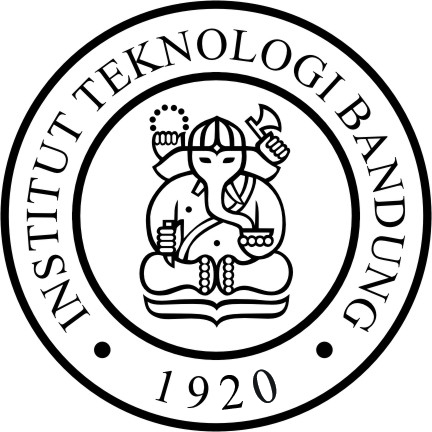
**TUGAS IMPLEMENTASI NEURAL NETWORK**

**IF4071 MACHINE LEARNING**



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# **Hasil Eksekusi**

## **Multilayer Perceptron**

//Configuration

learningRate = 0.1;  
momentum = 0.0;  
deltaMSEthreshold = 0.00001;  
maxIteration = 10000;

normalizeAttribute = yes;

activationFunction = Sigmoid;

topology = 1 hidden layer with 3 neurons

randomInitialWeight = yes

evaluation = using test set

### Weather Numeric

NEURAL NETWORK TOPOLOGY

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Hidden Layer 0

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Node 0 Activation Function = SIGMOID

Bias Weight = 0.9157406252516512

Weight from previous layer neuron0 = 1.8790401671873391

Weight from previous layer neuron1 = 1.4767671101606858

Weight from previous layer neuron2 = -1.8069818434366764

Weight from previous layer neuron3 = 1.5149839846437927

Weight from previous layer neuron4 = -0.28735471435729454

Weight from previous layer neuron5 = 2.945240928458917

Node 1 Activation Function = SIGMOID

Bias Weight = -0.6823701696636022

Weight from previous layer neuron0 = -3.978582585520162

Weight from previous layer neuron1 = 4.941778657708268

Weight from previous layer neuron2 = -0.10600892964164126

Weight from previous layer neuron3 = -2.286764849280576

Weight from previous layer neuron4 = -2.1975986762941404

Weight from previous layer neuron5 = 5.277543425263123

Node 2 Activation Function = SIGMOID

Bias Weight = -1.1704278589280424

Weight from previous layer neuron0 = -1.9801229261052122

Weight from previous layer neuron1 = 0.5020452204198911

Weight from previous layer neuron2 = 2.0935036880762934

Weight from previous layer neuron3 = 1.0493734380892434

Weight from previous layer neuron4 = 4.595288359526482

Weight from previous layer neuron5 = 1.7900664068504486

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Output Layer

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Activation Function = SIGMOID

Bias Weight = -0.8850182673107159

Weight from previous layer neuron0 = 2.741581103125547

Weight from previous layer neuron1 = 6.161619719999919

Weight from previous layer neuron2 = -4.367949996758652

Activation Function = SIGMOID

Bias Weight = 0.7533314671239184

Weight from previous layer neuron0 = -2.689060080222957

Weight from previous layer neuron1 = -6.249893399999873

Weight from previous layer neuron2 = 4.513901491789829

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Correctly Classified Instances 14 100 %

Incorrectly Classified Instances 0 0 %

Kappa statistic 1

Mean absolute error 0.0778

Root mean squared error 0.0982

Relative absolute error 16.7529 %

Root relative squared error 20.4797 %

Total Number of Instances 14

### Weather Nominal

NEURAL NETWORK TOPOLOGY

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Hidden Layer 0

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Node 0 Activation Function = SIGMOID

Bias Weight = -2.326988233824539

Weight from previous layer neuron0 = -2.513724408456283

Weight from previous layer neuron1 = 2.655111811882516

Weight from previous layer neuron2 = -1.4093384041535821

Weight from previous layer neuron3 = -0.8473851688760509

Weight from previous layer neuron4 = 1.1017628186067885

Weight from previous layer neuron5 = -2.3083238180894883

Weight from previous layer neuron6 = 4.294171839676748

Weight from previous layer neuron7 = 3.7910434773386084

Node 1 Activation Function = SIGMOID

Bias Weight = -0.4794906661380092

Weight from previous layer neuron0 = -2.2457024369518166

Weight from previous layer neuron1 = 2.2061004242982167

Weight from previous layer neuron2 = 1.4221084515693594

Weight from previous layer neuron3 = -0.3195559817967314

Weight from previous layer neuron4 = 0.24585534904192768

Weight from previous layer neuron5 = 1.1226449367629407

Weight from previous layer neuron6 = 4.138488525826388

Weight from previous layer neuron7 = 0.73428921330341

Node 2 Activation Function = SIGMOID

Bias Weight = 0.7083978333059683

Weight from previous layer neuron0 = 0.0848835129865091

Weight from previous layer neuron1 = -0.9670039668507193

Weight from previous layer neuron2 = 1.6936514125139763

Weight from previous layer neuron3 = 0.8546865499599161

Weight from previous layer neuron4 = 0.05604395511212379

Weight from previous layer neuron5 = 1.1636549491045105

Weight from previous layer neuron6 = -1.0000622250661577

Weight from previous layer neuron7 = 0.8790204427867253

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Output Layer

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Activation Function = SIGMOID

Bias Weight = -2.6906678541066142

Weight from previous layer neuron0 = 5.725856237493295

Weight from previous layer neuron1 = 2.9345714016220517

Weight from previous layer neuron2 = -2.670446945437455

Activation Function = SIGMOID

Bias Weight = 2.6750924692876907

Weight from previous layer neuron0 = -5.745935440097181

Weight from previous layer neuron1 = -3.005017496145442

Weight from previous layer neuron2 = 2.7650975820456907

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Correctly Classified Instances 14 100 %

Incorrectly Classified Instances 0 0 %

Kappa statistic 1

Mean absolute error 0.0741

Root mean squared error 0.0972

Relative absolute error 15.951 %

Root relative squared error 20.2613 %

Total Number of Instances 14

### Iris

NEURAL NETWORK TOPOLOGY

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Hidden Layer 0

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Node 0 Activation Function = SIGMOID

Bias Weight = 1.6832098750571494

Weight from previous layer neuron0 = 0.40923600238049

Weight from previous layer neuron1 = 0.9507834501229776

Weight from previous layer neuron2 = -0.25048789691048706

Weight from previous layer neuron3 = -0.5038222354463274

Node 1 Activation Function = SIGMOID

Bias Weight = -1.8543807447014813

Weight from previous layer neuron0 = 1.811971507897354

Weight from previous layer neuron1 = -3.5647421773552126

Weight from previous layer neuron2 = 5.228597355719405

Weight from previous layer neuron3 = 5.425701767199585

Node 2 Activation Function = SIGMOID

Bias Weight = -7.999147741660438

Weight from previous layer neuron0 = -1.1409855329168617

Weight from previous layer neuron1 = -3.064109800481986

Weight from previous layer neuron2 = 6.711464310140943

Weight from previous layer neuron3 = 8.527418799989002

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Output Layer

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Activation Function = SIGMOID

Bias Weight = 2.9649972415840935

Weight from previous layer neuron0 = 0.7824761168651361

Weight from previous layer neuron1 = -6.782820051235749

Weight from previous layer neuron2 = -4.632919775810493

Activation Function = SIGMOID

Bias Weight = -1.9562312188133677

Weight from previous layer neuron0 = -1.6266895913418278

Weight from previous layer neuron1 = 7.452675455495868

Weight from previous layer neuron2 = -8.790435160630848

Activation Function = SIGMOID

Bias Weight = -4.628616612119553

Weight from previous layer neuron0 = -2.818047845213337

Weight from previous layer neuron1 = 2.676873593638445

Weight from previous layer neuron2 = 9.381763651029198

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Correctly Classified Instances 145 96.6667 %

Incorrectly Classified Instances 5 3.3333 %

Kappa statistic 0.95

Mean absolute error 0.0596

Root mean squared error 0.1285

Relative absolute error 13.417 %

Root relative squared error 27.2534 %

Total Number of Instances 150

## **Single Perceptron Configuration**

learningRate = 0.1;

deltaMSEthreshold = 0.001;

mseThreshold = 0.001;//bila mse masih besar, lanjutkan iterasi

maxIteration = 10;

initialWeight = 0.0;

useNormalization = true; //normalize attribute

## **Single Perceptron – Perceptron Training Rule**

### Weather Numeric

Last Weight: [-0.200000, 0.000000, -0.400000, 0.200000, 0.266667, 0.296774, -0.600000]

Accuracy = 0.8571428571428571

### Weather Nominal

Last Weight: [0.400000, 0.400000, -0.600000, 0.600000, 0.400000, -0.200000, 0.200000, -0.800000, -0.400000]

Accuracy = 0.9285714285714286

### Iris

Not Supported

## **Single Perceptron – Delta Rule Batch**

### Weather Numeric

Last Weight: [256.258625, 97.212931, 68.238721, 90.806974, 128.056106, 149.561168, 169.488437]

Accuracy = 0.35714285714285715

### Weather Nominal

Last Weight: [522.874237, 184.679081, 139.360880, 198.834276, 141.488753, 218.738615, 162.646869, 290.989792, 332.233037]

Accuracy = 0.35714285714285715

### Iris

Not Supported

## **Single Perceptron – Delta Incremental**

### Weather Numeric

Last Weight: [-0.317130, 0.232561, -0.702135, 0.152444, 0.348839, 0.643711, -0.800695]

Accuracy = 0.7142857142857143

### Weather Nominal

Last Weight: [0.313212, 0.379554, -0.695489, 0.629147, 0.561551, -0.282048, 0.033708, -0.765562, -0.674430]

Accuracy = 0.8571428571428571

### Iris

Not Supported

# **Deskripsi**

Ekplorasi menggunakan library weka telah dikuasai dengan baik. Implementasi *Single Perceptron* diuji menggunakan data latihan kelas (excel tanpa normalisasi) dan sudah benar. Implementasi *Multilayer Perceptron* diuji dengan membandingkan dengan ANN pada weka dan menghasilkan performa yang cukup mirip. Impelmentasi *Multilayer Perceptron* (*custom*) sudah mampu dimodifikasi untuk banyak *hidden layer*, maupun kelas *numeric*. Apabila kelas merupakan kelas *numeric*, maka *neuron* pada *output layer* akan memiliki fungsi aktivasi *linear*.