ML LAB 7: 19 Feb, 2025

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In [1]:

```
import numpy as np
import pandas as pd
```

Q1

In [2]:

```
df = pd.read_csv('liver_patient.csv')
df.head()
```

Out[2]:

	Age	Gender	Total_Bilirubin	Direct_Bilirubin	Alkaline_Phosphotase	Alamine_Aminotransferase	Aspartate_Aminotransferase	Total_Proti
0	65	Female	0.7	0.1	187	16	18	
1	62	Male	10.9	5.5	699	64	100	
2	62	Male	7.3	4.1	490	60	68	
3	58	Male	1.0	0.4	182	14	20	
4	72	Male	3.9	2.0	195	27	59	

In [3]:

```
df.drop(['Gender'], axis=1, inplace=True)
```

In [4]:

```
from sklearn.preprocessing import MinMaxScaler
from sklearn.model_selection import train_test_split
```

In [5]:
```
scaler = MinMaxScaler()
```

In [6]:
```
X = df.drop(['liver_disease'], axis=1)
y = df['liver_disease']
```

In [7]:
```
scaled_X = scaler.fit_transform(X)
scaled_y = scaler.fit_transform(np.array(y).reshape(-1, 1))
```

In [8]:
```
X_train, X_test, y_train, y_test = train_test_split(scaled_X, scaled_y, test_size = 0.2, random_state=42)
```

In [9]:
```
from sklearn.linear_model import LogisticRegression
```

In [10]:
```
LR = LogisticRegression()
LR.fit(X_train, y_train)
```

```
e:\VIT Study Materials\SEM 2\Data Mining and ML\LAB\.venv\Lib\site-packages\sklearn\utils\validation.py:1408: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
```

Out[10]:
```
▾ LogisticRegression  i ?
LogisticRegression()
```

In [11]:
```
from sklearn.metrics import accuracy_score

y_pred = LR.predict(X_test)
print(f'Accuracy Score: {accuracy_score(y_test, y_pred)}')
```

```
Accuracy Score: 0.7435897435897436
```

Decision Tree

In [12]:
```
from sklearn.tree import DecisionTreeClassifier

DT = DecisionTreeClassifier()
```

In [13]:

```
DT.fit(X_train, y_train)
```

Out[13]:

```
▾ DecisionTreeClassifier

DecisionTreeClassifier()
```

In [14]:

```
y_pred = DT.predict(X_test)
print(f'Accuracy Score: {accuracy_score(y_test, y_pred)}')
```

```
Accuracy Score: 0.717948717948718
```

Bagging Classifier

In [15]:

```
from sklearn.ensemble import BaggingClassifier, RandomForestClassifier
BC = BaggingClassifier(n_estimators = 100, random_state = 0)
BC.fit(X_train,y_train)
print(accuracy_score(BC.predict(X_test),y_test))
```

```
e:\VIT Study Materials\SEM 2\Data Mining and ML\LAB\.venv\Lib\site-packages\sklearn\ensemble\_bagging.py:877: DataConversionWar
ning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n_samples, ), for example usi
ng ravel().
  y = column_or_1d(y, warn=True)
0.7264957264957265
```

Random Forest Classifier

In [16]:

```
RF = RandomForestClassifier(n_estimators = 100, max_features = "sqrt",random_state = 0)
RF.fit(X_train,y_train)
print(accuracy_score(RF.predict(X_test),y_test))
```

```
0.7350427350427351
e:\VIT Study Materials\SEM 2\Data Mining and ML\LAB\.venv\Lib\site-packages\sklearn\base.py:1389: DataConversionWarning: A colu
mn-vector y was passed when a 1d array was expected. Please change the shape of y to (n_samples,), for example using ravel().
  return fit_method(estimator, *args, **kwargs)
```

Q2

In [ ]:

```
from sklearn.datasets import make_classification
import matplotlib.pyplot as plt
```

In [21]:

```
X, y = make_classification(n_classes=3, n_features=2, n_redundant=0, n_clusters_per_class=1, random_state=42)
y
```

Out[21]:

```
array([0, 0, 1, 0, 2, 2, 1, 1, 0, 1, 0, 2, 0, 1, 2, 0, 1, 2, 1, 0, 1, 0,
       0, 0, 2, 1, 2, 0, 2, 2, 0, 2, 1, 1, 0, 0, 2, 1, 2, 1, 1, 2, 1, 1,
       1, 1, 1, 2, 2, 2, 0, 2, 1, 0, 1, 0, 1, 2, 1, 1, 0, 0, 0, 2, 0, 2,
       1, 2, 2, 0, 1, 2, 2, 0, 0, 2, 0, 1, 0, 1, 1, 0, 2, 2, 2, 1, 1, 0,
       2, 0, 2, 0, 2, 1, 0, 2, 1, 2, 0, 0])
```

In [22]:

```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.2, random_state=42)
```

Decision Tree

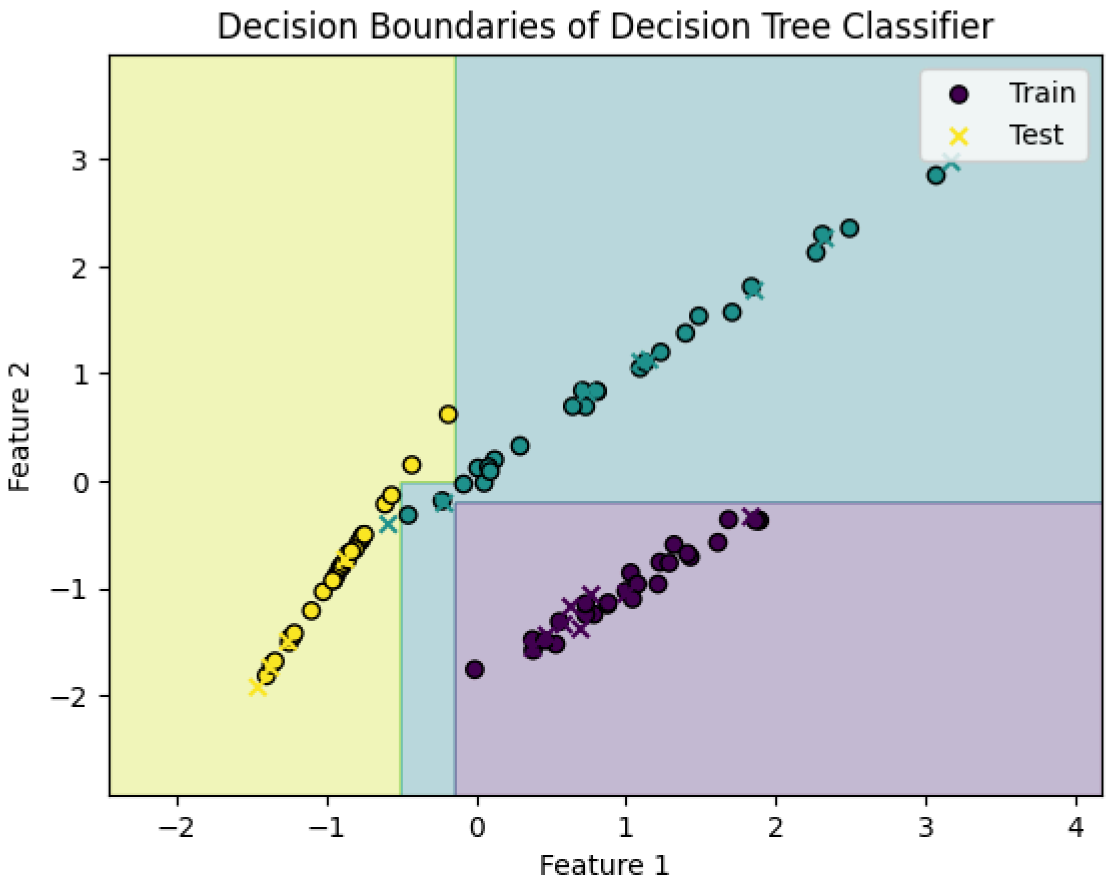
In [23]:

```
DT = DecisionTreeClassifier()
DT.fit(X_train, y_train)
y_pred = DT.predict(X_test)
print(f'Accuracy Score: {accuracy_score(y_test, y_pred)}')
```

```
Accuracy Score: 0.95
```

In [24]:

```
x_min, x_max = X[:, 0].min() -1, X[:, 0].max() +1
y_min, y_max = X[:, 1].min() -1, X[:, 1].max() +1
xx, yy = np.meshgrid(np.linspace(x_min, x_max, 400), np.linspace(y_min, y_max, 400))
Z = DT.predict(np.c_[xx.ravel(), yy.ravel()])
Z = Z.reshape(xx.shape)
plt.contourf(xx, yy, Z, alpha=0.3)
plt.scatter(X_train[:, 0], X_train[:, 1], c=y_train, edgecolors='k', label='Train')
plt.scatter(X_test[:, 0], X_test[:, 1], c=y_test, marker='x', label='Test')
plt.xlabel("Feature 1")
plt.ylabel("Feature 2")
plt.title("Decision Boundaries of Decision Tree Classifier")
plt.legend()
plt.show()
```



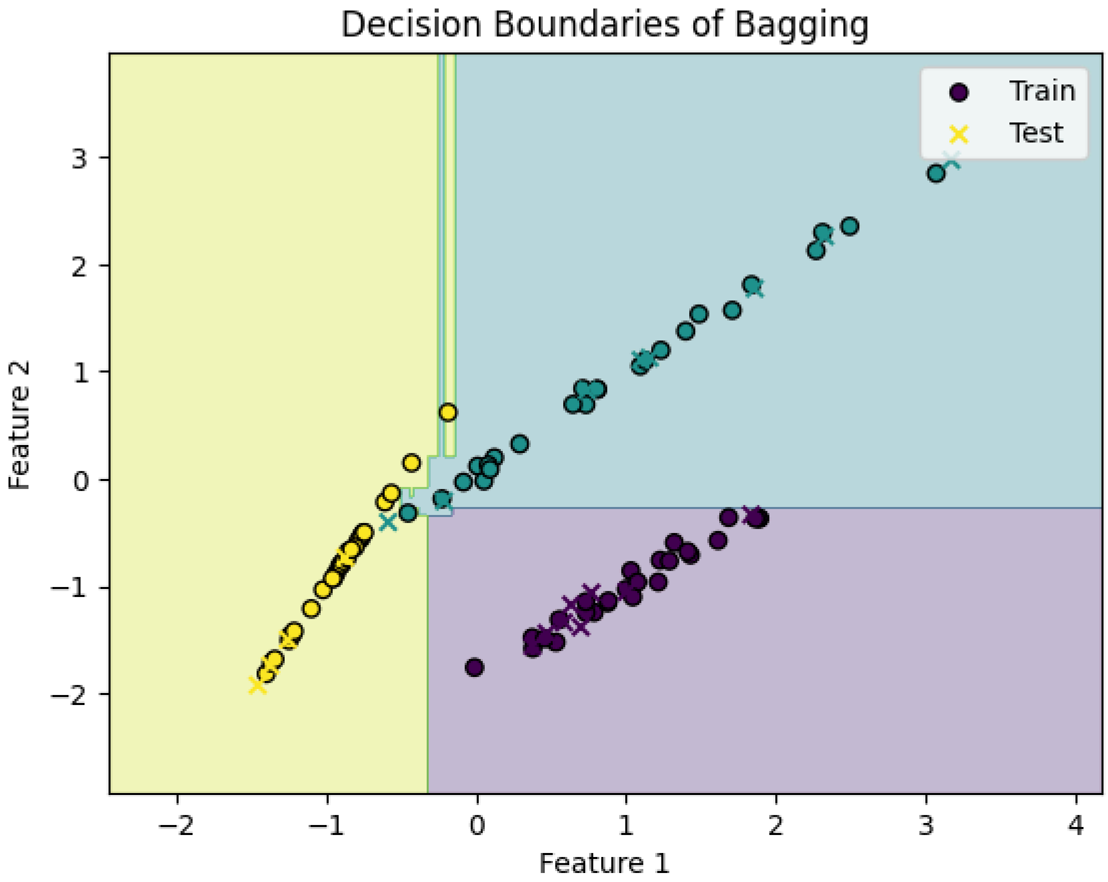
Bagging

```
In [26]: BC = BaggingClassifier(n_estimators = 100, random_state = 0)
         BC.fit(X_train,y_train)
         print(accuracy_score(BC.predict(X_test),y_test))
```

```
0.95
```

In [28]:

```
x_min, x_max = X[:, 0].min() -1, X[:, 0].max() +1
y_min, y_max = X[:, 1].min() -1, X[:, 1].max() +1
xx, yy = np.meshgrid(np.linspace(x_min, x_max, 400), np.linspace(y_min, y_max, 400))
Z = BC.predict(np.c_[xx.ravel(), yy.ravel()])
Z = Z.reshape(xx.shape)
plt.contourf(xx, yy, Z, alpha=0.3)
plt.scatter(X_train[:, 0], X_train[:, 1], c=y_train, edgecolors='k', label='Train')
plt.scatter(X_test[:, 0], X_test[:, 1], c=y_test, marker='x', label='Test')
plt.xlabel("Feature 1")
plt.ylabel("Feature 2")
plt.title("Decision Boundaries of Bagging")
plt.legend()
plt.show()
```



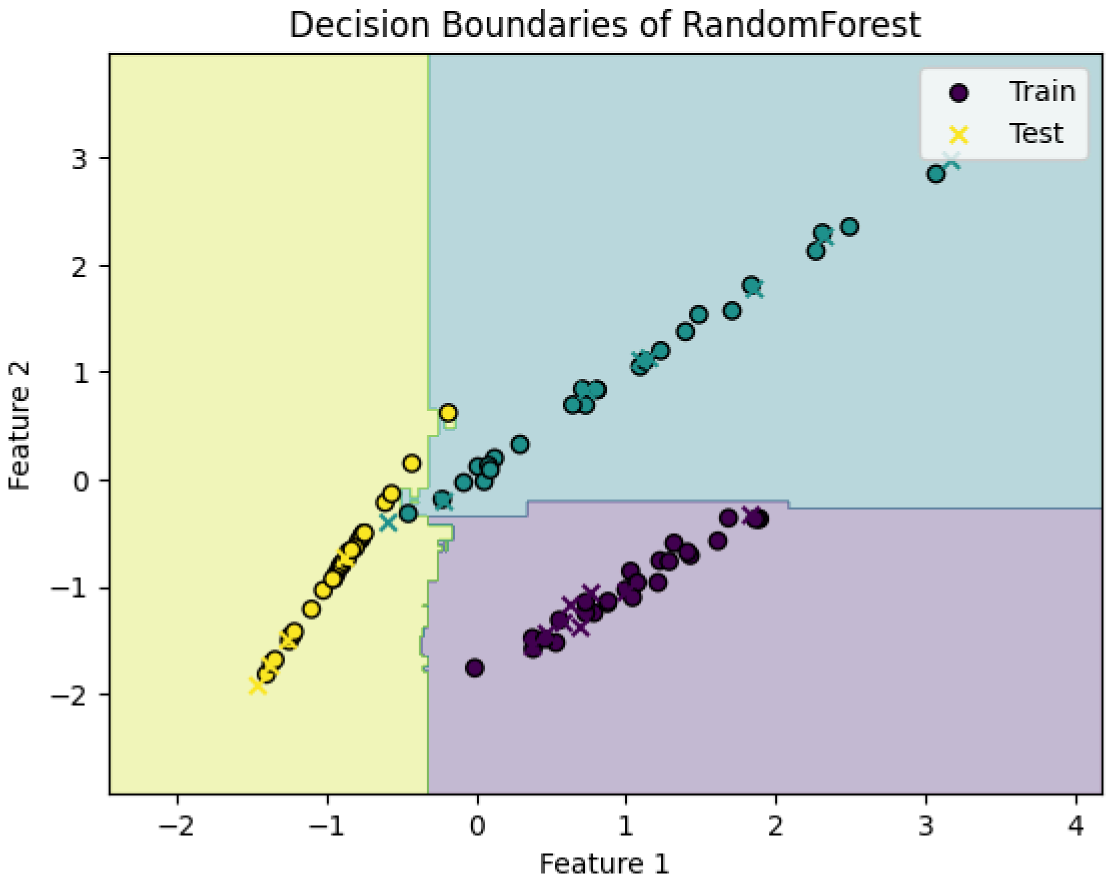
RandomForest

In [30]:
```
RF = RandomForestClassifier(n_estimators = 100, max_features = "sqrt",random_state = 0)
RF.fit(X_train,y_train)
print(accuracy_score(RF.predict(X_test),y_test))
```

```
0.95
```

In [31]:
```
x_min, x_max = X[:, 0].min() -1, X[:, 0].max() +1
y_min, y_max = X[:, 1].min() -1, X[:, 1].max() +1
xx, yy = np.meshgrid(np.linspace(x_min, x_max, 400), np.linspace(y_min, y_max, 400))
Z = RF.predict(np.c_[xx.ravel(), yy.ravel()])
```

```
Z = Z.reshape(xx.shape)
plt.contourf(xx, yy, Z, alpha=0.3)
plt.scatter(X_train[:, 0], X_train[:, 1], c=y_train, edgecolors='k', label='Train')
plt.scatter(X_test[:, 0], X_test[:, 1], c=y_test, marker='x', label='Test')
plt.xlabel("Feature 1")
plt.ylabel("Feature 2")
plt.title("Decision Boundaries of RandomForest")
plt.legend()
plt.show()
```



Voting Classifier

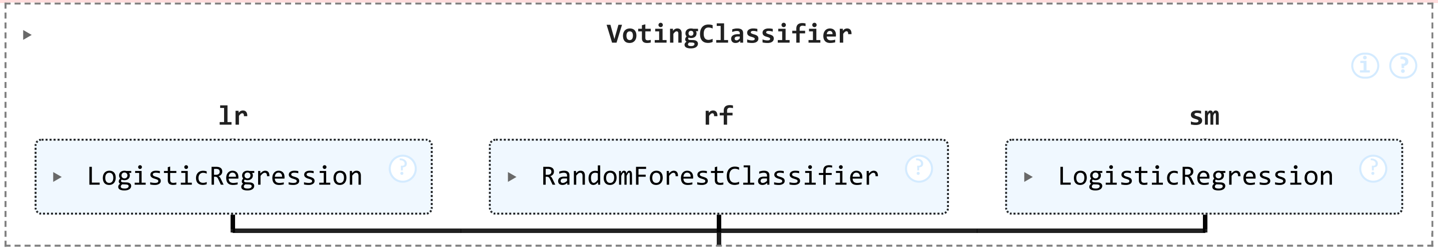
In [32]:

```
from sklearn.ensemble import VotingClassifier

log_clf = LogisticRegression()
rnd_clf = RandomForestClassifier(random_state = 0)
sm_clf = model = LogisticRegression(multi_class='multinomial')
voting_clf = VotingClassifier( estimators=[('lr', log_clf), ('rf', rnd_clf), ('sm', sm_clf)], voting='soft')
voting_clf.fit(X_train, y_train)
```

```
e:\VIT Study Materials\SEM 2\Data Mining and ML\LAB\.venv\Lib\site-packages\sklearn\linear_model\_logistic.py:1247: FutureWarni
ng: 'multi_class' was deprecated in version 1.5 and will be removed in 1.7. From then on, it will always use 'multinomial'. Lea
ve it to its default value to avoid this warning.
  warnings.warn(
```

Out[32]:



▸ VotingClassifier

lr — ▸ LogisticRegression

rf — ▸ RandomForestClassifier

sm — ▸ LogisticRegression

In [33]:

```
print(accuracy_score(y_test, voting_clf.predict(X_test)))
```

```
0.95
```

Boosting

In [35]:

```
from sklearn.ensemble import AdaBoostClassifier

base_model = DecisionTreeClassifier(max_depth=1)
ABC = AdaBoostClassifier(base_model, n_estimators = 500, random_state = 0)
ABC.fit(X_train, y_train)
```

Out[35]:

```
▸ AdaBoostClassifier

▸ estimator:
  DecisionTreeClassifier

  ▸ DecisionTreeClassifier
```

In [36]:

```python
pred_ABC = ABC.predict(X_test)
print("AdaBoost Accuracy: ", accuracy_score(y_test, pred_ABC))
```

```
AdaBoost Accuracy:  0.9
```

In [37]:

```python
from sklearn.model_selection import GridSearchCV

param_grid = {
    'n_estimators': [10, 50, 100, 200, 300, 400, 500, 700],
    'max_depth': [3, 5, 7],
    'min_samples_leaf': [1, 2, 4]
}

rf = RandomForestClassifier(random_state=42)
```

In [38]:

```python
grid_search = GridSearchCV(estimator=rf, param_grid=param_grid, cv=5, scoring='accuracy', n_jobs=-1)
grid_search.fit(X_train, y_train.ravel())


print("Best Parameters for Random Forest:", grid_search.best_params_)
print("Best Accuracy:", grid_search.best_score_)
```

```
Best Parameters for Random Forest: {'max_depth': 3, 'min_samples_leaf': 1, 'n_estimators': 500}
Best Accuracy: 0.95
```

In [47]:

```python
from sklearn.linear_model import LinearRegression
from sklearn.tree import DecisionTreeRegressor
from sklearn.ensemble import BaggingRegressor, RandomForestRegressor, AdaBoostRegressor
from sklearn.metrics import mean_squared_error

df_reg = pd.read_csv('Book1.csv')
df_reg = df_reg.drop(['furnishingstatus'], axis = 1)

X_reg = df_reg.iloc[:, :-1]
y_reg = df_reg.iloc[:, -1]
```

In [48]:

```
X_train_reg, X_test_reg, y_train_reg, y_test_reg = train_test_split(X_reg, y_reg, test_size=0.2, random_state=42)
```

In [49]:

```
models = {
    "Linear Regression": LinearRegression(),
    "Decision Tree Regressor": DecisionTreeRegressor(),
    "Bagging Regressor": BaggingRegressor(n_estimators=100, random_state=42),
    "Random Forest Regressor": RandomForestRegressor(n_estimators=100, random_state=42),
    "AdaBoost Regressor": AdaBoostRegressor(n_estimators=100, random_state=42)
}

for name, model in models.items():
    model.fit(X_train_reg, y_train_reg)
    y_pred = model.predict(X_test_reg)
    mse = mean_squared_error(y_test_reg, y_pred)
    print(f"{name} MSE: {mse}")
```

```
Linear Regression MSE: 0.5411497791403432
Decision Tree Regressor MSE: 1.44
Bagging Regressor MSE: 0.73795
Random Forest Regressor MSE: 0.7314779999999999
AdaBoost Regressor MSE: 0.6486355266811188
```

In [ ]: