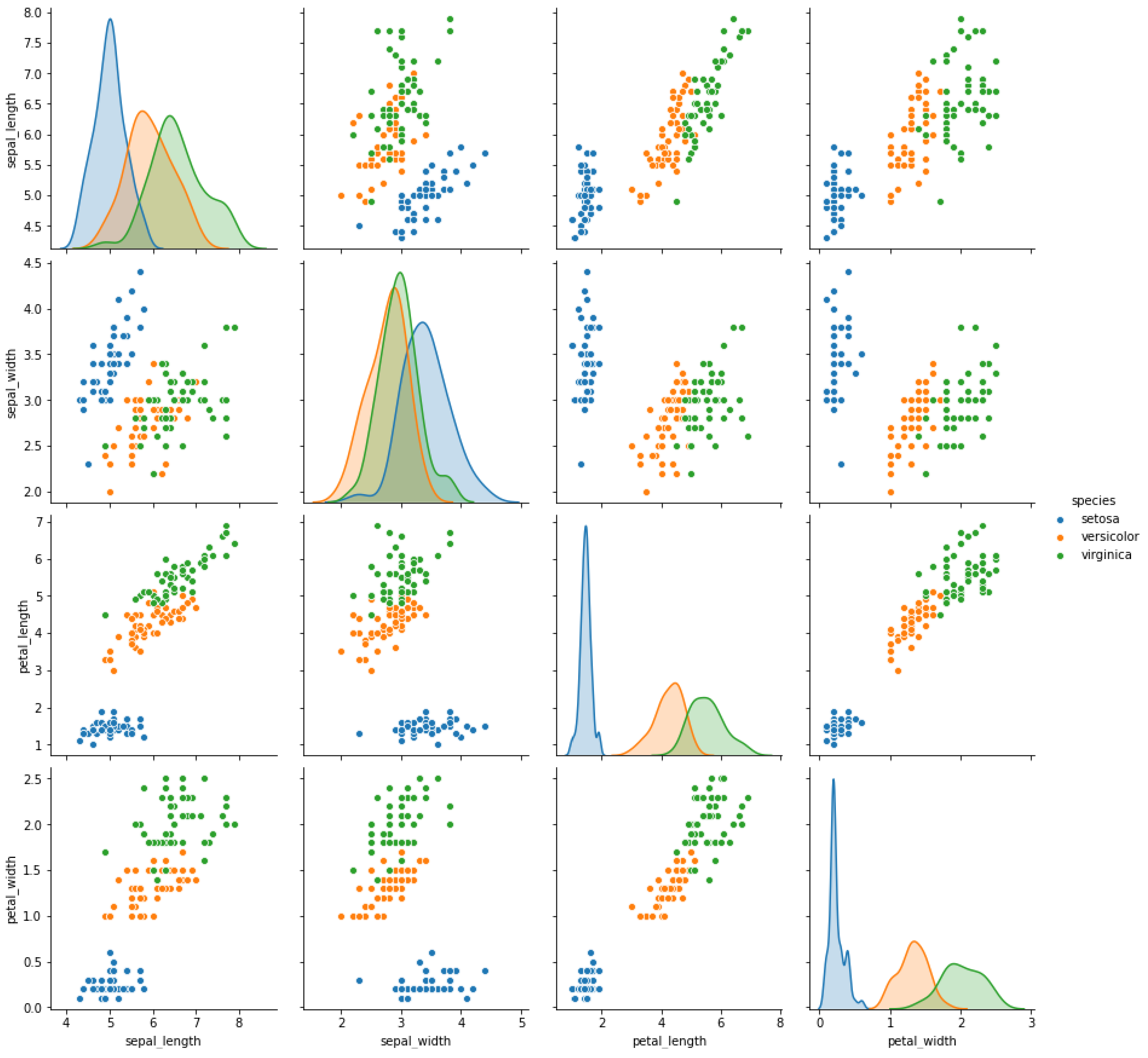
In [1]:

```
import matplotlib.pyplot as plt
import pandas as pd
import seaborn as sns
import numpy as np
from sklearn.preprocessing import StandardScaler
```

In [2]:

```
##Training data
data=pd.read_csv("Iris.csv",header=0)
print("Total Instances on each iris species class")
print (data["species"].value_counts())
print("\n\n      Bivariate Pairwise relationships between features of train data")
sns.pairplot(data, hue="species", height=3, diag_kind="kde")
plt.show(sns)
```

```
Total Instances on each iris species class
setosa        50
virginica     50
versicolor    50
Name: species, dtype: int64


     Bivariate Pairwise relationships between features of train data
```



In [3]:

```
x_train=[]
y_train=[]
for i in range(0,len(data)):
    x_train.append([data.values[i,0],data.values[i,1],data.values[i,2],data.values[i,3]]
)
    if data.values[i,4]=='Iris-setosa':
        y_train.append([0.0001])
    else:
        y_train.append([0.9999])
```

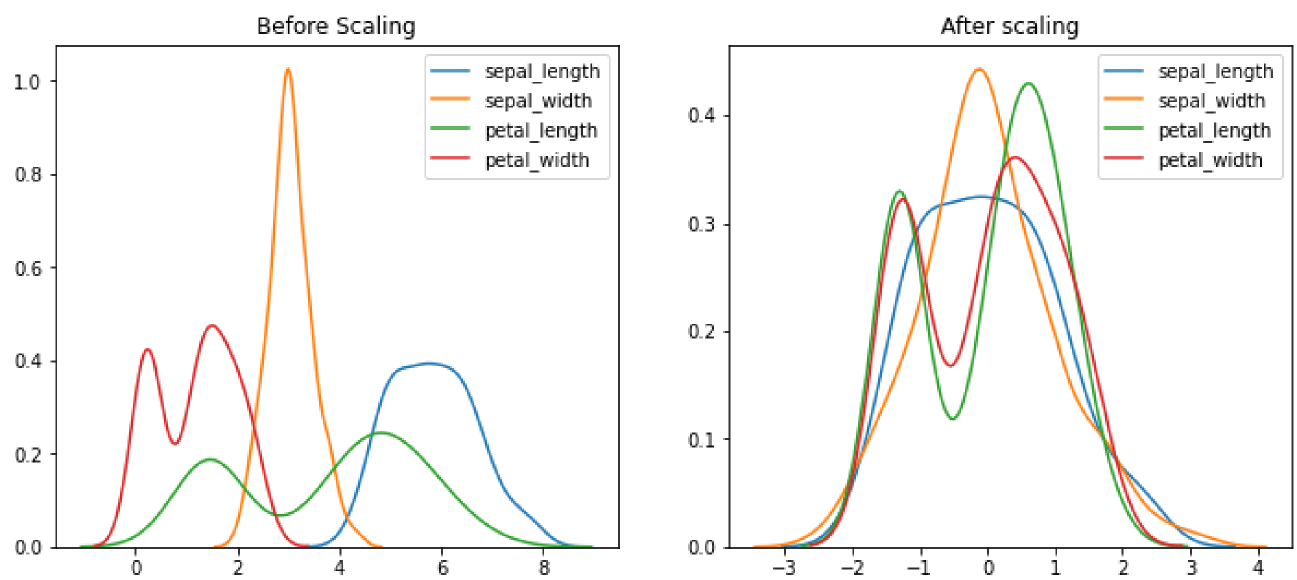
In [4]:

```
#Normalising the inputs
sc = StandardScaler()
sc.fit(x_train)
xtrain=sc.transform(x_train)
```

In [5]:

```
#Plot to visualise the input values before and after scaling
fig, (ax1, ax2) = plt.subplots(ncols=2,figsize=(12,5))
ax1.set_title('Before Scaling')
ax2.set_title('After scaling')
print("\n\n\n\n\n\n\n\n   Input values before and after Scaling")
label_names=['sepal_length','sepal_width','petal_length','petal_width']
for i in range(0,4):
    t1=[]
    t2=[]
    for row1 in x_train:
        t1.append(row1[i])
    for row2 in xtrain:
        t2.append(row2[i])
    sns.kdeplot(t1,ax=ax1,label=label_names[i])
    sns.kdeplot(t2,ax=ax2,label=label_names[i])
plt.show()
```

```
   Input values before and after Scaling
```



In [6]:

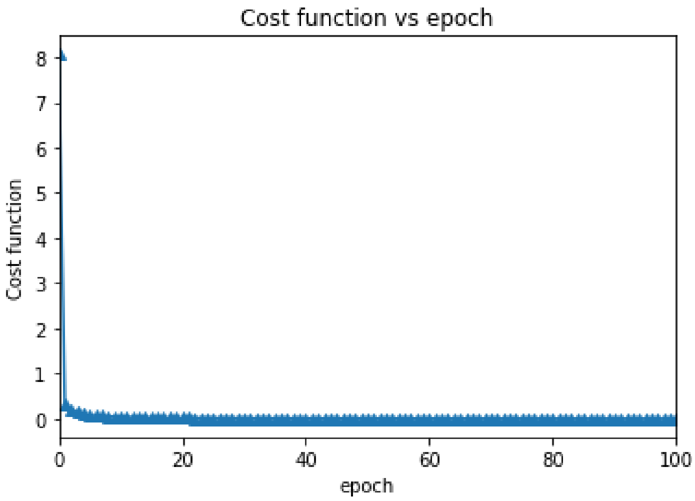
```
class NeuralNet:
```

```
    def __init__(self,x,y,lr,epoch):
        np.random.seed(100)
        self.input      = x
        self.weights1   = np.random.rand(self.input.shape[1],6)
        self.weights2   = np.random.rand(6,1)
        self.y          = y
        self.output     = np.zeros(self.y.shape)
        self.lr         = lr
        self.epoch      = epoch
        self.costlist   = []

    @staticmethod
    def _sigmoid(x):
        return 1.0 / (1.0 + np.exp(-x))

    @staticmethod
    def _sigmoid_derivative(x): return x * (1 - x)

    @staticmethod
    def cost(y_target,y_output):
        return 0.5*np.sum(np.square(np.subtract(y_target,y_output)))

    def feedforward(self):
        self.layer1 = self._sigmoid(np.dot(self.input, self.weights1))
        self.output = self._sigmoid(np.dot(self.layer1, self.weights2))

    def backprop(self):
        # application of the chain rule to find derivative of the cost function with resp
ect to weights2 and weights1
        d_weights2 = np.dot(self.layer1.T, ((self.y - self.output) * self._sigmoid_deriv
ative(self.output)))
        d_weights1 = np.dot(self.input.T,  (np.dot((self.y - self.output) * self._sigmoi
d_derivative(self.output), self.weights2.T) * self._sigmoid_derivative(self.layer1)))

        # update the weights with the derivative (slope) of the cost function
        self.weights1 += d_weights1 * self.lr
        self.weights2 += d_weights2 * self.lr

    def train(self):
        for i in range (self.epoch):
            self.feedforward()
            self.backprop()
            self.costlist.append(self.cost(self.y,self.output))

    def predict(self,input_data):
        self.input=input_data
        self.feedforward()
        return self.output
```

In [7]:

```
if __name__ == "__main__":
    nn = NeuralNet(x=xtrain,y=np.array(y_train),lr=0.3,epoch=2000)
    nn.train()


    ##Plotting the cost vs epoch
    ep=[]
    for i in range (0,len(nn.costlist)):
        ep.append(i)
    plt.plot(ep,nn.costlist,marker = '^')
    plt.xlabel('epoch')
    plt.ylabel('Cost function')
    plt.title("Cost function vs epoch")
    plt.xlim((0,100))
    plt.show()


    ##Normalising the inputs of test data

    x_test=[[4.4,3.2,1.3,0.2],[5.0,3.5,1.6,0.6],[5.6,2.7,4.2,1.3],[5.7,3.0,4.2,1.2]]
```

```
    xtest=sc.transform(x_test)
    out=nn.predict(xtest)

    ##Labeling the test data based on the output of the Neuralnet
    species=[]
    print("\n\n  Output obtained from NeuralNetwork for Test data")
    print("\nsepal_length  sepal_width  petal_length  petal_width  Neuralnet_output  Spe
cies")
    for i in range(0,len(xtest)):
        if(out[i]<0.5):
            species.append('Iris-setosa')
        else:
            species.append('Iris-versicolor')
        print("       ",x_test[i][0],"        ",x_test[i][1],"         ",x_test[i][2],"
",x_test[i][3],"    ",out[i]," ",species[i])
```




```
  Output obtained from NeuralNetwork for Test data

sepal_length  sepal_width  petal_length  petal_width  Neuralnet_output  Species
        4.4           3.2            1.3          0.2      [0.99860763]   Iris-versicolor
        5.0           3.5            1.6          0.6      [0.99860937]   Iris-versicolor
        5.6           2.7            4.2          1.3      [0.99825919]   Iris-versicolor
        5.7           3.0            4.2          1.2      [0.99849512]   Iris-versicolor
```

In [ ]: