Model_Selection_Training_Cluster_1

In [2]:

```
import pandas as pd
import numpy as np
from sklearn.ensemble import RandomForestClassifier
from sklearn.model_selection import GridSearchCV
from sklearn.metrics  import roc_auc_score,accuracy_score
from sklearn.neighbors import KNeighborsClassifier
from sklearn.svm import SVC
from sklearn.tree import DecisionTreeClassifier
from sklearn.model_selection import train_test_split
import pickle
```

```
C:\Users\Dinesh\AppData\Roaming\Python\Python39\site-packages\scipy\__ini
t__.py:177: UserWarning: A NumPy version >=1.18.5 and <1.26.0 is required
for this version of SciPy (detected version 1.26.4
  warnings.warn(f"A NumPy version >={np_minversion} and <{np_maxversion}"
```

In [3]:

```
df = pd.read_csv("Data/Cluster_data.csv")
```

In [4]:

```
df.head()
```

Out[4]:

	age	sex	on_thyroxine	query_on_thyroxine	on_antithyroid_medication	sick	pregnant	t
0	42.0	0.0	0.0	0.0	0.0	0.0	0.0	
1	24.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	47.0	1.0	0.0	0.0	0.0	0.0	0.0	
3	71.0	0.0	1.0	0.0	0.0	0.0	0.0	
4	71.0	0.0	0.0	0.0	0.0	0.0	0.0	

5 rows × 22 columns

In [5]:

```
list_of_clusters = df["Cluster"].unique()
```

In [6]:

```
list_of_clusters
```

Out[6]:

```
array([2, 0, 1], dtype=int64)
```

In [7]:

```
cluster_data_2 = df[df["Cluster"] == list_of_clusters[2]]
```

In [8]:
```
cluster_data_2.head()
```

Out[8]:

	age	sex	on_thyroxine	query_on_thyroxine	on_antithyroid_medication	sick	pregnant
40	45.0	1.0	0.0	0.0	0.0	0.0	0.0
88	40.0	0.0	0.0	0.0	0.0	0.0	0.0
89	50.0	0.0	0.0	0.0	0.0	0.0	0.0
91	81.0	1.0	0.0	0.0	0.0	0.0	0.0
116	51.0	1.0	0.0	0.0	0.0	0.0	0.0

5 rows × 22 columns

In [9]:
```
cluster_feature_2 = cluster_data_2.drop(["Cluster", "Label"], axis = 1)
cluster_label_2 = cluster_data_2["Label"]
```

In [10]:
```
x_train, x_test, y_train, y_test = train_test_split(cluster_feature_2, clus
```

Random Forest

In [11]:
```
clf = RandomForestClassifier()
```

In [12]:
```
clf.fit(x_train, y_train)
```

Out[12]:
```
RandomForestClassifier()
```

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In [13]:
```
clf.score(x_test, y_test)
```

Out[13]:
```
0.9965936739659368
```

In [14]:
```
clf.score(x_train, y_train)
```

Out[14]:
```
1.0
```

In [15]:
```
param_clf = {"n_estimators": [10, 50, 100, 130, 160, 200, 250],
             "criterion": ['gini', 'entropy'],
            "max_depth": range(2, 8, 1),
             "max_features": ['sqrt', 'log2']
}
```

In [16]:
```
grid = GridSearchCV(estimator=clf, param_grid=param_clf, cv=10, n_jobs=-1,
```

In [16]:
```
grid.fit(x_train, y_train)
```

Out[16]:
```
GridSearchCV(cv=10, error_score='raise', estimator=RandomForestClassifier
(),
             n_jobs=-1,
             param_grid={'criterion': ['gini', 'entropy'],
                         'max_depth': range(2, 8),
                         'max_features': ['sqrt', 'log2'],
                         'n_estimators': [10, 50, 100, 130, 160, 200, 25
0]})
```

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In [17]:
```
grid.best_params_
```

Out[17]:
```
{'criterion': 'entropy',
 'max_depth': 7,
 'max_features': 'sqrt',
 'n_estimators': 10}
```

In [17]:
```
clf = RandomForestClassifier(criterion='entropy', max_depth=7, max_features
```

In [18]:
```
clf.fit(x_train, y_train)
```

Out[18]:
```
RandomForestClassifier(criterion='entropy', max_depth=7, n_estimators=10)
```

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In [19]:
```
clf.score(x_test, y_test)
```

Out[19]:
```
0.9961070559610705
```

In [20]:
```
clf.score(x_train, y_train)
```

Out[20]:
```
0.9979136240350511
```

In [22]:
```
prediction_clf = clf.predict_proba(x_test)
```

In [25]:

```
if len(y_test.unique()) == 1:
    clf_score = accuracy_score(y_test, prediction_clf)
else:
    clf_score = roc_auc_score(y_test, prediction_clf, multi_class="ovr")
```

In [26]:

```
clf_score
```

Out[26]:

```
0.9932519073016862
```

KNN

In [27]:

```
knn = KNeighborsClassifier()
```

In [28]:

```
knn.fit(x_train, y_train)
```

Out[28]:

```
KNeighborsClassifier()
```

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In [29]:

```
knn.score(x_test, y_test)
```

Out[29]:

```
0.9951338199513382
```

In [30]:

```
param_knn = {
    'n_neighbors' : [i for i in range(5, 25)],
    'algorithm' : ['auto', 'ball_tree', 'kd_tree', 'brute'],
    'leaf_size' : [10, 15, 20, 25, 30, 35, 40, 50],
    'p' : [1,2],
    'weights' : ['uniform', 'distance']
}
```

In [44]:

```
grid_knn = GridSearchCV(estimator=knn, param_grid=param_knn, cv = 10, error
```

In [45]:
```
grid_knn.fit(x_train, y_train)
```

Out[45]:
```
GridSearchCV(cv=10, error_score='raise', estimator=KNeighborsClassifier
(),
             n_jobs=-1,
             param_grid={'algorithm': ['auto', 'ball_tree', 'kd_tree', 'b
rute'],
                         'leaf_size': [10, 15, 20, 25, 30, 35, 40, 50],
                         'n_neighbors': [5, 6, 7, 8, 9, 10, 11, 12, 13, 1
4, 15,
                                         16, 17, 18, 19, 20, 21, 22, 23,
24],
                         'p': [1, 2], 'weights': ['uniform', 'distanc
e']})
```

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In [46]:
```
grid_knn.best_params_
```

Out[46]:
```
{'algorithm': 'auto',
 'leaf_size': 10,
 'n_neighbors': 5,
 'p': 1,
 'weights': 'distance'}
```

In [31]:
```
knn = KNeighborsClassifier(algorithm='auto', leaf_size=10, n_neighbors = 5,
```

In [32]:
```
knn.fit(x_test, y_test)
```

Out[32]:
```
KNeighborsClassifier(leaf_size=10, p=1, weights='distance')
```

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In [33]:
```
knn.score(x_train, y_train)
```

Out[33]:
```
0.9912372209472147
```

In [34]:
```
knn.score(x_test, y_test)
```

Out[34]:
```
1.0
```

In [35]:
```
prediction_score = knn.predict_proba(x_test)
```

In [36]:
```
if len(y_test.unique()) == 1:
    knn_score = accuracy_score(y_test, prediction_score)
else:
    knn_score = roc_auc_score(y_test, prediction_score, multi_class="ovr")
```

In [37]:
```
knn_score
```

Out[37]:
```
1.0
```

SVM

In [39]:
```
svm = SVC()
```

In [40]:
```
svm.fit(x_train, y_train)
```

Out[40]:
```
SVC()
```

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In [41]:
```
svm.score(x_test, y_test)
```

Out[41]:
```
0.9712895377128954
```

In [42]:
```
svm.score(x_train, y_train)
```

Out[42]:
```
0.968078447736282
```

In [43]:
```
param_svc = {
    'kernel' :['linear', 'poly', 'rbf', 'sigmoid']
}
```

In [63]:
```
grid_svc = GridSearchCV(estimator=svm, param_grid=param_svc, cv = 10, n_job
```

In [64]:
```
grid_svc.fit(x_train, y_train)
```

Out[64]:
```
GridSearchCV(cv=10, error_score='raise', estimator=SVC(), n_jobs=-1,
             param_grid={'kernel': ['linear', 'poly', 'rbf', 'sigmoid']})
```

In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
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In [65]:
```
grid_svc.best_params_
```

Out[65]:
```
{'kernel': 'linear'}
```

In [44]:
```
svm = SVC(kernel = 'linear')
```

In [45]:
```
svm.fit(x_train, y_train)
```

Out[45]:
```
SVC(kernel='linear')
```

In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
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In [46]:
```
svm.score(x_test, y_test)
```

Out[46]:
```
0.9664233576642336
```

In [47]:
```
svm.score(x_train, y_train)
```

Out[47]:
```
0.9609847694554559
```

In [58]:
```
prediction_svm = svm.score(x_test, y_test)
```

In [59]:
```
prediction_svm
```

Out[59]:
```
0.9664233576642336
```

In [ ]:
```

```

Decision Tree

In [60]:
```
dt = DecisionTreeClassifier()
```

In [61]:
```
dt.fit(x_train, y_train)
```

Out[61]:
```
DecisionTreeClassifier()
```

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In [62]:
```
dt.score(x_test, y_test)
```

Out[62]:
```
0.9965936739659368
```

In [63]:
```
dt.score(x_train, y_train)
```

Out[63]:
```
1.0
```

```
In [64]: param_dt = {"criterion" : ['gini', 'entropy'],
                     "splitter" : ['best', 'random'],
                     "max_depth" : range(2, 40, 1),
                     "min_samples_split" : range(2, 10, 1),
                     "min_samples_leaf" : range(1, 10, 1)
         }
```

```
In [65]: grid_dt = GridSearchCV(estimator=dt, param_grid=param_dt, n_jobs=3, cv = 10
```

```
In [66]: grid_dt.fit(x_train, y_train)
```

```
Out[66]: GridSearchCV(cv=10, error_score='raise', estimator=DecisionTreeClassifier
         (),
                      n_jobs=3,
                      param_grid={'criterion': ['gini', 'entropy'],
                                  'max_depth': range(2, 40),
                                  'min_samples_leaf': range(1, 10),
                                  'min_samples_split': range(2, 10),
                                  'splitter': ['best', 'random']})
```

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```
In [68]: grid_dt.best_params_
```

```
Out[68]: {'criterion': 'gini',
          'max_depth': 33,
          'min_samples_leaf': 1,
          'min_samples_split': 5,
          'splitter': 'random'}
```

```
In [69]: dt = DecisionTreeClassifier(criterion='gini', max_depth=33, min_samples_lea
```

```
In [71]: dt.fit(x_train, y_train)
```

```
Out[71]: DecisionTreeClassifier(max_depth=33, min_samples_split=5, splitter='rando
         m')
```

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```
In [72]: dt.score(x_test, y_test)
```

```
Out[72]: 0.9975669099756691
```

```
In [73]: dt.score(x_train, y_train)

Out[73]: 1.0
```

```
In [74]: prediction_dt = dt.predict_proba(x_test)
```

```
In [76]: dt_score = roc_auc_score(y_test, prediction_dt, multi_class='ovr')
```

```
In [77]: dt_score

Out[77]: 0.9426115627073657
```

Model Accuracy

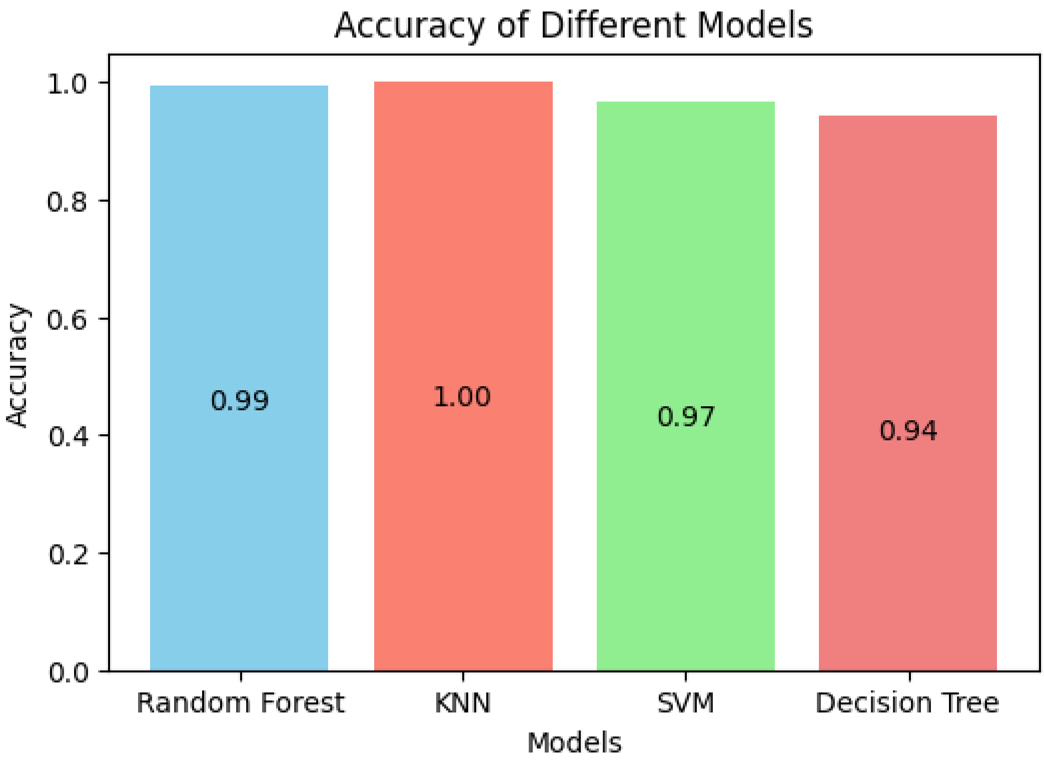
```
In [79]: import matplotlib.pyplot as plt
```

In [102]:

```
models = ['Random Forest', 'KNN', 'SVM', 'Decision Tree']

accuracies = [clf_score, knn_score, prediction_svm, dt_score]
colors = ['skyblue', 'salmon', 'lightgreen', 'lightcoral']


plt.figure(figsize=(6, 4))
bars = plt.bar(models, accuracies, color=colors)
plt.xlabel('Models')
plt.ylabel('Accuracy')
plt.title('Accuracy of Different Models')
for bar, acc in zip(bars, accuracies):
    plt.text(bar.get_x() + bar.get_width() / 2, bar.get_height() - 0.55, f
plt.show()
```



Here the KNN is performing well on the cluster data 2 so we are using knn to predict the data

In [101]:

```
with open("Models/KNN2/knn.pkl", 'wb') as f:
    pickle.dump(knn, f)
```

In [ ]: