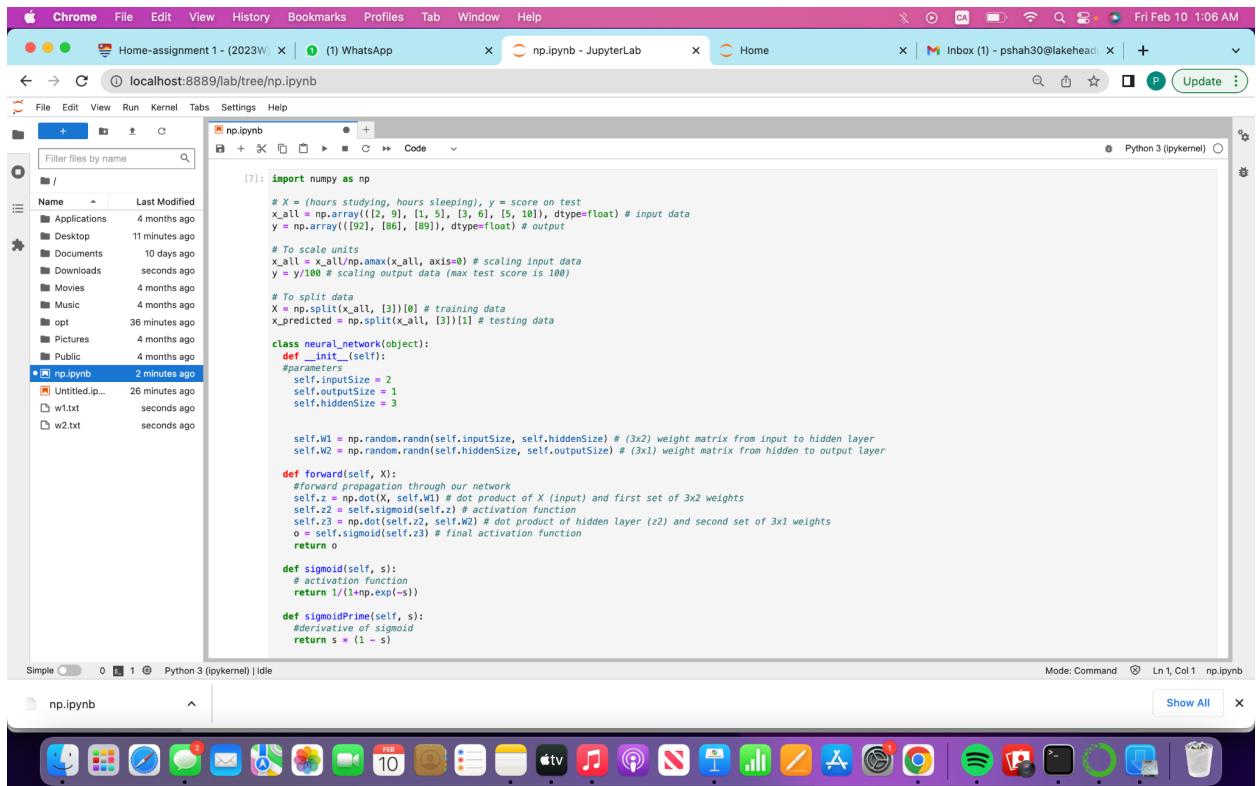


Deep Learning Assignment No. 1

Output :

Code:



The screenshot shows a Mac desktop environment. At the top, there is a horizontal bar with various application icons and a date/time indicator ('Fri Feb 10 1:06 AM'). Below this is a standard Mac-style window for a Jupyter Notebook titled 'np.ipynb'. The notebook contains Python code for a neural network. The code imports numpy, defines input data (X and y), scales the data, splits it into training and testing sets, and defines a neural network class with methods for forward propagation and activation functions. On the left side of the Jupyter window, there is a sidebar showing a file tree with files like 'np.ipynb', 'Untitled.ipynb', 'w1.txt', and 'w2.txt'. The bottom of the screen shows the Mac Dock with various application icons.

```
# X = (hours studying, hours sleeping), y = score on test
x_all = np.array(([12, 9], [1, 5], [3, 6], [5, 10]), dtype=float) # input data
y = np.array([92, [86], [89]], dtype=float) # output

# To scale units
x_all = x_all/np.amax(x_all, axis=0) # scaling input data
y = y/100 # scaling output data (max test score is 100)

# To split data
X = np.split(x_all, [3])[0] # training data
X_predicted = np.split(x_all, [3])[1] # testing data

class neural_network(object):
    def __init__(self):
        #parameters
        self.inputSize = 2
        self.outputSize = 1
        self.hiddenSize = 3

        self.W1 = np.random.randn(self.inputSize, self.hiddenSize) # (3x2) weight matrix from input to hidden layer
        self.W2 = np.random.randn(self.hiddenSize, self.outputSize) # (3x1) weight matrix from hidden to output layer

    def forward(self, X):
        #forward propagation through our network
        self.z = np.dot(X, self.W1) # dot product of X (input) and first set of 3x2 weights
        self.z2 = self.sigmoid(self.z) # activation function
        self.z3 = np.dot(self.z2, self.W2) # dot product of hidden layer (z2) and second set of 3x1 weights
        o = self.sigmoid(self.z3) # final activation function
        return o

    def sigmoid(self, s):
        # activation function
        return 1/(1+np.exp(-s))

    def sigmoidPrime(self, s):
        #derivative of sigmoid
        return s * (1 - s)
```

Chrome File Edit View History Bookmarks Profiles Tab Window Help

Fri Feb 10 1:06 AM

localhost:8889/lab/tree/np.ipynb

File Edit View Run Kernel Tabs Settings Help

np.ipynb

Code

Python 3 (ipykernel)

np.ipynb

```
def sigmoidPrime(self, s):
    #derivative of sigmoid
    return s * (1 - s)

def backward(self, X, y, o):
    # backward propagate through the network
    self.o_error = y - o # error in output
    self.o_delta = self.o_error*self.sigmoidPrime(o) # applying derivative of sigmoid to error

    self.z2_error = self.o_error.T # z2 error: how much our hidden layer weights contributed to output error
    self.z2_delta = self.z2_error*self.sigmoidPrime(self.z2) # applying derivative of sigmoid to z2 error

    self.W1 += X.T.dot(self.z2_delta) # adjusting first set (input --> hidden) weights
    self.W2 += self.z2.T.dot(self.o_delta) # adjusting second set (hidden --> output) weights

def train(self, X, y):
    o = self.forward(X)
    self.backward(X, y, o)

def saveWeights(self):
    np.savetxt("W1.txt", self.W1, fmt="%s")
    np.savetxt("W2.txt", self.W2, fmt="%s")

def predict(self):
    print("Predicted data based on trained weights: ")
    print("Input (scaled): \n" + str(x_predicted))
    print("Output: \n" + str(self.forward(x_predicted)))

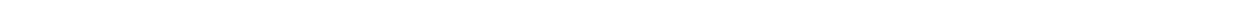
nn = neural_network()
for i in range(1000): # trains the nn 1,000 times
    print("Input: \n" + str(X))
    print("Actual Output: \n" + str(y))
    print("Predicted Output: \n" + str(nn.forward(X)))
    print("Loss: \n" + str(np.mean(np.square(y - nn.forward(X))))) # mean squared error
    print("\n")
    nn.train(X, y)

nn.saveWeights()
nn.predict()

# 0
```

Simple Python 3 (ipykernel) | Idle Mode: Command Ln 1, Col 1 np.ipynb

Show All



First 20 Iterations:

```
# 0
Input (scaled):
[[0.4 0.9]
 [0.2 0.5]
 [0.6 0.61]]
Actual Output:
[[0.92]
 [0.86]
 [0.89]]
Predicted Output:
[[0.65229878]
 [0.68835321]
 [0.68266773]]
Loss:
0.050467995967500866

# 1
Input (scaled):
[[0.4 0.9]
 [0.2 0.5]
 [0.6 0.61]]
Actual Output:
[[0.92]
 [0.86]
 [0.89]]
Predicted Output:
[[0.67136192]
 [0.68771587]
 [0.702043851]]
Loss:
0.04227693540159829

# 2
Input (scaled):
[[0.4 0.9]
 [0.2 0.5]
 [0.6 0.61]]
Actual Output:
[[0.92]
 [0.86]
 [0.89]]
Predicted Output:
[[0.67136192]
 [0.68771587]
 [0.702043851]]
Loss:
0.04227693540159829

# 3
Input (scaled):
[[0.4 0.9]
 [0.2 0.5]
 [0.6 0.61]]
Actual Output:
[[0.92]
 [0.86]
 [0.89]]
Predicted Output:
[[0.70342997]
 [0.71955828]
 [0.73417872]]
Loss:
0.03038299875801769

# 4
Input (scaled):
[[0.4 0.9]
 [0.2 0.5]
 [0.6 0.61]]
Actual Output:
[[0.92]
 [0.86]
 [0.89]]
Predicted Output:
[[0.71693458]
 [0.73417872]
 [0.75142291]]
```

Chrome File Edit View History Bookmarks Profiles Tab Window Help

localhost:8889/lab/tree/np.ipynb

File Edit View Run Kernel Tabs Settings Help

np.ipynb

Code

Python 3 (ipykernel)

5

```
Input (scaled): [[0.4 0.9] [0.2 0.5] [0.6 0.61]]  
Actual Output: [[0.92] [0.86] [0.89]]  
Predicted Output: [[0.74293956] [0.7429224] [0.7592397]]  
Loss: 0.022312693304660097
```

6

```
Input (scaled): [[0.4 0.9] [0.2 0.5] [0.6 0.61]]  
Actual Output: [[0.92] [0.86] [0.89]]  
Predicted Output: [[0.73811225] [0.73811225] [0.74599581]]  
Loss: 0.01932666025092677
```

Simple 0 1 Python 3 (ipykernel) | Idle Mode: Command Ln 1, Col 1 np.ipynb

np.ipynb

Show All

Chrome File Edit View History Bookmarks Profiles Tab Window Help

localhost:8889/lab/tree/np.ipynb

File Edit View Run Kernel Tabs Settings Help

np.ipynb

Code

Python 3 (ipykernel)

7

```
Input (scaled): [[0.4 0.9] [0.2 0.5] [0.6 0.61]]  
Actual Output: [[0.92] [0.86] [0.89]]  
Predicted Output: [[0.74971758] [0.7384116] [0.77922246]]  
Loss: 0.016638095948424725
```

8

```
Input (scaled): [[0.4 0.9] [0.2 0.5] [0.6 0.61]]  
Actual Output: [[0.92] [0.86] [0.89]]  
Predicted Output: [[0.75859485] [0.7210684] [0.787665147]]  
Loss: 0.014751077516664102
```

9

```
Input (scaled): [[0.4 0.9] [0.2 0.5] [0.6 0.61]]
```

Simple 0 1 Python 3 (ipykernel) | Idle Mode: Command np.ipynb

Fri Feb 10 1:07 AM

localhost:8889/lab/tree/np.ipynb

File Edit View Run Kernel Tabs Settings Help

np.ipynb

Actual Output:
[0.92]
[0.86]
[0.89]
Predicted Output:
[[0.76662858]
[0.77954642]
[0.79526268]]
Loss:
0.01299024357562459

10

Input (scaled):
[[0.4 0.9]
[0.2 0.5]
[0.6 0.6]]
Actual Output:
[[0.92]
[0.86]
[0.89]]
Predicted Output:
[[0.7739474]
[0.78626834]
[0.80213392]]
Loss:
0.011496055921568995

11

Input (scaled):
[[0.4 0.9]
[0.2 0.5]
[0.6 0.6]]
Actual Output:
[[0.92]
[0.86]
[0.89]]
Predicted Output:
[[0.78862629]

Simple 0 1 Python 3 (ipykernel) | Idle Mode: Command

np.ipynb



Fri Feb 10 1:07 AM

localhost:8889/lab/tree/np.ipynb

File Edit View Run Kernel Tabs Settings Help

np.ipynb

Actual Output:
[0.79236422]
[0.80836685]
Loss:
0.01022120054531896

12

Input (scaled):
[[0.4 0.9]
[0.2 0.5]
[0.6 0.6]]
Actual Output:
[[0.92]
[0.86]
[0.89]]
Predicted Output:
[[0.79673858]
[0.79791172]
[0.81403954]]
Loss:
0.009127851221516946

13

Input (scaled):
[[0.4 0.9]
[0.2 0.5]
[0.6 0.6]]
Actual Output:
[[0.92]
[0.86]
[0.89]]
Predicted Output:
[[0.79234767]
[0.88297687]
[0.81921867]]
Loss:
0.008185583727020967

Simple 0 1 Python 3 (ipykernel) | Idle Mode: Command

np.ipynb



Chrome File Edit View History Bookmarks Profiles Tab Window Help Fri Feb 10 1:07 AM

localhost:8889/lab/tree/np.ipynb np.ipynb - JupyterLab Home Inbox (1) - pshah30@lakehead...

File Edit View Run Kernel Tabs Settings Help

np.ipynb # 14

```
Input (scaled): [[0.4 0.9] [0.2 0.5] [0.6 0.61]] Actual Output: [[0.92] [0.86] [0.89]] Predicted Output: [[0.79750849] [0.88761608] [0.82396141]] Loss: 0.0073697803264423135
```

15

```
Input (scaled): [[0.4 0.9] [0.2 0.5] [0.6 0.61]] Actual Output: [[0.92] [0.86] [0.89]] Predicted Output: [[0.89226875] [0.8187766] [0.82831689]] Loss: 0.0066680404027183452
```

16

```
Input (scaled): [[0.4 0.9] [0.2 0.5] [0.6 0.61]]
```

Simple Python 3 (ipykernel) | idle Mode: Command np.ipynb



Chrome File Edit View History Bookmarks Profiles Tab Window Help Fri Feb 10 1:07 AM

localhost:8889/lab/tree/np.ipynb np.ipynb - JupyterLab Home Inbox (1) - pshah30@lakehead...

File Edit View Run Kernel Tabs Settings Help

np.ipynb # 17

```
Actual Output: [[0.92] [0.86] [0.89]] Predicted Output: [[0.86667002] [0.81580321] [0.8323275]] Loss: 0.00604105236817189
```

18

```
Input (scaled): [[0.4 0.9] [0.2 0.5] [0.6 0.61]] Actual Output: [[0.92] [0.86] [0.89]] Predicted Output: [[0.81494851] [0.81943641] [0.83603997]] Loss: 0.005498223228881094
```

19

```
Input (scaled): [[0.4 0.9] [0.2 0.5] [0.6 0.61]] Actual Output: [[0.92] [0.86] [0.89]] Predicted Output: [[0.81453626]]
```

Simple Python 3 (ipykernel) | idle Mode: Command np.ipynb



Chrome File Edit View History Bookmarks Profiles Tab Window Help Fri Feb 10 1:07 AM

localhost:8889/lab/tree/np.ipynb np.ipynb - JupyterLab Home Inbox (1) - pshah30@lakehead + Update

File Edit View Run Kernel Tabs Settings Help

np.ipynb

Filter files by name

/

Name Last Modified

- Applications 4 months ago
- Desktop seconds ago
- Documents 10 days ago
- Downloads a minute ago
- Movies 4 months ago
- Music 4 months ago
- opt 37 minutes ago
- Pictures 4 months ago
- Public 4 months ago
- np.ipynb seconds ago
- Untitled.ip... 27 minutes ago
- w1.txt 2 minutes ago
- w2.txt 2 minutes ago

19

```
Input (scaled): [[0.4 0.9] [0.2 0.5] [0.6 0.6]]  
Actual Output: [[0.92] [0.86] [0.89]]  
Predicted Output: [[0.81806969] [0.82589973] [0.84263396]]  
Loss: 0.00592074210148639
```

20

```
Input (scaled): [[0.4 0.9] [0.2 0.5] [0.6 0.6]]  
Actual Output: [[0.92] [0.86] [0.89]]  
Predicted Output: [[0.8213473] [0.8287962] [0.84558762]]  
Loss: 0.004226163567948058
```

Simple 0 1 Python 3 (ipykernel) | Idle Mode: Command

np.ipynb



Chrome File Edit View History Bookmarks Profiles Tab Window Help Fri Feb 10 1:07 AM

localhost:8889/lab/tree/np.ipynb np.ipynb - JupyterLab Home Inbox (1) - pshah30@lakehead + Update

File Edit View Run Kernel Tabs Settings Help

np.ipynb

Filter files by name

/

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- Movies 4 months ago
- Music 4 months ago
- opt 37 minutes ago
- Pictures 4 months ago
- Public 4 months ago
- np.ipynb a minute ago
- Untitled.ip... 27 minutes ago
- w1.txt 2 minutes ago
- w2.txt 2 minutes ago

21

```
Input (scaled): [[0.4 0.9] [0.2 0.5] [0.6 0.6]]  
Actual Output: [[0.92] [0.86] [0.89]]  
Predicted Output: [[0.82441794] [0.83149531] [0.84833854]]  
Loss: 0.0038947654421192276
```

22

```
Input (scaled): [[0.4 0.9] [0.2 0.5] [0.6 0.6]]  
Actual Output: [[0.92] [0.86] [0.89]]  
Predicted Output: [[0.82728945] [0.83401533] [0.85090553]]  
Loss: 0.00359960904023885
```

23

```
Input (scaled): [[0.4 0.9] [0.2 0.5] [0.6 0.6]]
```

Simple 0 1 Python 3 (ipykernel) | Idle Mode: Command

np.ipynb



Last 10 Iterations:

```
# 988
Input (scaled):
[[0.4 0.9]
 [0.2 0.5]
 [0.6 0.6]]
Actual Output:
[[0.92]
 [0.86]
 [0.89]]
Predicted Output:
[[0.89278128]
 [0.87882113]
 [0.89981682]]
Loss:
0.000397154613463399

# 989
Input (scaled):
[[0.4 0.9]
 [0.2 0.5]
 [0.6 0.6]]
Actual Output:
[[0.92]
 [0.86]
 [0.89]]
Predicted Output:
[[0.89278661]
 [0.87881626]
 [0.89981481]]
Loss:
0.00039699445130992494

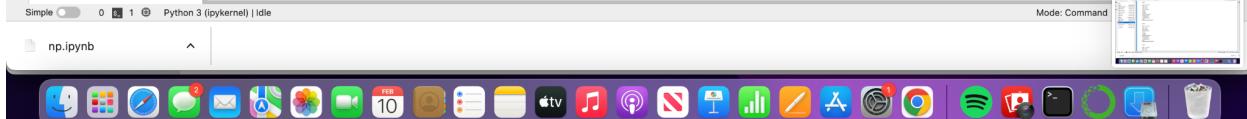
# 990
Input (scaled):
[[0.4 0.9]
 [0.2 0.5]
 [0.6 0.6]]
```



```
# 988
Input (scaled):
[[0.4 0.9]
 [0.2 0.5]
 [0.6 0.6]]
Actual Output:
[[0.92]
 [0.86]
 [0.89]]
Predicted Output:
[[0.89278074]
 [0.87881129]
 [0.89981288]]
Loss:
0.0003968344292277495

# 989
Input (scaled):
[[0.4 0.9]
 [0.2 0.5]
 [0.6 0.6]]
Actual Output:
[[0.92]
 [0.86]
 [0.89]]
Predicted Output:
[[0.89278075]
 [0.87881052]
 [0.899810791]]
Loss:
0.000396674547057076

# 990
Input (scaled):
[[0.4 0.9]
 [0.2 0.5]
 [0.6 0.6]]
Actual Output:
[[0.92]
 [0.86]
 [0.89]]
```



Fri Feb 10 1:08 AM

localhost:8889/lab/tree/np.ipynb

File Edit View Run Kernel Tabs Settings Help

np.ipynb

Code

Actual Output:
[0.92]
[0.86]
[0.89]

Predicted Output:
[[0.89280018]
[0.87880166]
[0.89980878]]

Loss:
0.000396514880463832645

993

Input (scaled):
[[0.4 0.9]
[0.2 0.5]
[0.6 0.61]]

Actual Output:
[[0.92]
[0.86]
[0.89]]

Predicted Output:
[[0.8928049]
[0.8787968]
[0.89980677]]

Loss:
0.0003963552018121364

994

Input (scaled):
[[0.4 0.9]
[0.2 0.5]
[0.6 0.61]]

Actual Output:
[[0.92]
[0.86]
[0.89]]

Predicted Output:
[[0.8928049]
[0.8787968]
[0.89980677]]

Loss:
0.0003963552018121364

Simple 0 1 Python 3 (ipykernel) | Idle Mode: Command

np.ipynb



Fri Feb 10 1:08 AM

localhost:8889/lab/tree/np.ipynb

File Edit View Run Kernel Tabs Settings Help

np.ipynb

Code

Actual Output:
[0.86]
[0.89]

Predicted Output:
[[0.89280962]
[0.87879394]
[0.89980477]]

Loss:
0.00039619573841936104

995

Input (scaled):
[[0.4 0.9]
[0.2 0.5]
[0.6 0.61]]

Actual Output:
[[0.92]
[0.86]
[0.89]]

Predicted Output:
[[0.89281434]
[0.87878799]
[0.89980277]]

Loss:
0.00039603641430105153

996

Input (scaled):
[[0.4 0.9]
[0.2 0.5]
[0.6 0.61]]

Actual Output:
[[0.92]
[0.86]
[0.89]]

Predicted Output:
[[0.89281985]
[0.87878224]
[0.89980076]]

Simple 0 1 Python 3 (ipykernel) | Idle Mode: Command

np.ipynb



Fri Feb 10 1:08 AM

localhost:8889/lab/tree/np.ipynb

File Edit View Run Kernel Tabs Settings Help

np.ipynb - Python 3 (ipykernel)

Code

np.ipynb

Filter files by name

/

Name Last Modified

- Applications 4 months ago
- Desktop seconds ago
- Documents 10 days ago
- Downloads 2 minutes ago
- Movies 4 months ago
- Music 4 months ago
- opt 38 minutes ago
- Pictures 4 months ago
- Public 4 months ago
- np.ipynb 2 minutes ago
- Untitled.ip... 28 minutes ago
- w1.txt 3 minutes ago
- w2.txt 3 minutes ago

Loss: 0.00039587722929847565

```
# 997
Input (scaled):
[[0.4 0.9]
 [0.2 0.5]
 [0.6 0.6]]
Actual Output:
[[0.92]
 [0.86]
 [0.89]]
Predicted Output:
[[0.89202375]
 [0.8787735]
 [0.89979876]]
Loss:
0.0003957181832531149
```

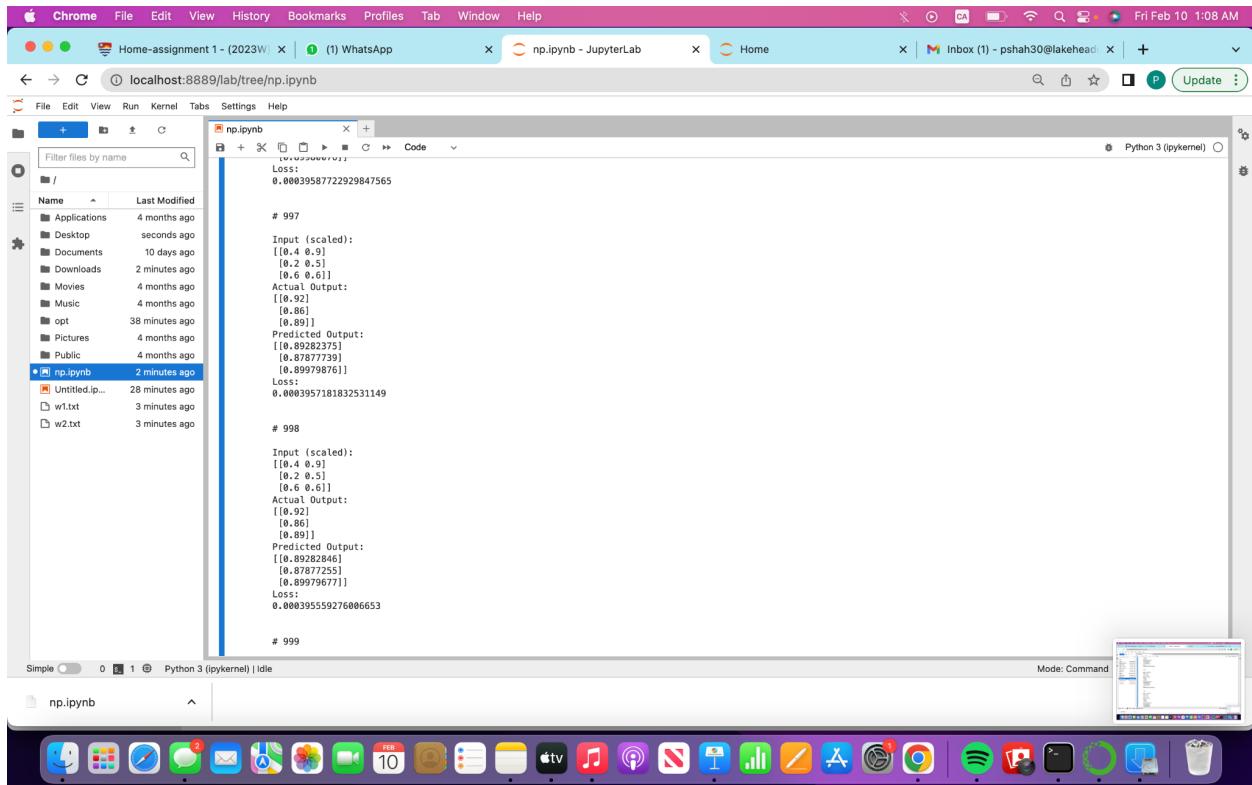
998

```
Input (scaled):
[[0.4 0.9]
 [0.2 0.5]
 [0.6 0.6]]
Actual Output:
[[0.92]
 [0.86]
 [0.89]]
Predicted Output:
[[0.89202375]
 [0.8787735]
 [0.89979876]]
Loss:
0.000395559276006653
```

999

Simple Mode: Command

np.ipynb



Fri Feb 10 1:08 AM

localhost:8889/lab/tree/np.ipynb

File Edit View Run Kernel Tabs Settings Help

np.ipynb - Python 3 (ipykernel)

Code

np.ipynb

Filter files by name

/

Name Last Modified

- Applications 4 months ago
- Desktop seconds ago
- Documents 10 days ago
- Downloads 2 minutes ago
- Movies 4 months ago
- Music 4 months ago
- opt 38 minutes ago
- Pictures 4 months ago
- Public 4 months ago
- np.ipynb 2 minutes ago
- Untitled.ip... 28 minutes ago
- w1.txt 3 minutes ago
- w2.txt 3 minutes ago

Loss: 0.000395559276006653

```
# 999
Input (scaled):
[[0.4 0.9]
 [0.2 0.5]
 [0.6 0.6]]
Actual Output:
[[0.92]
 [0.86]
 [0.89]]
Predicted Output:
[[0.89203316]
 [0.87876771]
 [0.89979477]]
Loss:
0.0003954085074009877
```

Predicted data based on trained weights:

```
Input (scaled):
[[1. 1.]]
Output:
[[0.91771253]]
```

Simple Mode: Command

np.ipynb

