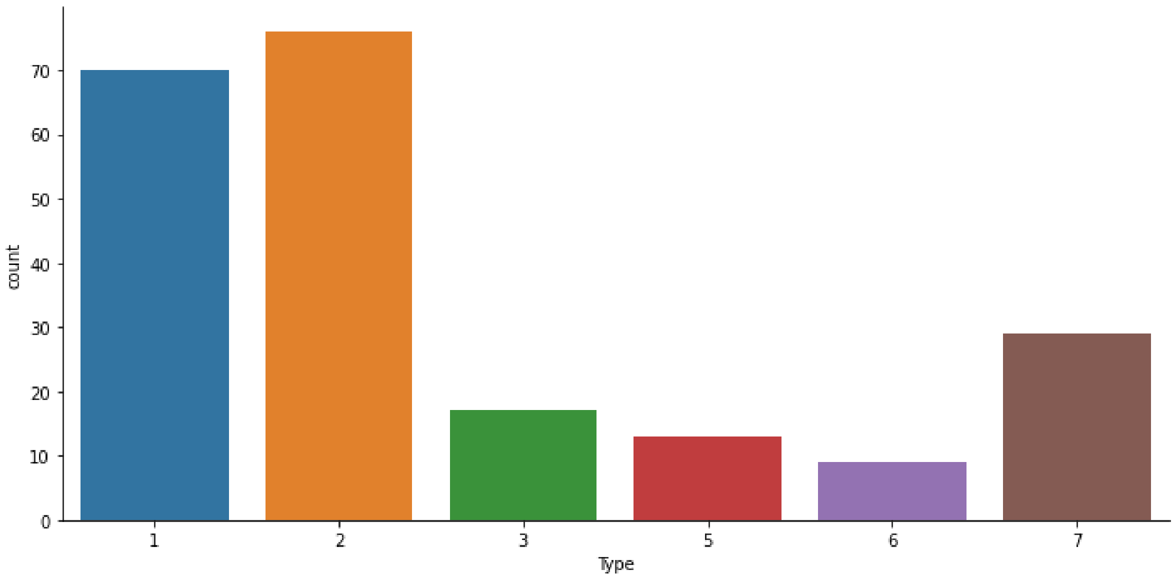
```
RI      0
Na      0
Mg      0
Al      0
Si      0
K       0
Ca      0
Ba      0
Fe      0
Type    0
dtype: int64
```

In [5]:

```
sns.catplot('Type',data=glass,height = 5,kind="count",aspect=2)
```

Out[5]:

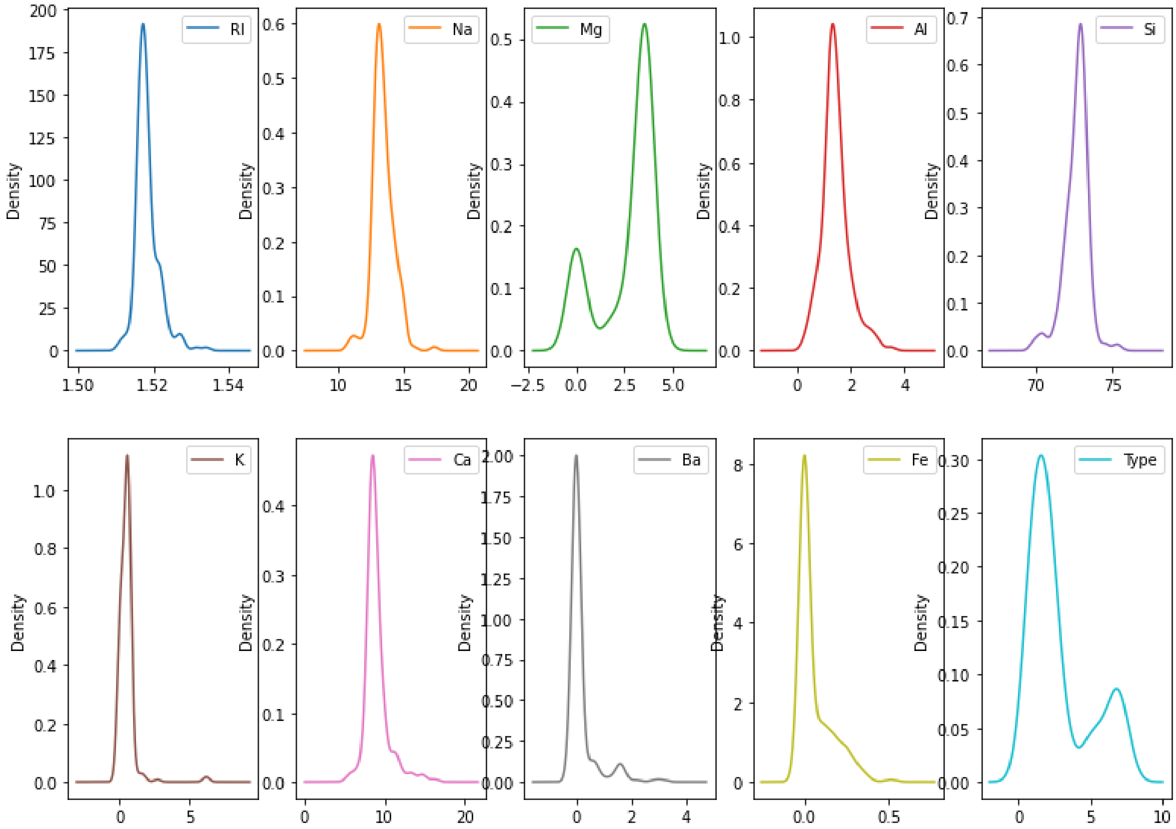
```
<seaborn.axisgrid.FacetGrid at 0x14e3ac9a7c0>
```



majority of the glass types are 1 = building_windows_float_processed and 2 = building_windows_non_float_processed, followed by 7 = headlamps.

In [6]:

```
glass.plot(kind='density', subplots=True, layout=(4,5), figsize=(13,20),sharex=False)
plt.show()
```



4. Model Building

In [7]:

```
X = glass.drop(['Type'],axis=1)
y = glass['Type']
```

In [8]:

```
X_train,X_test,y_train,y_test = train_test_split(X,y,test_size=0.20,random_state= 12,strati
X_train.shape,y_train.shape,X_test.shape,y_test.shape
```

Out[8]:

```
((171, 9), (171,), (43, 9), (43,))
```

Finding optimal number of K

In [9]:

```
# X =np.array(X)
# y =np.array(y)
```

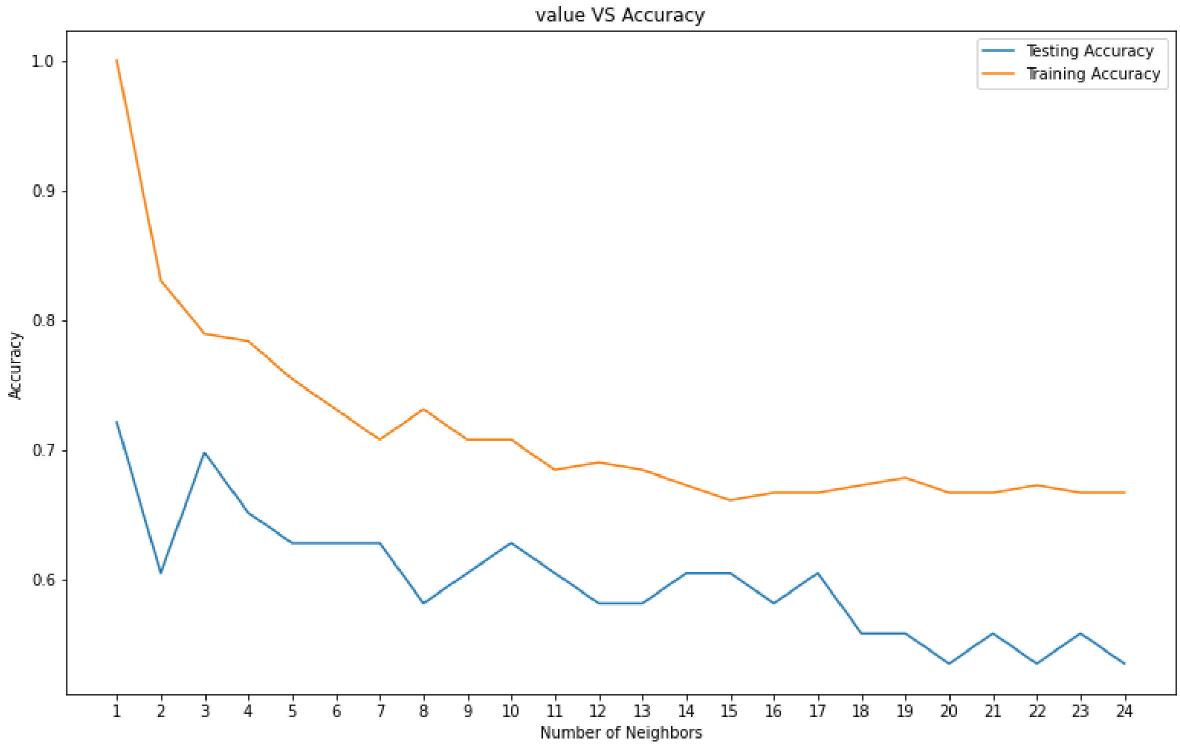
In [10]:

```
k_values = list(range(1,25))
train_accuracy = []
test_accuracy = []

for i, k in enumerate(k_values):
    knn = KNeighborsClassifier(n_neighbors=k)
    knn.fit(X_train,y_train)
    train_accuracy.append(knn.score(X_train, y_train))
    test_accuracy.append(knn.score(X_test, y_test))
```

In [11]:

```
plt.figure(figsize=[13,8])
plt.plot(k_values, test_accuracy, label = 'Testing Accuracy')
plt.plot(k_values, train_accuracy, label = 'Training Accuracy')
plt.legend()
plt.title('value VS Accuracy')
plt.xlabel('Number of Neighbors')
plt.ylabel('Accuracy')
plt.xticks(k_values)
plt.show()
```



as we can see k =4 has most accurate result ,so we'll go with that

5. KNN

Generating a Model with K = 4

Model Training without STANDARDIZATION

In [12]:

```
knn_model = KNeighborsClassifier(n_neighbors=4)
knn_model.fit(X_train,y_train)
y_pred = knn_model.predict(X_test)
print("Accuracy score: ", round(accuracy_score(y_test,y_pred),4))
```

```
Accuracy score:  0.6512
```

Model Training with STANDARDIZATION

In [13]:

```
scaler   = StandardScaler()
scaled_X = scaler.fit_transform(X)
```

In [14]:

```
pd.DataFrame(scaled_X)
```

Out[14]:

	0	1	2	3	4	5	6	7	
0	0.872868	0.284953	1.254639	-0.692442	-1.127082	-0.671705	-0.145766	-0.352877	-0.5
1	-0.249333	0.591817	0.636168	-0.170460	0.102319	-0.026213	-0.793734	-0.352877	-0.5
2	-0.721318	0.149933	0.601422	0.190912	0.438787	-0.164533	-0.828949	-0.352877	-0.5
3	-0.232831	-0.242853	0.698710	-0.310994	-0.052974	0.112107	-0.519052	-0.352877	-0.5
4	-0.312045	-0.169205	0.650066	-0.411375	0.555256	0.081369	-0.624699	-0.352877	-0.5
...	...	...	...	...	...	...	...	...	
209	-0.704815	0.898681	-1.865511	2.881125	-0.052974	-0.640968	0.157088	1.783978	-0.5
210	-0.500178	1.856097	-1.865511	1.094342	0.529374	-0.763919	-0.392276	2.852405	-0.5
211	0.754046	1.168721	-1.865511	1.154570	0.995252	-0.763919	-0.364103	2.953200	-0.5
212	-0.612399	1.193270	-1.865511	0.993960	1.241133	-0.763919	-0.335931	2.812087	-0.5
213	-0.414363	1.009152	-1.865511	1.275028	0.917606	-0.763919	-0.237327	3.013677	-0.5

214 rows × 9 columns

In [15]:

```
X_train,X_test,y_train,y_test = train_test_split(scaled_X,y,test_size=0.20,random_state= 12
X_train.shape,y_train.shape,X_test.shape,y_test.shape
```

Out[15]:

```
((171, 9), (171,), (43, 9), (43,))
```

In [16]:

```
X_train
```

Out[16]:

```
array([[-1.20610400e-01,  3.70875159e-01,  8.65488567e-01, ...,
        -5.26095044e-01, -3.52876828e-01,  9.56587946e-01],
       [-1.70159374e+00, -5.00618371e-01, -1.86551055e+00, ...,
        -1.42761494e+00, -3.52876828e-01, -5.86450902e-01],
       [-1.73419864e-01, -4.02421917e-01,  5.59727851e-01, ...,
        -3.28887568e-01, -3.52876828e-01, -5.86450902e-01],
       ...,
       [ 1.24253390e+00,  9.84602997e-01,  7.89048388e-01, ...,
         4.31769840e-01, -3.52876828e-01, -5.86450902e-01],
       [-3.61553581e-01,  1.58605628e+00, -1.86551055e+00, ...,
        -4.90385747e-03,  9.77617652e-01, -5.86450902e-01],
       [ 4.25267336e+00, -3.28694275e+00, -1.86551055e+00, ...,
         3.05885515e+00,  5.99721046e+00,  2.29388828e+00]])
```

In [17]:

```
X_test
```

Out[17]:

```
array([[ 4.77197670e-02, -2.55127236e-01,  6.57015352e-01,
        -7.52670580e-01,  2.31729707e-01,  1.12106515e-01,
        -3.85232561e-01, -1.71445763e-01,  1.16232646e+00],
       [-7.51023380e-01,  1.96656754e+00, -1.86551055e+00,
         2.13830494e+00,  5.16433114e-01, -6.87074327e-01,
        -8.94213472e-02,  7.15550557e-01, -5.86450902e-01],
       [ 1.23593271e+00,  9.60053883e-01,  7.61251959e-01,
        -1.07389008e+00, -1.67060670e+00, -4.10434805e-01,
         1.28915501e-01, -3.52876828e-01,  3.21971159e+00],
       [-5.45985699e-02, -9.67051528e-01,  5.24430284e-02,
        -1.23449983e+00,  1.49995398e+00, -2.26008457e-01,
         3.26122977e-01, -3.52876828e-01,  1.47093423e+00],
       [ 1.83044019e-01,  6.40112399e-02,  7.95997495e-01,
        -3.71222421e-01, -1.30620085e-01,  1.12106515e-01,
        -5.26095044e-01, -3.52876828e-01,  8.53718690e-01],
       [ 1.12371260e+00, -2.55127236e-01,  6.91760888e-01,
        -5.92060829e-01,  1.28201195e-01,  6.59999275e-02,
        -3.07758196e-01, -3.52876828e-01, -5.86450902e-01],
```

In [18]:

```
knn_model = KNeighborsClassifier(n_neighbors=4)
knn_model.fit(X_train,y_train)
y_pred = knn_model.predict(X_test)
print("Accuracy score: ", round(accuracy_score(y_test,y_pred),4))
```

```
Accuracy score:  0.6977
```

Model Accuracy score without standardization is : 0.6977

Model Accuracy score with standardization is : 0.6977

In [ ]:

```
```