Milk Quality Prediction ¶

Introduction :

Build a model that will classify quality of milk into 3 types i.e. low, medium & high. Use different classifiers, calculate their accuracy & state which Model will be fit for classification of " Quality of Milk ".

In [1]:
```
# Import required libraries
import pandas  as pd
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
import seaborn as sns
import warnings
warnings.filterwarnings('ignore')
from sklearn.model_selection import cross_val_score
from sklearn.linear_model import LogisticRegression
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import RandomForestClassifier
from sklearn.neighbors import KNeighborsClassifier
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score, classification_report, confusion_matrix, roc_curve, roc_auc_score, auc
```

In [2]:
```
df = pd.read_csv("milk_data.csv")
```

In [3]:
```
df.head()
```

Out[3]:

	pH	Temprature	Taste	Odor	Fat	Turbidity	Colour	Grade
0	6.6	35	1	0	1	0	254	high
1	6.6	36	0	1	0	1	253	high
2	8.5	70	1	1	1	1	246	low
3	9.5	34	1	1	0	1	255	low
4	6.6	37	0	0	0	0	255	medium

In [4]:
```
df.isnull().sum()
```

Out[4]:
```
pH            0
Temprature    0
Taste         0
Odor          0
Fat           0
Turbidity     0
Colour        0
Grade         0
dtype: int64
```

In [5]:
```
df.duplicated().sum()
```

Out[5]:
```
976
```

In [6]:
```
df = df.drop_duplicates()
```

In [7]:
```
df.nunique()
```

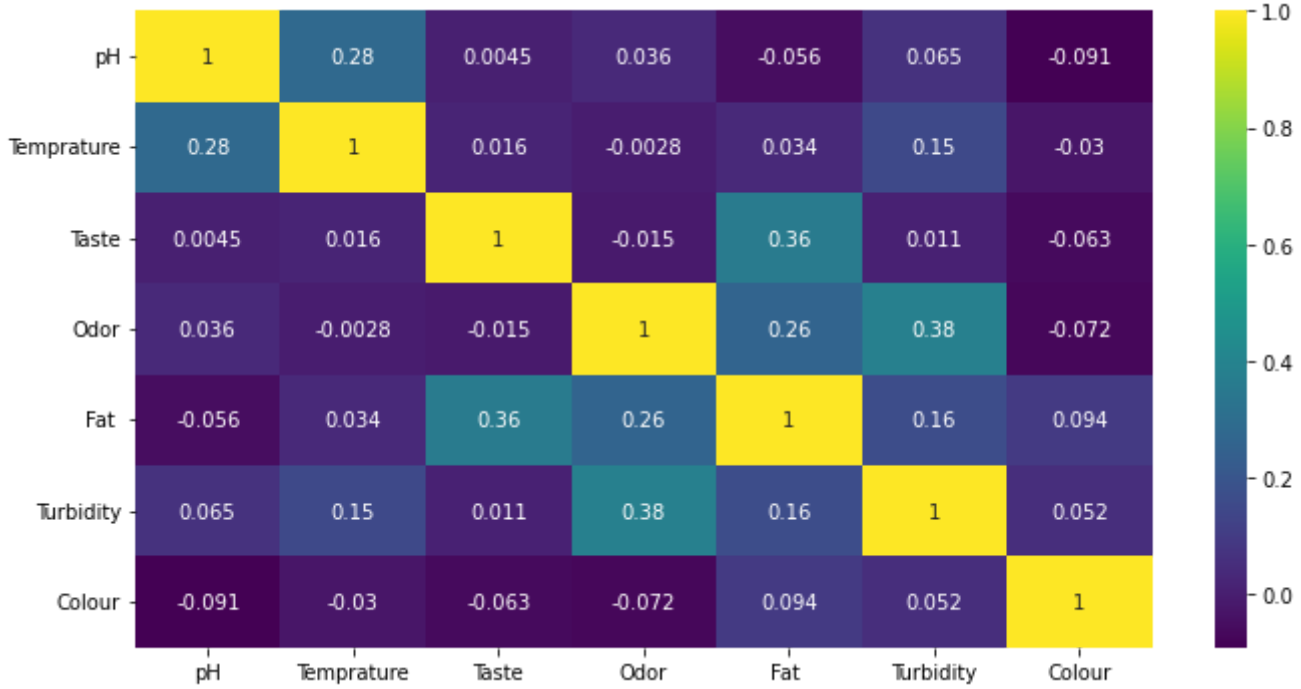
Out[7]:
```
pH             16
Temprature     17
Taste           2
Odor            2
Fat             2
Turbidity       2
Colour          9
Grade           3
dtype: int64
```

In [8]:
```
df.corr()
```

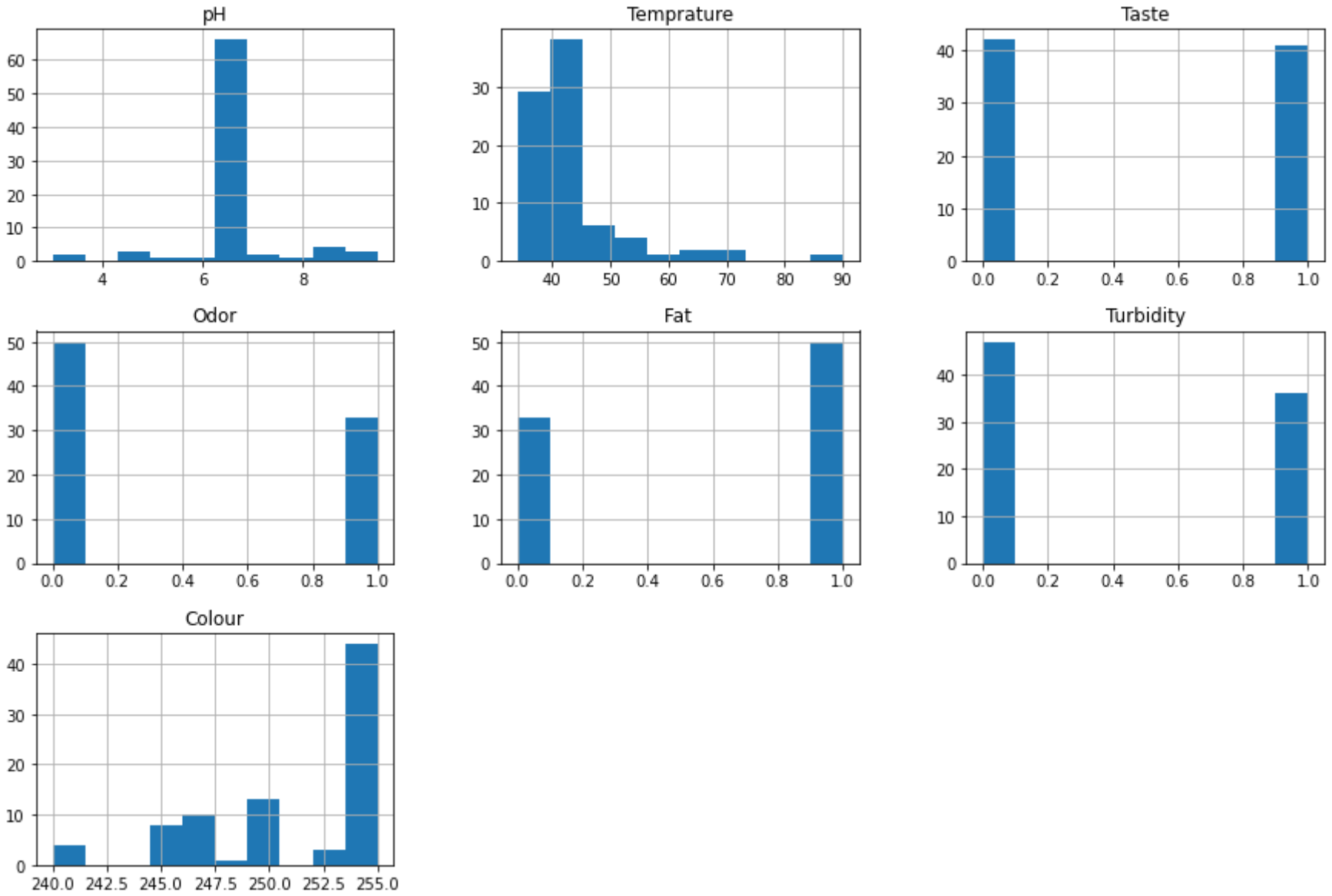
Out[8]:

	pH	Temprature	Taste	Odor	Fat	Turbidity	Colour
pH	1.000000	0.276312	0.004529	0.035984	-0.056062	0.065126	-0.090947
Temprature	0.276312	1.000000	0.016413	-0.002800	0.034489	0.150841	-0.030160
Taste	0.004529	0.016413	1.000000	-0.014831	0.359513	0.010545	-0.062734
Odor	0.035984	-0.002800	-0.014831	1.000000	0.257576	0.381837	-0.072173
Fat	-0.056062	0.034489	0.359513	0.257576	1.000000	0.164585	0.093818
Turbidity	0.065126	0.150841	0.010545	0.381837	0.164585	1.000000	0.051957
Colour	-0.090947	-0.030160	-0.062734	-0.072173	0.093818	0.051957	1.000000

In [9]:
```
plt.figure(figsize=(10,5))
sns.heatmap(df.corr(),annot=True, cmap="viridis")
plt.tight_layout()
plt.show()
```

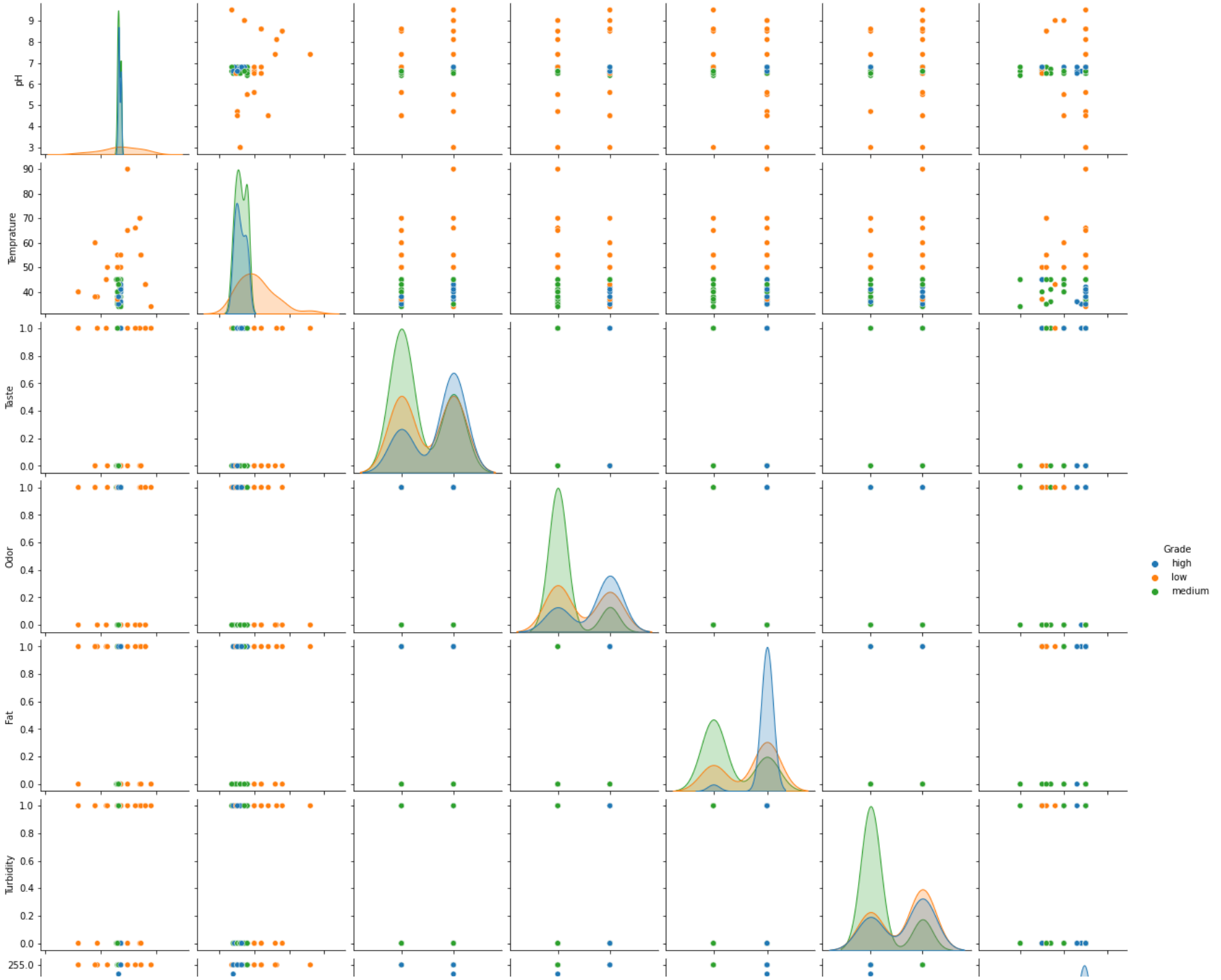


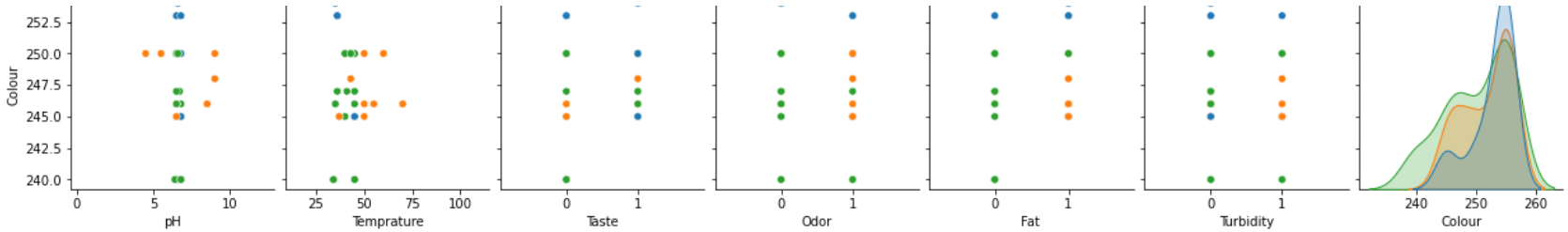
In [10]:
```
df.hist(figsize=(15,10))
plt.show()
```



In [11]:
```
sns.pairplot(data=df, hue="Grade")
```

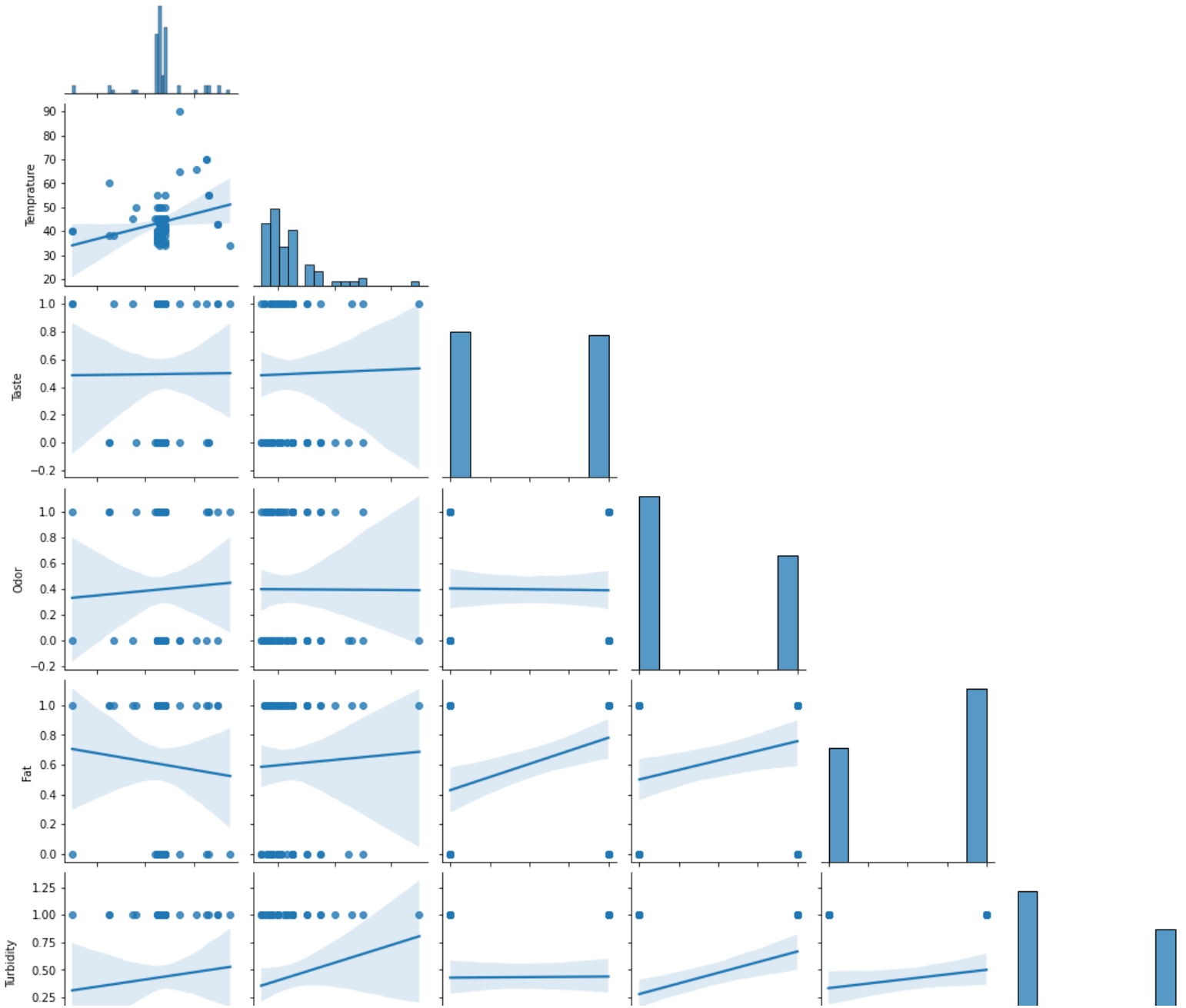
Out[11]:
```
<seaborn.axisgrid.PairGrid at 0x29c66067d90>
```

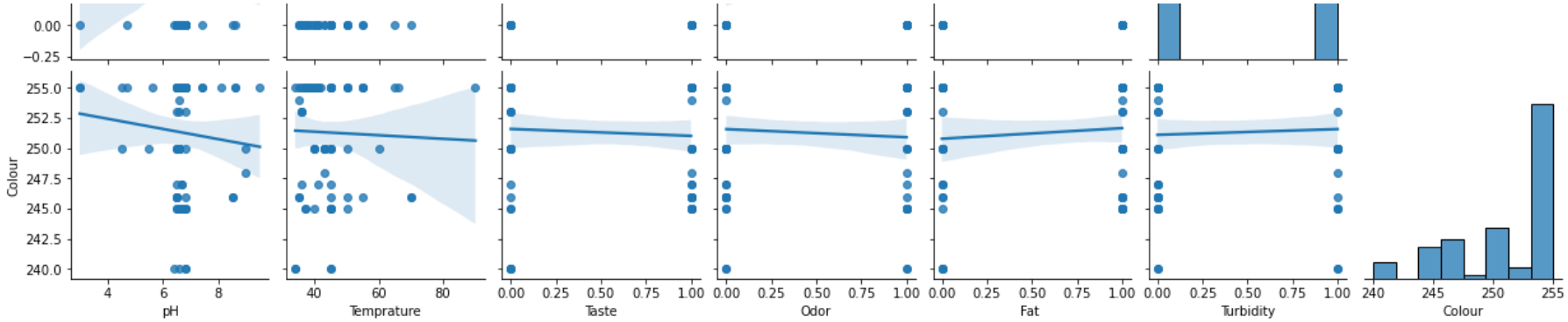

pH
Temprature
Taste
Odor
Fat
Turbidity
Grade
high
low
medium


Colour
252.5
250.0
247.5
245.0
242.5
240.0
0
5
10
pH
25
50
75
100
Temprature
0
1
Taste
0
1
Odor
0
1
Fat
0
1
Turbidity
240
250
260
Colour

In [12]:
```
sns.pairplot(data=df, kind="reg", corner=True)
```

Out[12]:
```
<seaborn.axisgrid.PairGrid at 0x29c690e1640>
```


Temprature
Taste
Odor
Fat
Turbidity



In [13]:
```
# Build the Model
X = df.drop("Grade", axis=1).values
y = df['Grade'].values
```

Logistic Regression

In [14]:
```
# Train test split
X_train, X_test, y_train, y_test = train_test_split(X,y,test_size=0.20,random_state=0)
```

In [15]:
```
#Train the Model
reg   = LogisticRegression()
model = reg.fit(X_train,y_train)
```

In [16]:
```
# Predicted values
y_pred = model.predict(X_test)
y_pred
```

Out[16]:
```
array(['medium', 'high', 'high', 'medium', 'high', 'high', 'low',
       'medium', 'low', 'low', 'medium', 'low', 'high', 'medium', 'high',
       'medium', 'medium'], dtype=object)
```

In [17]:
```
# Accuracy of Train & Test data set.
print("Accuracy of Train Model is : {:0.2f}".format(reg.score(X_train, y_train)))
print("Accuracy of Test Model is  : {:0.2f}".format(reg.score(X_test, y_test)))
```

```
Accuracy of Train Model is : 0.71
Accuracy of Test Model is  : 0.71
```

In [18]:
```
# classification Report
print(classification_report(y_test, y_pred))
```

```
              precision    recall  f1-score   support

        high       0.50      0.75      0.60         4
         low       1.00      0.57      0.73         7
      medium       0.71      0.83      0.77         6

    accuracy                           0.71        17
   macro avg       0.74      0.72      0.70        17
weighted avg       0.78      0.71      0.71        17
```

Decision Tree

In [19]:
```
dt = DecisionTreeClassifier(criterion="entropy", random_state=0, max_depth=4).fit(X_train, y_train)
```

In [20]:
```
y_pred = dt.predict(X_test)
y_pred
```

Out[20]:
```
array(['medium', 'medium', 'high', 'low', 'low', 'low', 'low', 'medium',
       'low', 'low', 'medium', 'low', 'high', 'medium', 'medium',
       'medium', 'medium'], dtype=object)
```

In [21]:
```
print("Accuracy of Train Model is : {:0.2f}".format(dt.score(X_train, y_train)))
print("Accuravy of Test Model is  : {:0.2f}".format(dt.score(X_test, y_test)))
```

```
Accuracy of Train Model is : 0.86
Accuravy of Test Model is  : 0.82
```

In [22]:
```
# Classification Report
dtc_Report = classification_report(y_test, y_pred)
print(dtc_Report)
```

```
              precision    recall  f1-score   support

        high       1.00      0.50      0.67         4
         low       0.86      0.86      0.86         7
      medium       0.75      1.00      0.86         6

    accuracy                           0.82        17
   macro avg       0.87      0.79      0.79        17
weighted avg       0.85      0.82      0.81        17
```

Random Forest

In [23]:
```
rf = RandomForestClassifier(n_estimators=20, random_state=42, max_depth = 5).fit(X_train, y_train)
```

In [24]:
```
y_pred = rf.predict(X_test)
y_pred
```

Out[24]:
```
array(['medium', 'medium', 'high', 'low', 'low', 'high', 'low', 'medium',
       'low', 'low', 'medium', 'low', 'high', 'medium', 'low', 'medium',
       'medium'], dtype=object)
```

In [25]:
```
# Accuracy
print("Accuracy of Train Model is : {:0.2f}".format(rf.score(X_train,y_train)))
print("Accuracy of Test Model is  : {:0.2f}".format(rf.score(X_test, y_test)))
```

```
Accuracy of Train Model is : 0.97
Accuracy of Test Model is  : 0.94
```

In [26]:
```
# Classification Report
rf_report = classification_report(y_test,y_pred)
print(rf_report)
```

```
              precision    recall  f1-score   support

        high       1.00      0.75      0.86         4
         low       1.00      1.00      1.00         7
      medium       0.86      1.00      0.92         6

    accuracy                           0.94        17
   macro avg       0.95      0.92      0.93        17
weighted avg       0.95      0.94      0.94        17
```

KNN

In [27]:
```
knn = KNeighborsClassifier()
knn_model = knn.fit(X_train, y_train)
```

In [28]:
```
y_pred = knn_model.predict(X_test)
y_pred
```

Out[28]:
```
array(['high', 'medium', 'high', 'low', 'high', 'high', 'low', 'medium',
       'low', 'low', 'low', 'low', 'medium', 'high', 'medium', 'medium',
       'medium'], dtype=object)
```

In [29]:
```
# Accuracy Score
print("Accuracy of Train Model is : {:0.2f}".format(knn.score(X_train,y_train)))
print("Accuracy of Test Model is  : {:0.2f}".format(knn.score(X_test, y_test)))
```

```
Accuracy of Train Model is : 0.80
Accuracy of Test Model is  : 0.65
```

In [30]:
```
# Classification Report
knn_report = classification_report(y_test,y_pred)
print(knn_report)
```

```
              precision    recall  f1-score   support

        high       0.40      0.50      0.44         4
         low       0.83      0.71      0.77         7
      medium       0.67      0.67      0.67         6

    accuracy                           0.65        17
   macro avg       0.63      0.63      0.63        17
weighted avg       0.67      0.65      0.66        17
```

Conclusion:

As per the above analysis we can say that Random Forest Classifier is having higher accuracy score. So Random Forest Classifier is good fit for classification of " Quality of Milk ".