Competitive Learning

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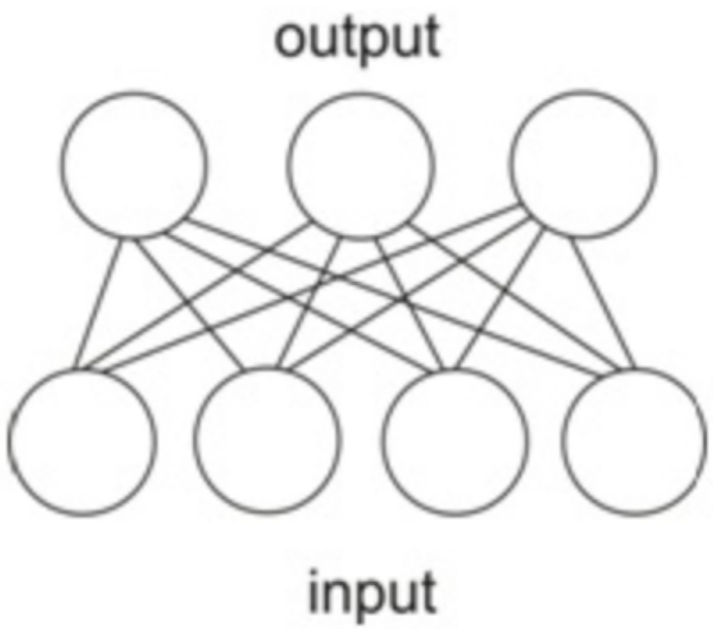
Network Architecture

```
training = np.zeros((120, 5), dtype=np.float)
validation = np.zeros((30, 5), dtype=np.float)
input = np.zeros(4, dtype=np.float)
output = np.zeros(3, dtype=np.float)
```



Training #1

```
dataset_num = random.sample(range(0, 150), 150)


while fold < 5:
    weight = np.random.uniform(0, 1, size=(3, 4))
    training = np.zeros((120, 5), dtype=np.float)
    validation = np.zeros((30, 6), dtype=np.float)
    y = fold * 30
    z += 30
    testing_num = dataset_num[y: z]
    training_num = list(set(dataset_num).difference(set(testing_num)))
    i = 0
    j = 0
```

Training #2

```
with open('iris.csv', newline='') as csvfile:
    rows = csv.DictReader(csvfile)
    for row in rows:
        # print(num)
        if num in testing_num:
            #print(num)
            validation[j][0] = row['sepal.length']
            validation[j][1] = row['sepal.width']
            validation[j][2] = row['petal.length']
            validation[j][3] = row['petal.width']
            x = row['variety']
            if (x == 'Setosa'):
                validation[j][5] = '0'
            if (x == 'Versicolor'):
                validation[j][5] = '1'
            if (x == 'Virginica'):
                validation[j][5] = '2'
            j += 1

        if num in training_num:
            # print(num)
            training[i][0] = row['sepal.length']
            training[i][1] = row['sepal.width']
            training[i][2] = row['petal.length']
            training[i][3] = row['petal.width']

            i += 1
```

Training #3 Normalization

```
    for i in range(4):
        validation[:, i] = validation[:, i] / (sum(validation[:, i]) + sum(training[:, i]))
        training[:, i] = training[:, i] / (sum(validation[:, i]) + sum(training[:, i]))

    for i in range(3):
        weight[i] = weight[i] / weight[i].sum()
```

Training #4 Forward

```
while epoch < 100000:

    num = random.randrange(0, 119)
    for i in range(4):
        input[i] = training[num][i]
    ###### Foward ######
    for j in range(3):
        output[j] = 0
        for i in range(4):
            output[j] += input[i] * weight[j][i]
```

Update

```
j = np.argmax(output)
for i in range(4):
    weight[j][i] = weight[j][i] + g * ((input[i] / input.sum()) - weight[j][i])

epoch = epoch + 1
```

Validation

```
    for x in range(30):
        for i in range(4):
            input[i] = validation[x][i]
        for j in range(3):
            output[j] = 0
            for i in range(4):
                output[j] += input[i] * weight[j][i]
        print(x,':  ans =',validation[x][5],'detect =',np.argmax(output))

fold += 1
```

Result

Fold #1

```
1 :  ans = 0.0 detect = 0
2 :  ans = 0.0 detect = 0
3 :  ans = 0.0 detect = 0
4 :  ans = 0.0 detect = 0
5 :  ans = 0.0 detect = 0
6 :  ans = 0.0 detect = 0
7 :  ans = 0.0 detect = 0
8 :  ans = 0.0 detect = 0
9 :  ans = 0.0 detect = 0
10 :  ans = 0.0 detect = 0
11 :  ans = 1.0 detect = 2
12 :  ans = 1.0 detect = 2
13 :  ans = 1.0 detect = 2
14 :  ans = 1.0 detect = 2
15 :  ans = 1.0 detect = 2
16 :  ans = 1.0 detect = 2
17 :  ans = 1.0 detect = 2
18 :  ans = 1.0 detect = 2
19 :  ans = 1.0 detect = 0
20 :  ans = 1.0 detect = 2
21 :  ans = 1.0 detect = 2
22 :  ans = 2.0 detect = 2
23 :  ans = 2.0 detect = 2
24 :  ans = 2.0 detect = 2
25 :  ans = 2.0 detect = 2
26 :  ans = 2.0 detect = 2
27 :  ans = 2.0 detect = 2
28 :  ans = 2.0 detect = 2
29 :  ans = 2.0 detect = 2
30 :  ans = 2.0 detect = 2
```

Fold #2

```
1 :  ans = 0.0 detect = 0
2 :  ans = 0.0 detect = 0
3 :  ans = 0.0 detect = 0
4 :  ans = 0.0 detect = 0
5 :  ans = 0.0 detect = 0
6 :  ans = 0.0 detect = 0
7 :  ans = 0.0 detect = 0
8 :  ans = 0.0 detect = 0
9 :  ans = 0.0 detect = 0
10 :  ans = 1.0 detect = 1
11 :  ans = 1.0 detect = 1
12 :  ans = 1.0 detect = 1
13 :  ans = 1.0 detect = 1
14 :  ans = 1.0 detect = 1
15 :  ans = 1.0 detect = 1
16 :  ans = 1.0 detect = 1
17 :  ans = 1.0 detect = 1
18 :  ans = 1.0 detect = 1
19 :  ans = 1.0 detect = 1
20 :  ans = 1.0 detect = 1
21 :  ans = 2.0 detect = 1
22 :  ans = 2.0 detect = 1
23 :  ans = 2.0 detect = 1
24 :  ans = 2.0 detect = 1
25 :  ans = 2.0 detect = 1
26 :  ans = 2.0 detect = 1
27 :  ans = 2.0 detect = 1
28 :  ans = 2.0 detect = 1
29 :  ans = 2.0 detect = 1
30 :  ans = 2.0 detect = 1
```

Fold #3

```
1 :  ans = 0.0 detect = 1
2 :  ans = 0.0 detect = 1
3 :  ans = 0.0 detect = 1
4 :  ans = 0.0 detect = 1
5 :  ans = 0.0 detect = 1
6 :  ans = 0.0 detect = 1
7 :  ans = 0.0 detect = 1
8 :  ans = 0.0 detect = 1
9 :  ans = 0.0 detect = 1
10 :  ans = 0.0 detect = 1
11 :  ans = 0.0 detect = 1
12 :  ans = 0.0 detect = 1
13 :  ans = 0.0 detect = 1
14 :  ans = 1.0 detect = 1
15 :  ans = 1.0 detect = 1
16 :  ans = 1.0 detect = 0
17 :  ans = 1.0 detect = 2
18 :  ans = 1.0 detect = 0
19 :  ans = 1.0 detect = 2
20 :  ans = 2.0 detect = 0
21 :  ans = 2.0 detect = 0
22 :  ans = 2.0 detect = 0
23 :  ans = 2.0 detect = 2
24 :  ans = 2.0 detect = 0
25 :  ans = 2.0 detect = 0
26 :  ans = 2.0 detect = 2
27 :  ans = 2.0 detect = 0
28 :  ans = 2.0 detect = 0
29 :  ans = 2.0 detect = 0
30 :  ans = 2.0 detect = 2
```

Fold #4

```
1 :  ans = 0.0 detect = 2
2 :  ans = 0.0 detect = 2
3 :  ans = 0.0 detect = 2
4 :  ans = 0.0 detect = 2
5 :  ans = 0.0 detect = 2
6 :  ans = 0.0 detect = 2
7 :  ans = 0.0 detect = 2
8 :  ans = 0.0 detect = 2
9 :  ans = 1.0 detect = 0
10 :  ans = 1.0 detect = 0
11 :  ans = 1.0 detect = 0
12 :  ans = 1.0 detect = 0
13 :  ans = 1.0 detect = 1
14 :  ans = 1.0 detect = 0
15 :  ans = 1.0 detect = 0
16 :  ans = 1.0 detect = 0
17 :  ans = 1.0 detect = 0
18 :  ans = 1.0 detect = 0
19 :  ans = 1.0 detect = 0
20 :  ans = 1.0 detect = 0
21 :  ans = 1.0 detect = 0
22 :  ans = 2.0 detect = 1
23 :  ans = 2.0 detect = 0
24 :  ans = 2.0 detect = 0
25 :  ans = 2.0 detect = 1
26 :  ans = 2.0 detect = 1
27 :  ans = 2.0 detect = 1
28 :  ans = 2.0 detect = 1
29 :  ans = 2.0 detect = 1
30 :  ans = 2.0 detect = 0
```

Fold #5

```
1 :  ans = 0.0 detect = 2
2 :  ans = 0.0 detect = 2
3 :  ans = 0.0 detect = 2
4 :  ans = 0.0 detect = 2
5 :  ans = 0.0 detect = 2
6 :  ans = 0.0 detect = 2
7 :  ans = 0.0 detect = 2
8 :  ans = 0.0 detect = 2
9 :  ans = 0.0 detect = 2
10 :  ans = 0.0 detect = 2
11 :  ans = 1.0 detect = 0
12 :  ans = 1.0 detect = 0
13 :  ans = 1.0 detect = 0
14 :  ans = 1.0 detect = 0
15 :  ans = 1.0 detect = 2
16 :  ans = 1.0 detect = 0
17 :  ans = 1.0 detect = 2
18 :  ans = 1.0 detect = 0
19 :  ans = 1.0 detect = 0
20 :  ans = 2.0 detect = 0
21 :  ans = 2.0 detect = 0
22 :  ans = 2.0 detect = 0
23 :  ans = 2.0 detect = 0
24 :  ans = 2.0 detect = 0
25 :  ans = 2.0 detect = 0
26 :  ans = 2.0 detect = 0
27 :  ans = 2.0 detect = 0
28 :  ans = 2.0 detect = 0
29 :  ans = 2.0 detect = 0
30 :  ans = 2.0 detect = 0
```