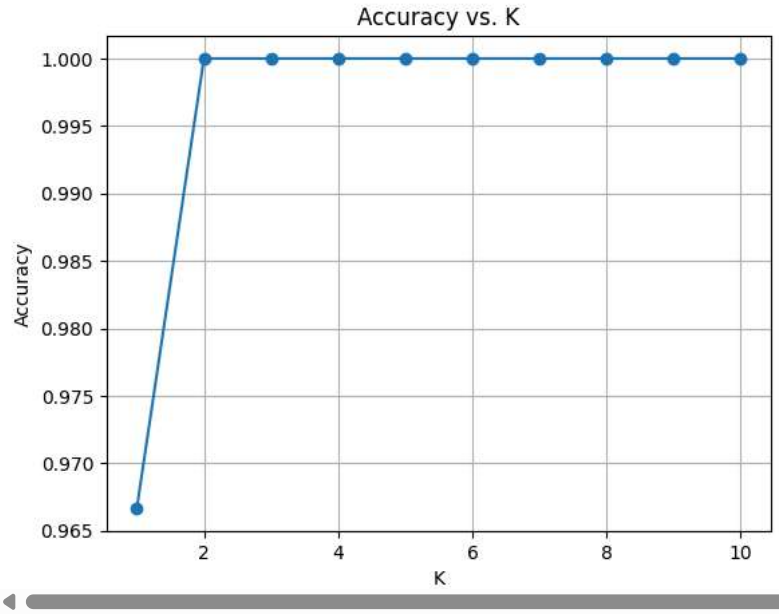
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.datasets import load_iris
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import accuracy_score, confusion_matrix, ConfusionMatrixDisplay

iris = load_iris()
X = iris.data
y = iris.target

scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)
X_train, X_test, y_train, y_test = train_test_split(X_scaled, y, test_size=0.2, random_state=42)

k_values = range(1, 11)
accuracies = []

for k in k_values:
    knn = KNeighborsClassifier(n_neighbors=k)
    knn.fit(X_train, y_train)
    y_pred = knn.predict(X_test)
    acc = accuracy_score(y_test, y_pred)
    accuracies.append(acc)
    print(f"K={k}, Accuracy={acc:.2f}")


```

```
K=1, Accuracy=0.97
K=2, Accuracy=1.00
K=3, Accuracy=1.00
K=4, Accuracy=1.00
K=5, Accuracy=1.00
K=6, Accuracy=1.00
K=7, Accuracy=1.00
K=8, Accuracy=1.00
K=9, Accuracy=1.00
K=10, Accuracy=1.00
```

Plot Accuracy vs K

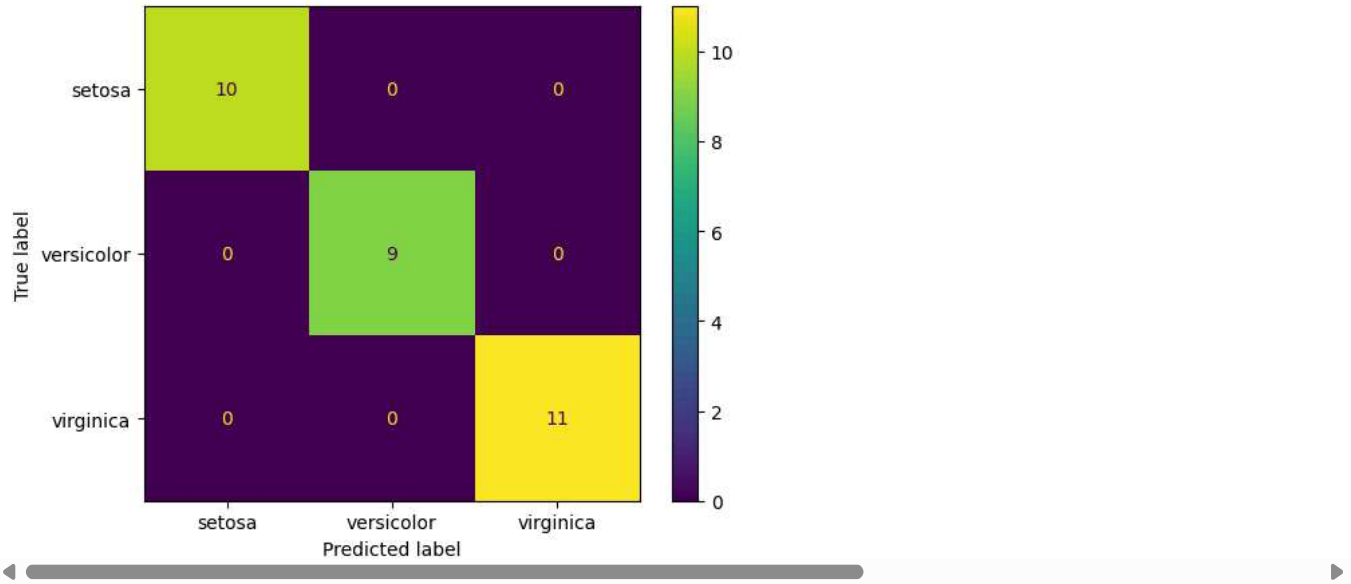
```
plt.plot(k_values, accuracies, marker='o')
plt.title('Accuracy vs. K')
plt.xlabel('K')
plt.ylabel('Accuracy')
plt.grid(True)
plt.show()

```



Evaluate Best Model

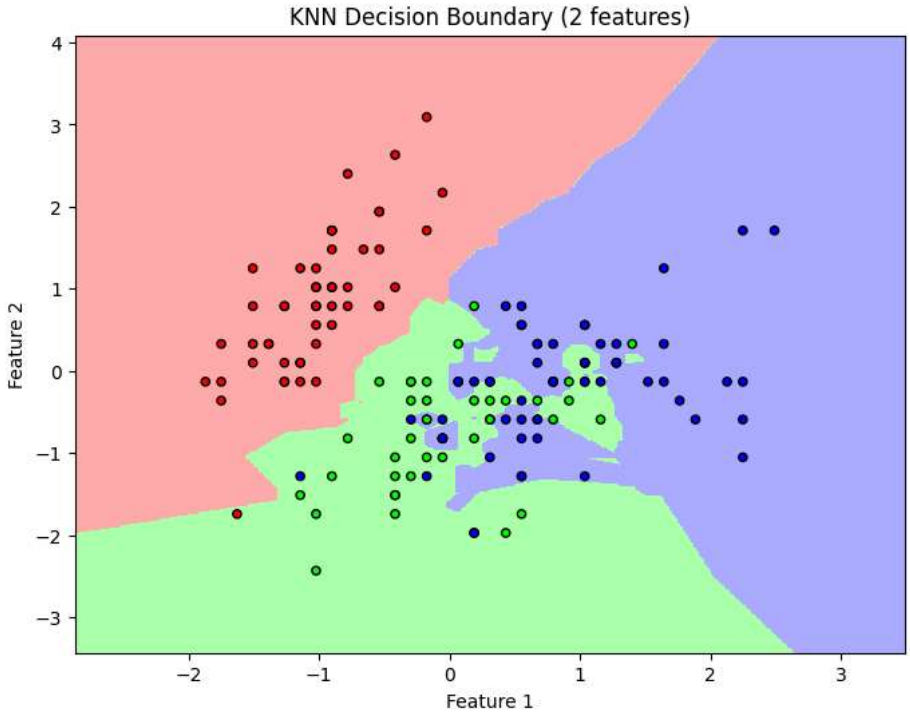
```
best_k = 3
knn = KNeighborsClassifier(n_neighbors=best_k)
knn.fit(X_train, y_train)
y_pred = knn.predict(X_test)

print("Accuracy:", accuracy_score(y_test, y_pred))

cm = confusion_matrix(y_test, y_pred)
disp = ConfusionMatrixDisplay(confusion_matrix=cm, display_labels=iris.target_names)
disp.plot()
plt.show()

```

```
Accuracy: 1.0
```



Visualize Decision Boundary (Using 2 Features)

```
from matplotlib.colors import ListedColormap

X_vis = X_scaled[:, :2]
X_train_v, X_test_v, y_train_v, y_test_v = train_test_split(X_vis, y, test_size=0.2, random_state=42)

knn_vis = KNeighborsClassifier(n_neighbors=3)
knn_vis.fit(X_train_v, y_train_v)

h = .02
x_min, x_max = X_vis[:, 0].min() - 1, X_vis[:, 0].max() + 1
y_min, y_max = X_vis[:, 1].min() - 1, X_vis[:, 1].max() + 1
xx, yy = np.meshgrid(np.arange(x_min, x_max, h),
                     np.arange(y_min, y_max, h))
Z = knn_vis.predict(np.c_[xx.ravel(), yy.ravel()])
Z = Z.reshape(xx.shape)

plt.figure(figsize=(8, 6))
cmap_light = ListedColormap(['#FFAAAA', '#AAFFAA', '#AAAAFF'])
cmap_bold = ListedColormap(['#FF0000', '#00FF00', '#0000FF'])
plt.contourf(xx, yy, Z, cmap=cmap_light)
plt.scatter(X_vis[:, 0], X_vis[:, 1], c=y, cmap=cmap_bold, edgecolor='k', s=20)
plt.title("KNN Decision Boundary (2 features)")
plt.xlabel("Feature 1")
plt.ylabel("Feature 2")
plt.show()

```


KNN Decision Boundary (2 features)
Feature 2
Feature 1
4
3
2
1
0
−1
−2
−3
−2
−1
0
1
2
3