

# CS589-HW4

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## 1 COMPSCI589 Homework 4

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### 1.1 Implementation of Backpropagation Algorithm

#### 1.1.1 Correctness Verification 1

To run the first correctness verification: use

```
from backprop_ex1 import *
```

which will output the following text

```
weights_list:
  [array([[0.4, 0.1],
          [0.3, 0.2]]), array([0.7, 0.5, 0.6])]
```

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```
Computing the error/cost, J, of the network
Processing training instance #0
activation1: 0.13
z2: [0.413 0.326]
activation2: [0.601807 0.5807858]
z3: 1.3493749808489859
activation3: 0.7940274264318581
propagated_output: 0.7940274264318581, expected_output: 0.9
current_J: 0.36557477431084995
```

```
Processing training instance #1
activation1: 0.42
z2: [0.442 0.384]
activation2: [0.60873549 0.59483749]
z3: 1.3612702382294442
activation3: 0.7959660671522611
propagated_output: 0.7959660671522611, expected_output: 0.23
current_J: 1.2763768066887786
```

```
Total J: 0.8209757904998143
```

```

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Running backpropagation
Processing training instance #0
activation1: 0.13
z2: [0.413 0.326]
activation2: [0.601807 0.5807858]
z3: 1.3493749808489859
activation3: 0.7940274264318581
delta_list: [array([0.]), array([-0.01269739, -0.01548092]), -0.10597257356814194]
gradient_list: [array([[ -0.01269739, -0.00165066],
                        [-0.01548092, -0.00201252]]), array([-0.10597257, -0.06377504, -0.06154737])]

Processing training instance #1
activation1: 0.42
z2: [0.442 0.384]
activation2: [0.60873549 0.59483749]
z3: 1.3612702382294442
activation3: 0.7959660671522611
delta_list: [array([0.]), array([0.06739994, 0.08184068]), 0.5659660671522612]
gradient_list: [array([[0.06739994, 0.02830797],
                        [0.08184068, 0.03437309]]), array([0.56596607, 0.34452363, 0.33665784])]

total gradient_list: [array([[0.02735127, 0.01332866],
                        [0.03317988, 0.01618028]]), array([0.22999675, 0.1403743 , 0.13755523])]

```

### 1.1.2 Correctness Verification 2

and to run the second correctness verification: run

```
from backprop_ex2 import *
```

which will output the following