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In [1]:
```
import numpy as np
import matplotlib.pyplot as plt from
sklearn import tree from
sklearn.datasets import load_iris
from itertools import combinations
```

In [2]:
```
iris = load_iris() X = iris.data
y = iris.target feature_names =
iris.feature_names target_names =
iris.target_names
```

In [3]:
```
print("Feature names:", feature_names)
print("Target names:", target_names)
print("\nFirst 5 samples:\n", X[:5])
print("\nFirst 5 labels:\n", y[:5])
```

```
Feature names: ['sepal length (cm)', 'sepal width (cm)', 'petal length (cm)',
'petal width (cm)']
Target names: ['setosa' 'versicolor' 'virginica']

First 5 samples:
 [[5.1 3.5 1.4 0.2]
 [4.9 3.  1.4 0.2]
 [4.7 3.2 1.3 0.2]
 [4.6 3.1 1.5 0.2]
 [5.  3.6 1.4 0.2]]

First 5 labels:
 [0 0 0 0 0]
```

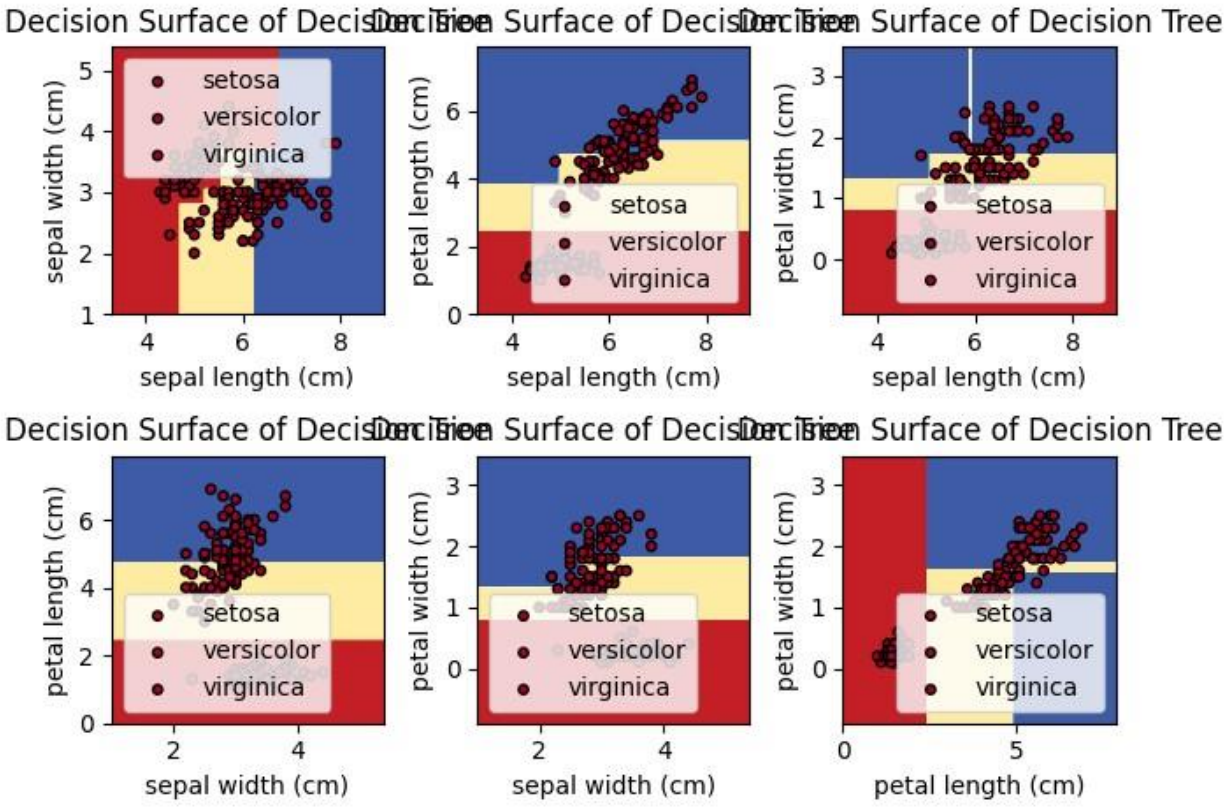
In [4]:
```
plot_colors = "ryb"
plot_step = 0.02
```

In [5]:
```
plt.figure(figsize=(12, 10))
pair_index = 1
```

```
<Figure size 1200x1000 with 0 Axes>
```

In [8]:

```
pair_index = 1 for pair in
combinations(range(4), 2): X_pair =
X[:, pair]
    clf = tree.DecisionTreeClassifier(criterion='entropy', max_depth=4,
    random clf.fit(X_pair, y)

    x_min, x_max = X_pair[:, 0].min() - 1, X_pair[:, 0].max() + 1
    y_min, y_max = X_pair[:, 1].min() - 1, X_pair[:, 1].max() + 1
    xx, yy = np.meshgrid(np.arange(x_min, x_max, plot_step),
    np.arange(y_min,

    plt.subplot(2, 3, pair_index)
    Z = clf.predict(np.c_[xx.ravel(),
    yy.ravel()]) Z = Z.reshape(xx.shape)
    cs = plt.contourf(xx, yy, Z, cmap=plt.cm.RdYlBu)



    plt.xlabel(feature_names[pair[0]])
    plt.ylabel(feature_names[pair[1]])

    for i, color in zip(range(len(target_names)), plot_colors):
        idx = np.where(y == i)
      plt.scatter(X_pair[idx, 0], X_pair[idx, 1], c=y[idx], label=target_nam

    plt.title('Decision Surface of Decision Tree')
    plt.legend()
plt.tight_layout()
pair_index += 1 plt.show()
```



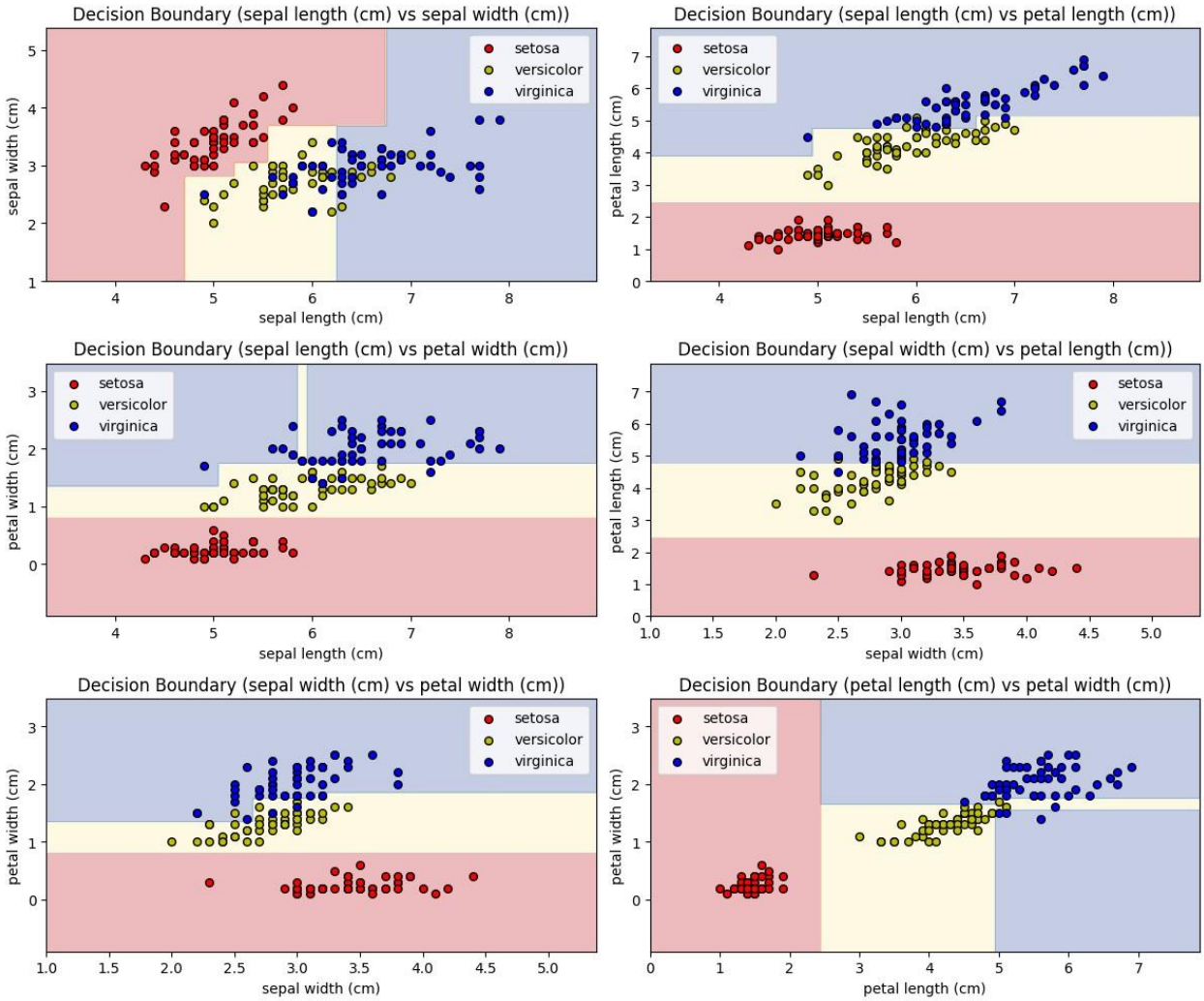
In [10]:
```
x_min, x_max = X_pair[:, 0].min() - 1, X_pair[:, 0].max() + 1
y_min, y_max = X_pair[:, 1].min() - 1, X_pair[:, 1].max() + 1
xx, yy = np.meshgrid(np.arange(x_min, x_max, plot_step),
         np.arange(y_min, y_max, plot_step))
```

In [11]:
```
Z = clf.predict(np.c_[xx.ravel(),
yy.ravel()]) Z = Z.reshape(xx.shape)
```

```
plt.figure(figsize=(12, 10))

for pair_index, pair in enumerate(combinations(range(4), 2), start=1):
    X_pair = X[:, pair]
  clf = tree.DecisionTreeClassifier(criterion='entropy', max_depth=4, random
```

In [14]:
[

```
    clf.fit(X_pair, y)

    x_min, x_max = X_pair[:, 0].min() - 1, X_pair[:, 0].max() + 1
    y_min, y_max = X_pair[:, 1].min() - 1, X_pair[:, 1].max() + 1
   xx, yy = np.meshgrid(np.arange(x_min, x_max, 0.02),
                        np.arange(y_min, y_max, 0.02))
    Z = clf.predict(np.c_[xx.ravel(), yy.ravel()]).reshape(xx.shape)

    plt.subplot(3, 2, pair_index)
    plt.contourf(xx, yy, Z, alpha=0.3, cmap=plt.cm.RdYlBu)

    plot_colors = "ryb" for i, color in
    zip(range(3), plot_colors):
        plt.scatter(X_pair[y == i, 0], X_pair[y == i, 1], c=color,
                    label=target_names[i], edgecolor='k', s=30)

    plt.xlabel(feature_names[pair[0]])
    plt.ylabel(feature_names[pair[1]])
    plt.title(f"Decision Boundary ({feature_names[pair[0]]} vs
    {feature_names plt.legend()

plt.tight_layout()
plt.show()
```


Decision Boundary (sepal length (cm) vs sepal width (cm))
sepal length (cm)
sepal width (cm)
setosa
versicolor
virginica
Decision Boundary (sepal length (cm) vs petal length (cm))
sepal length (cm)
petal length (cm)
setosa
versicolor
virginica
Decision Boundary (sepal length (cm) vs petal width (cm))
sepal length (cm)
petal width (cm)
setosa
versicolor
virginica
Decision Boundary (sepal width (cm) vs petal length (cm))
sepal width (cm)
petal length (cm)
setosa
versicolor
virginica
Decision Boundary (sepal width (cm) vs petal width (cm))
sepal width (cm)
petal width (cm)
setosa
versicolor
virginica
Decision Boundary (petal length (cm) vs petal width (cm))
petal length (cm)
petal width (cm)
setosa
versicolor
virginica