PHÁT TRIỂN HỆ THÔNG MINH

Môn học Phát triển Hệ thông minh gồm 2 phần:

Phần I: Machine Learning cơ bản

Phần này tập trung xem xét những vấn đề liên quan đến ML bao gồm các kỹ thuật học có giám sát (supervised learning) và học không có giám sát (unsupervised learning). Chúng ta đã trải nghiệm sử dụng các thư viện *numpy, pandas, matpololib* để cài đặt và triển khai một số ví dụ áp dụng.Các chủ đề sinh viên cần nắm vững:

- Các kỹ thuật xử lý dữ liệu
- Các kỹ thuật thử nghiệm, đánh giá kết quả
- Các kỹ thuật học có giám sát
- Các kỹ thuật học không có giám sát
- Sử dụng các thư viện để thử nghiệm và đánh giá

Phần II Deep learning

Phần này bao gồm 2 phần:

- Bài học 1: Tensorflow
- Bài học 2: Sử dụng thư viện keras cho phát triển ứng dụng

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DEEP LEARNING

Bài học 1: Tensorflow

Cài đặt tensorflow **pip install tensorflow hay conda install tensorflow**

Cài đặt keras: **pip install keras**

Introduction to Tensorflow

https://www.geeksforgeeks.org/introduction-to-tensorflow/

Bài học 2: Sử dụng keras

https://keras.io/getting_started/

https://www.tensorflow.org/tutorials/quickstart/beginner

https://keras.io/getting_started/intro_to_keras_for_engineers/

https://keras.io/getting_started/intro_to_keras_for_researchers/

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BÀI TẬP 3: TENSORFLOW

Due date: 18/09/2023

3.1. Chạy và giải thích (hằng **Constant** trong tensorflow)

```
import tensorflow as tf

# creating nodes in computation graph
node1 = tf.constant(3, dtype=tf.int32)
node2 = tf.constant(5, dtype=tf.int32)
node3 = tf.add(node1, node2)

# create tensorflow session object
sess = tf.compat.v1.Session()

# evaluating node3 and printing the result
print("sum of node1 and node2 is :",sess.run(node3))
# closing the session
sess.close()

========
import tensorflow.compat.v1 as tf
x = tf.constant(5,tf.float32)
y = tf.constant([5], tf.float32)
z = tf.constant([5,3,4], tf.float32)
t = tf.constant([[5,3,4,6],[2,3,4,7]], tf.float32)
u = tf.constant([[[5,3,4,6],[2,3,4,0]]], tf.float32)
v = tf.constant([[[5,3,4,6],[2,3,4,0]],
                 [[5,3,4,6],[2,3,4,0]],
                 [[5,3,4,6],[2,3,4,0]]
                ], tf.float32)
print(y)
……
```

3.2. Chạy và giải thích (Variable trong tensorflow)

```
=================================
import tensorflow.compat.v1 as tf
tf.compat.v1.disable_eager_execution()

x1 = tf.Variable(5.3, tf.float32)
x2 = tf.Variable(4.3, tf.float32)
x  = tf.multiply(x1,x2)

init = tf.global_variables_initializer()
with tf.Session() as sess:
     sess.run(init)
```

```
     t = sess.run(x)
     print(t)
==================================
import tensorflow.compat.v1 as tf
tf.compat.v1.disable_eager_execution()

x1 = tf.Variable([[5.3,4.5,6.0],
                  [4.3,4.3,7.0]
                 ], tf.float32)
x2 = tf.Variable([[4.3,4.3,7.0],
                  [5.3,4.5,6.0]
                 ], tf.float32)
x  = tf.multiply(x1,x2)

init = tf.global_variables_initializer()
with tf.Session() as sess:
    sess.run(init)
    t = sess.run(x)
    print(t)
```

```
import tensorflow.compat.v1 as tf

# creating nodes in computation graph
node = tf.Variable(tf.zeros([2,2]))

# running computation graph
with tf.Session() as sess:

    # initialize all global variables
    sess.run(tf.global_variables_initializer())

    # evaluating node
    print("Tensor value before addition:\n",sess.run(node))

    # elementwise addition to tensor
    node = node.assign(node + tf.ones([2,2]))

    # evaluate node again
    print("Tensor value after addition:\n", sess.run(node))
    sess.close()
```

3.3. Chạy và giải thích (Placeholder)

```
=======
import tensorflow.compat.v1 as tf
tf.compat.v1.disable_eager_execution()

x = tf.placeholder(tf.float32,None)
y = tf.add(x,x)

with tf.Session() as sess:
```

```
    x_data= 5
    result = sess.run(y,feed_dict={x:x_data})
    print(result)
=========
import tensorflow.compat.v1 as tf
tf.compat.v1.disable_eager_execution()

x = tf.placeholder(tf.float32,[None,3])
y = tf.add(x,x)

with tf.Session() as sess:
    x_data= [[1.5, 2.0, 3.3]]
    result = sess.run(y,feed_dict={x:x_data})
    print(result)
========
import tensorflow.compat.v1 as tf
tf.compat.v1.disable_eager_execution()

x = tf.placeholder(tf.float32,[None,None,3])
y = tf.add(x,x)

with tf.Session() as sess:
    x_data= [[[1,2,3]]]
    result = sess.run(y,feed_dict={x:x_data})
    print(result)
======
import tensorflow.compat.v1 as tf
tf.compat.v1.disable_eager_execution()

x = tf.placeholder(tf.float32,[None,4,3])
y = tf.add(x,x)

with tf.Session() as sess:
    x_data= [[[1,2,3],
              [2,3,4],
              [2,3,5],
              [0,1,2]
            ]]
    result = sess.run(y,feed_dict={x:x_data})
    print(result)
========
import tensorflow.compat.v1 as tf
tf.compat.v1.disable_eager_execution()

x = tf.placeholder(tf.float32,[2,4,3])
y = tf.add(x,x)

with tf.Session() as sess:
```

```
    x_data= [[[1,2,3],
               [2,3,4],
               [2,3,5],
               [0,1,2]
             ],
             [[1,2,3],
               [2,3,4],
               [2,3,5],
               [0,1,2]
             ]]
    result = sess.run(y,feed_dict={x:x_data})
    print(result)
========
import tensorflow.compat.v1 as tf
tf.compat.v1.disable_eager_execution()

x = tf.placeholder(tf.float32,[2,4,3])
y = tf.placeholder(tf.float32,[2,4,3])

z = tf.add(x,y)
u = tf.multiply(x,y)

with tf.Session() as sess:
    x_data= [[[1,2,3],
               [2,3,4],
               [2,3,5],
               [0,1,2]
             ],
             [[1,2,3],
               [2,3,4],
               [2,3,5],
               [0,1,2]
             ]]
    y_data= [[[1,2,3],
               [2,3,4],
          [2,3,5],
               [0,1,2]
             ],
             [[1,2,3],
               [2,3,4],
               [2,3,5],
               [0,1,2]
             ]]
    result1 = sess.run(z,feed_dict={x:x_data, y:y_data})
    result2 = sess.run(u,feed_dict={x:x_data, y:y_data})
    print("result1 =", result1)
    print("result2 =", result2)
========
```

3.4. Operation

```
import tensorflow.compat.v1 as tf
tf.compat.v1.disable_eager_execution()

x1 = tf.constant(5.3, tf.float32)
x2 = tf.constant(1.5, tf.float32)
w1 = tf.Variable(0.7, tf.float32)
w2 = tf.Variable(0.5, tf.float32)
u = tf.multiply(x1,w1)
v = tf.multiply(x2,w2)
z = tf.add(u,v)
result = tf.sigmoid(z)
init = tf.global_variables_initializer()

with tf.Session() as sess:
    sess.run(init)
    print(sess.run(result))
```

```
===

import numpy as np
import matplotlib.pyplot as plt

number_of_points = 500
x_point = []
y_point = []
a = 0.22
b = 0.78

for i in range(number_of_points):
    x = np.random.normal(0.0,0.5)
    y = a*x + b +np.random.normal(0.0,0.1)
    x_point.append([x])
    y_point.append([y])

plt.plot(x_point,y_point, 'o', label = 'Input Data')
plt.legend()
plt.show()

===
import tensorflow.compat.v1 as tf
tf.compat.v1.disable_eager_execution()

x1 = tf.placeholder(tf.float32,[None,3])
x2 = tf.placeholder(tf.float32,[None,3])
```

```
w1 = tf.Variable([0.5,0.4,0.7],tf.float32)
w2 = tf.Variable([0.8,0.5,0.6], tf.float32)

u1 = tf.multiply(w1,x1)
u2 = tf.multiply(w2,x2)
v = tf.add(u1,u2)
z = tf.sigmoid(v)

init = tf.global_variables_initializer()

with tf.Session() as sess:
    x1_data= [[1,2,3]]
    x2_data= [[1,2,3]]
    sess.run(init)
    result = sess.run(z,feed_dict={x1:x1_data, x2:x2_data})
    print(result)
====
import tensorflow as tf
import numpy as np

matrix1 = np.array([(2,2,2),(2,2,2),(2,2,2)],dtype = 'int32')
matrix2 = np.array([(1,1,1),(1,1,1),(1,1,1)],dtype = 'int32')

print (matrix1)
print (matrix2)

matrix1 = tf.constant(matrix1)
matrix2 = tf.constant(matrix2)
matrix_product = tf.matmul(matrix1, matrix2)
matrix_sum = tf.add(matrix1,matrix2)
matrix_3 = np.array([(2,7,2),(1,4,2),(9,0,2)],dtype = 'float32')
print (matrix_3)

matrix_det = tf.matrix_determinant(matrix_3)
with tf.Session() as sess:
   result1 = sess.run(matrix_product)
   result2 = sess.run(matrix_sum)
   result3 = sess.run(matrix_det)

print (result1)
print (result2)
print (result3)
```

3.5. Chạy ví dụ và giải thích **Linear Regression model** using TensorFlow Core API.

```
# importing the dependencies
import tensorflow.compat.v1 as tf
```

```
import numpy as np
import matplotlib.pyplot as plt

# Model Parameters
learning_rate = 0.01
training_epochs = 2000
display_step = 200

# Training Data
train_X =
np.asarray([3.3,4.4,5.5,6.71,6.93,4.168,9.779,6.182,7.59,2.167,

7.042,10.791,5.313,7.997,5.654,9.27,3.1])
train_y =
np.asarray([1.7,2.76,2.09,3.19,1.694,1.573,3.366,2.596,2.53,1.22
1,
                         2.827,3.465,1.65,2.904,2.42,2.94,1.3])
n_samples = train_X.shape[0]

# Test Data
test_X = np.asarray([6.83, 4.668, 8.9, 7.91, 5.7, 8.7, 3.1,
2.1])

# Set placeholders for feature and target vectors
X = tf.placeholder(tf.float32)
y = tf.placeholder(tf.float32)

# Set model weights and bias)
test_y = np.asarray([1.84, 2.273, 3.2, 2.831, 2.92, 3.24, 1.35,
1.03])
W = tf.Variable(np.random.randn(), name="weight")
b = tf.Variable(np.random.randn(), name="bias")

# Construct a linear model
linear_model = W*X + b

# Mean squared error
cost = tf.reduce_sum(tf.square(linear_model - y)) /
(2*n_samples)

# Gradient descent
optimizer =
tf.train.GradientDescentOptimizer(learning_rate).minimize(cost)

# Initializing the variables
init = tf.global_variables_initializer()

# Launch the graph
```

```
with tf.Session() as sess:
    # Load initialized variables in current session
    sess.run(init)
 # Fit all training data
    for epoch in range(training_epochs):

        # perform gradient descent step
        sess.run(optimizer, feed_dict={X: train_X, y: train_y})

        # Display logs per epoch step
        if (epoch+1) % display_step == 0:
            c = sess.run(cost, feed_dict={X: train_X, y:
train_y})
            print("Epoch:{0:6} \t Cost:{1:10.4} \t W:{2:6.4} \t
b:{3:6.4}".
                  format(epoch+1, c, sess.run(W), sess.run(b)))

    # Print final parameter values
    print("Optimization Finished!")
    training_cost = sess.run(cost, feed_dict={X: train_X, y:
train_y})
    print("Final training cost:", training_cost, "W:",
sess.run(W), "b:",
          sess.run(b), '\n')

    # Graphic display
    plt.plot(train_X, train_y, 'ro', label='Original data')
    plt.plot(train_X, sess.run(W) * train_X + sess.run(b),
label='Fitted line')
    plt.legend()
    plt.show()

    # Testing the model
    testing_cost = sess.run(tf.reduce_sum(tf.square(linear_model
- y)) / (2 * test_X.shape[0]),
                            feed_dict={X: test_X, y: test_y})

    print("Final testing cost:", testing_cost)
    print("Absolute mean square loss difference:",
abs(training_cost - testing_cost))

    # Display fitted line on test data
    plt.plot(test_X, test_y, 'bo', label='Testing data')
    plt.plot(train_X, sess.run(W) * train_X + sess.run(b),
label='Fitted line')
    plt.legend()
    plt.show()
```

3.6. Model Neuron Network

a. Hãy xem và hiểu (tham khảo [1], trg 18)

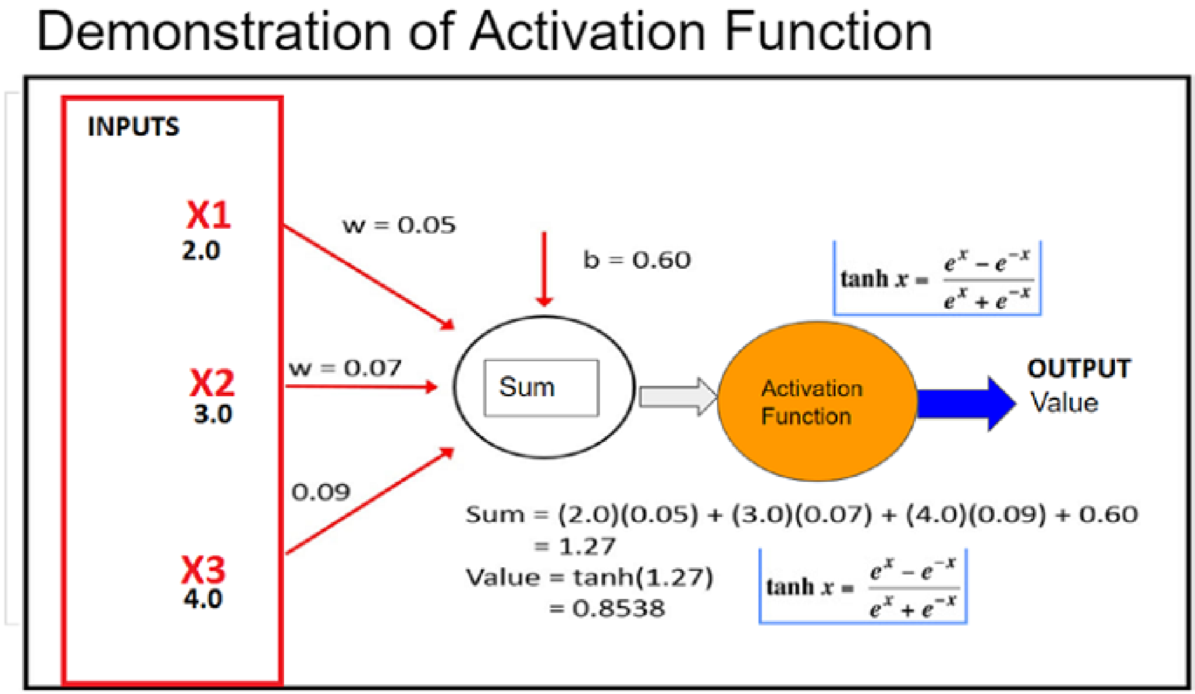
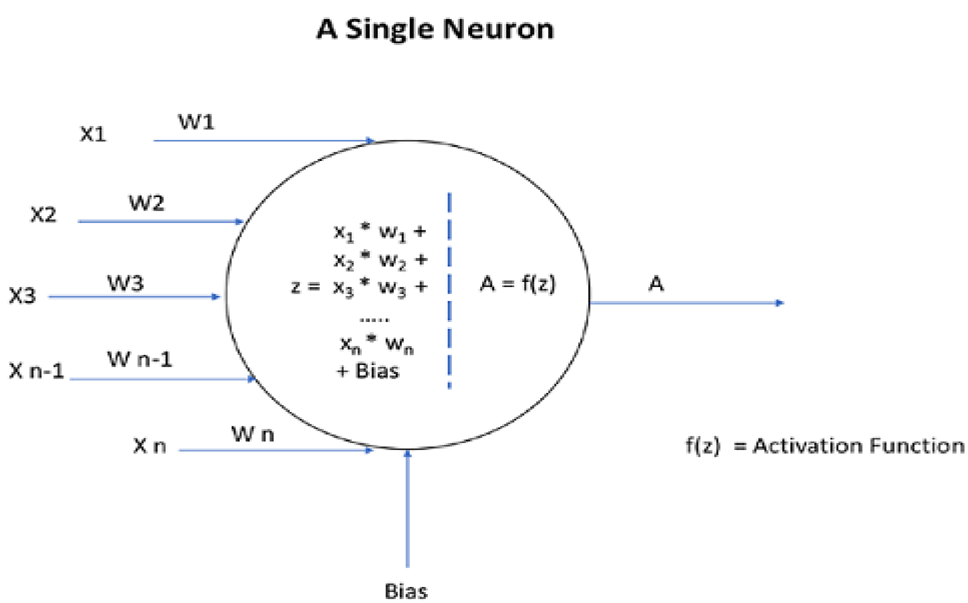
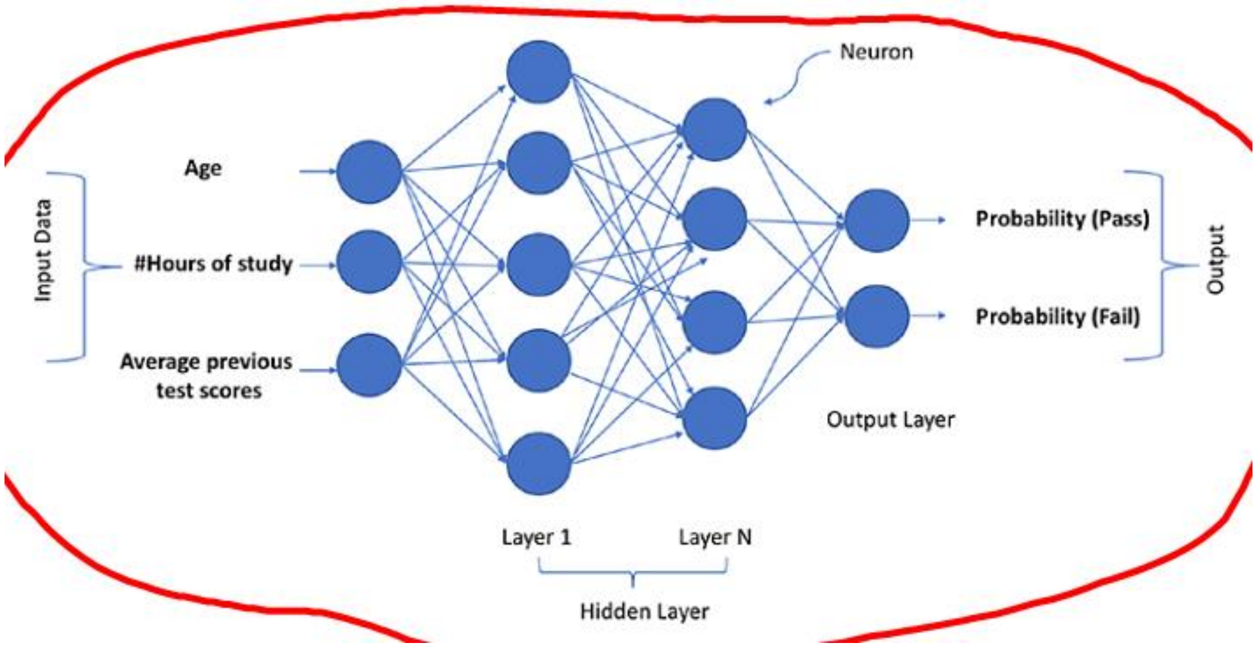


Figure 1-1. *An activation function*

b. Hãy thiết kế mạng neuron đơn giản như trình bày trong biểu đồ. Có thể thay hàm tanh bởi các hàm khác nhau ([1] trang 18-19) như sigmoid, relu… Sử dụng và hiểu **tf.nn.tanh(x).** Copy code và ảnh chương trình chạy

3.7 Sử dụng tensorflow để thiết kế với cấu trúc phức tạp hơn trong Hình và giải thích





==========================

TensorFlow operator	Shortcut	Description
`tf.add()`	`a + b`	Adds a and b, element-wise.
`tf.multiply()`	`a * b`	Multiplies a and b, element-wise.
`tf.subtract()`	`a - b`	Subtracts a from b, element-wise.
`tf.divide()`	`a / b`	Computes Python-style division of a by b.
`tf.pow()`	`a ** b`	Returns the result of raising each element in a to its corresponding element b, element-wise.
`tf.mod()`	`a % b`	Returns the element-wise modulo.
`tf.logical_and()`	`a & b`	Returns the truth table of `a & b`, element-wise. `dtype` must be `tf.bool`.
`tf.greater()`	`a > b`	Returns the truth table of `a > b`, element-wise.
`tf.greater_equal()`	`a >= b`	Returns the truth table of `a >= b`, element-wise.
`tf.less_equal()`	`a <= b`	Returns the truth table of `a <= b`, element-wise.
`tf.less()`	`a < b`	Returns the truth table of `a < b`, element-wise.
`tf.negative()`	`-a`	Returns the negative value of each element in a.
`tf.logical_not()`	`~a`	Returns the logical NOT of each element in a. Only compatible with Tensor objects with `dtype` of `tf.bool`.
`tf.abs()`	`abs(a)`	Returns the absolute value of each element in a.
`tf.logical_or()`	`a | b`	Returns the truth table of `a | b`, element-wise. `dtype` must be `tf.bool`.

Data type	Python type	Description
DT_FLOAT	tf.float32	32-bit floating point.
DT_DOUBLE	tf.float64	64-bit floating point.
DT_INT8	tf.int8	8-bit signed integer.
DT_INT16	tf.int16	16-bit signed integer.
DT_INT32	tf.int32	32-bit signed integer.
DT_INT64	tf.int64	64-bit signed integer.
DT_UINT8	tf.uint8	8-bit unsigned integer.
DT_UINT16	tf.uint16	16-bit unsigned integer.
DT_STRING	tf.string	Variable-length byte array. Each element of a Tensor is a byte array.
DT_BOOL	tf.bool	Boolean.
DT_COMPLEX64	tf.complex64	Complex number made of two 32-bit floating points: real and imaginary parts.
DT_COMPLEX128	tf.complex128	Complex number made of two 64-bit floating points: real and imaginary parts.
DT_QINT8	tf.qint8	8-bit signed integer used in quantized ops.
DT_QINT32	tf.qint32	32-bit signed integer used in quantized ops.
DT_QUINT8	tf.quint8	8-bit unsigned integer used in quantized ops.