Machine learning & deep learning basics

Practice Session 2

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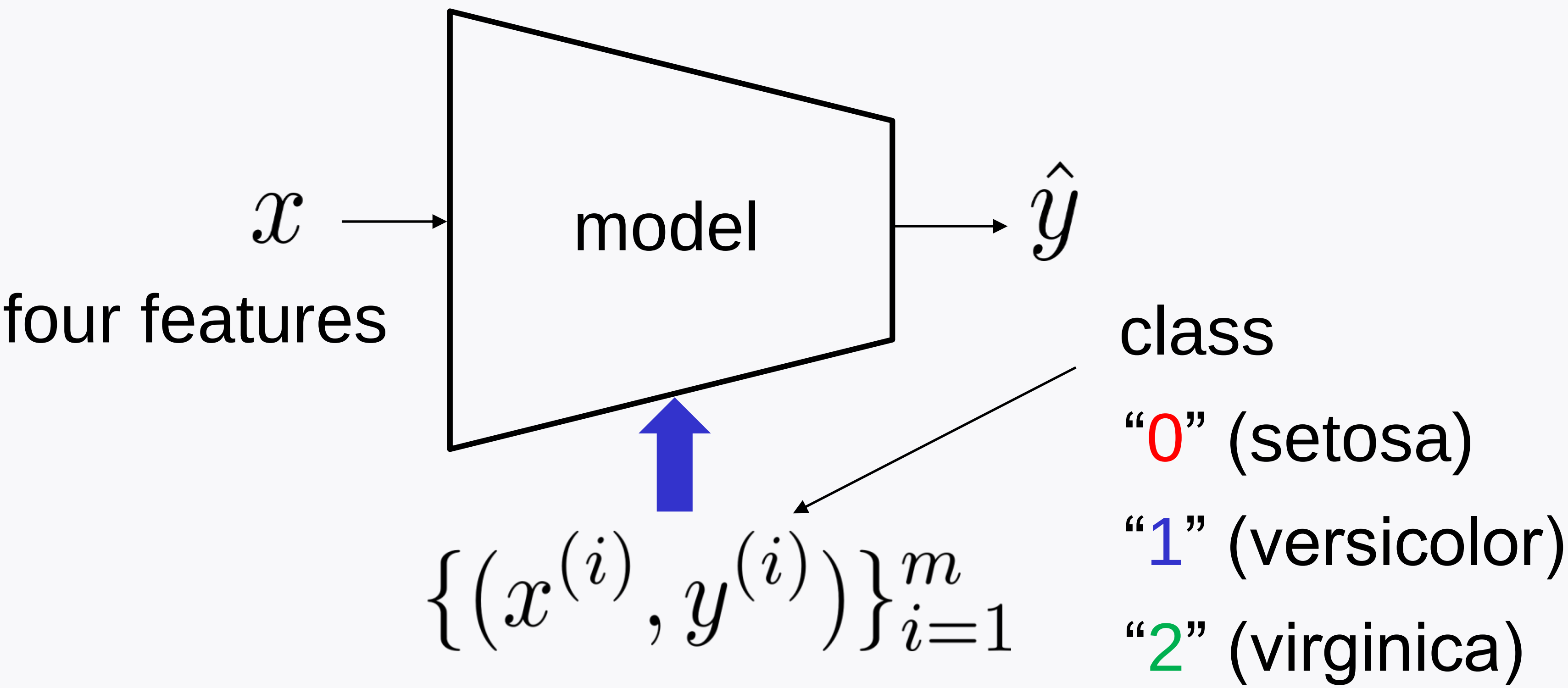
Outline

Will learn how to do **sklearn** implementation:

1. **Least Squares**
2. **Logistic regression**

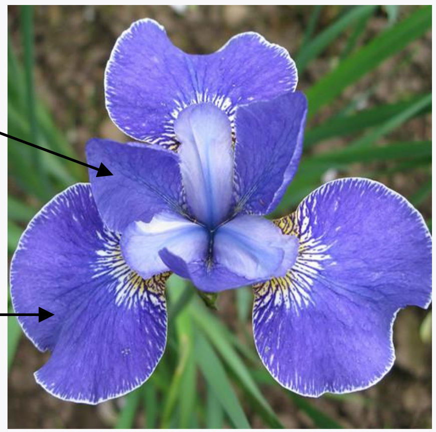
Will do this in the context of **Iris plants classification**.

Iris plants classification



Four features

class: setosa (0) versicolor (1) virginica (2)



Features:

x_1 : sepal length

x_2 : sepal width

x_3 : petal length

x_4 : petal width

How to load Iris dataset

```
from sklearn.datasets import load_iris
```

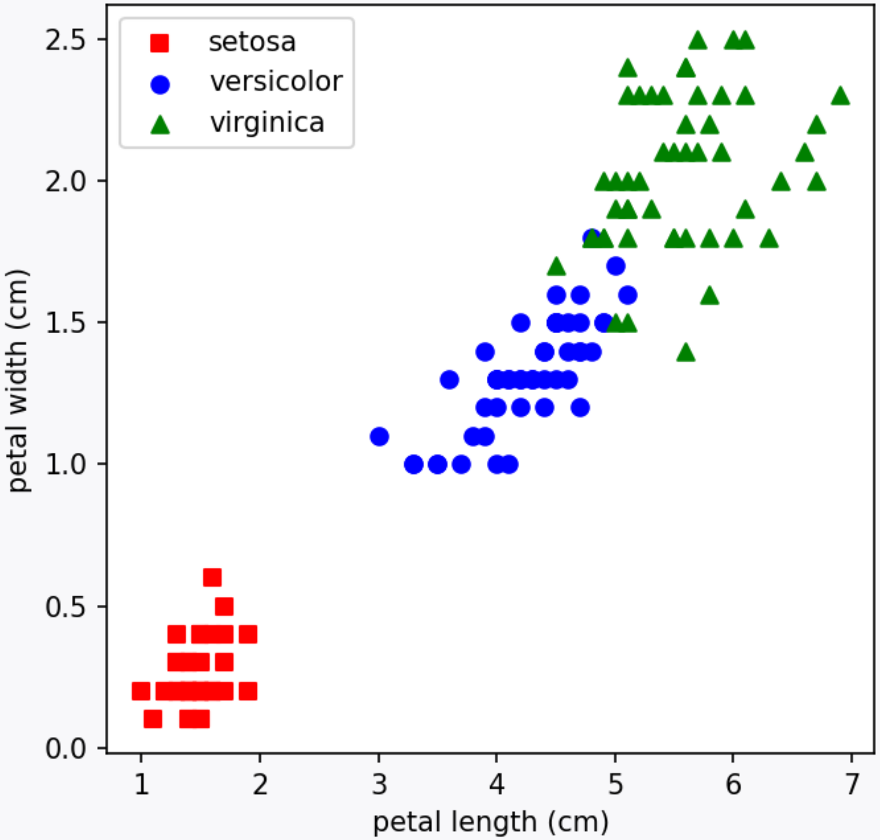
```
iris = load_iris()
y = iris.target
X = iris.data
class_labels = iris.target_names
feature_names = iris.feature_names
```

```
print(X.shape)
print(y.shape)
print(class_labels)
print(feature_names)
```

```
(150, 4)
(150,)
['setosa' 'versicolor' 'virginica']
['sepal length (cm)', 'sepal width (cm)', 'petal length (cm)', 'petal width
(cm)']
```

Data visualization

Suppose we want to plot:



Data visualization

```
print(y==0)
```

```
[ True  True  True  True  True  True  True  True  True  True  True  True
  True  True  True  True  True  True  True  True  True  True  True  True
  True  True  True  True  True  True  True  True  True  True  True  True
  True  True  True  True  True  True  True  True  True  True  True  True
  True  True False False False False False False False False False False
 False False False False False False False False False False False False
 False False False False False False False False False False False False
 False False False False False False False False False False False False
 False False False False False False False False False False False False
 False False False False False False False False False False False False
 False False False False False False False False False False False False
 False False False False False False False False False False False False
 False False False False False False]
```

Data visualization

```
print(X[y==0]) # extract setosa's features
```

```
[[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]
 [5.4 3.9 1.7 0.4]
 [4.6 3.4 1.4 0.3]
 [5.  3.4 1.5 0.2]
 [4.4 2.9 1.4 0.2]
 [4.9 3.1 1.5 0.1]
 [5.4 3.7 1.5 0.2]
 [4.8 3.4 1.6 0.2]
 [4.8 3.  1.4 0.1]
 [4.3 3.  1.1 0.1]
 [5.8 4.  1.2 0.2]
 [5.7 4.4 1.5 0.4]
 [5.4 3.9 1.3 0.4]
 [5.1 3.5 1.4 0.3]
 [5.7 3.8 1.7 0.3]
 [5.1 3.8 1.5 0.3]
 [5.4 3.4 1.7 0.2]
 [5.1 3.7 1.5 0.4]
```

⋮

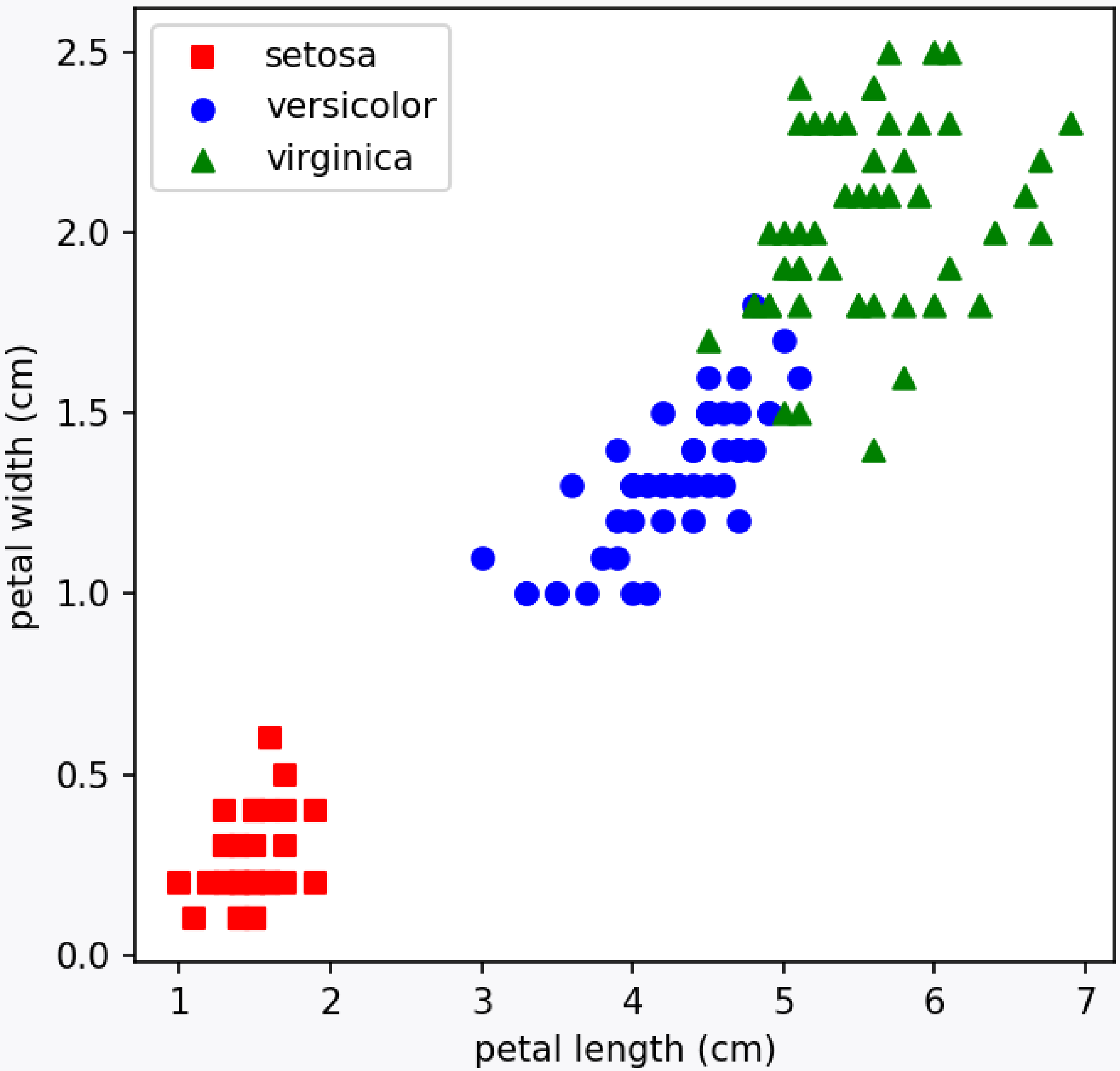
Data visualization

```
import matplotlib.pyplot as plt
```

```
X_y0 = X[y==0] # setosa
X_y1 = X[y==1] # versicolor
X_y2 = X[y==2] # virginica
```

```
plt.figure(figsize=(5,5), dpi=150)
plt.scatter (X_y0[:,2], X_y0[:,3],
             c='red', label='setosa',marker='s')
plt.scatter (X_y1[:,2], X_y1[:,3],
             c='blue', label='versicolor',marker='o')
plt.scatter (X_y2[:,2], X_y2[:,3],
             c='green', label='virginica',marker='^')
plt.xlabel(iris.feature_names[2])
plt.ylabel(iris.feature_names[3])
plt.legend()
plt.show()
```

Data visualization



Data split

```
from sklearn.model_selection import train_test_split
```

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

```
print(X_train.shape)
print(X_test.shape)
print(y_train.shape)
print(y_test.shape)
```

```
(120, 4)
(30, 4)
(120,)
(30,)
```

Least Squares

```
from sklearn.linear_model import RidgeClassifier
```

```
Model_LS = RidgeClassifier()
```

```
# training
Model_LS.fit(X_train,y_train)
```

```
# prediction on test data
y_pred = Model_LS.predict(X_test)
```

```
print(y_pred)
print(y_test)
```

```
[0 0 1 2 0 1 0 2 1 0 2 2 2 0 1 2 1 0 2 1 0 2 0 1 2 1 2 0 0 2]
[0 0 1 2 0 1 0 1 1 0 1 2 2 0 1 2 1 0 2 1 0 2 0 1 2 1 1 0 0 2]
```

Least Squares

```
from sklearn.linear_model import RidgeClassifier

Model_LS = RidgeClassifier()

# training
Model_LS.fit(X_train,y_train)

# prediction on test data
y_pred = Model_LS.predict(X_test)

# evaluate test accuracy
test_accuracy = Model_LS.score(X_test,y_test)

print(test_accuracy)
```

```
0.9
```

Logistic regression

```
from sklearn.linear_model import LogisticRegression
Model_LR = LogisticRegression()

# training
Model_LR.fit(X_train,y_train)

# prediction on test data
y_pred = Model_LR.predict(X_test)

# evaluate test accuracy
test_accuracy = Model_LR.score(X_test,y_test)

print(test_accuracy)
```

```
0.9666666666666667
```

Look ahead

Will learn how to implement **deep learning** via **TensorFlow** in the context of handwritten digit classification.