Neuron Model for Input Uncertainty

by Zulfian Azmi

Submission date: 30-Oct-2023 12:54AM (UTC-0700)
Submission ID: 2211733782
File name: JTI_UNISSULA.Semarang.pdf (655.58K)
Word count: 2699
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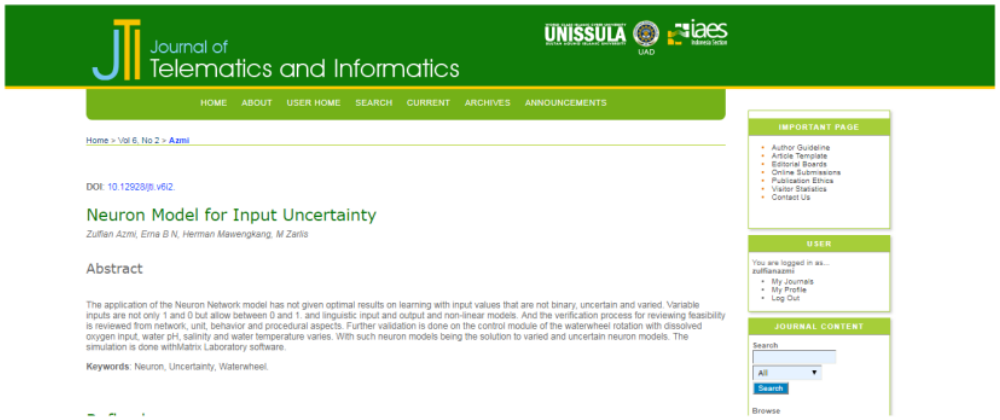
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Abstract
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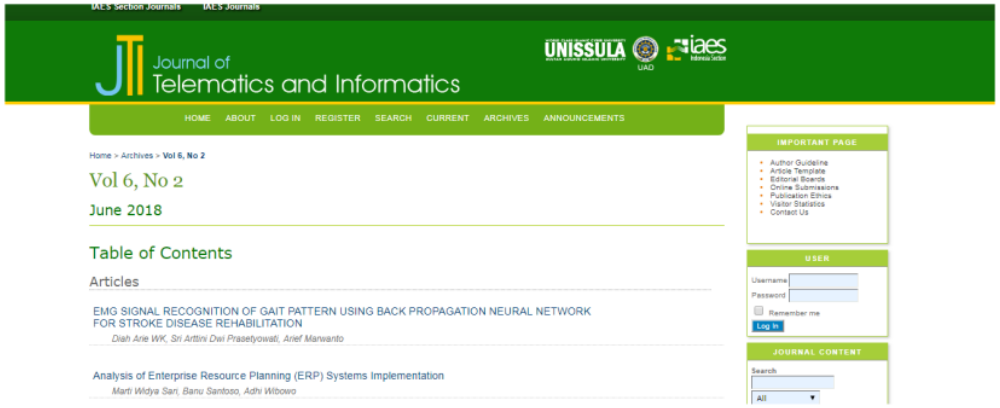
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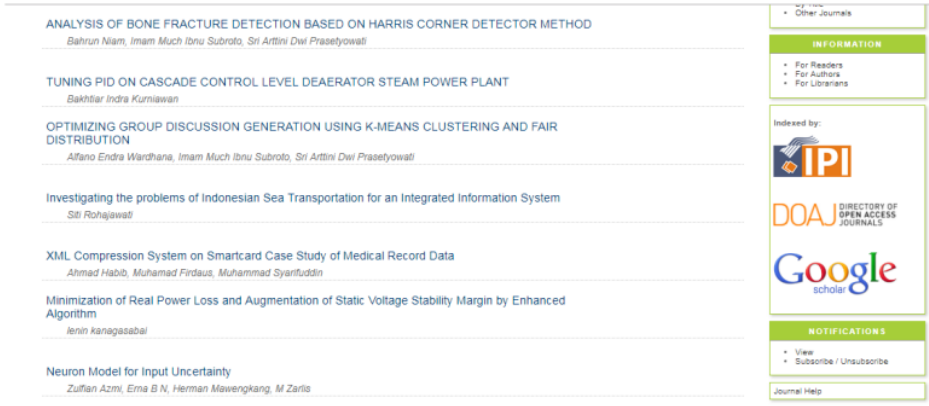
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Neuron Model for Input Uncertainty

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ABSTRACT

The application of the Neuron Network model has not given optimal results on learning with input values that are not binary, uncertain and varied. Variable inputs are not only 1 and 0 but allow between 0 and 1. and linguistic input and output and non-linear models. And the verification process for reviewing feasibility is reviewed from network, unit, behavior and procedural aspects. Further validation is done on the control module of the waterwheel rotation with dissolved oxygen input, water pH, salinity and water temperature varies. With such neuron models being the solution to varied and uncertain neuron models. The simulation is done withMatrix Laboratory software.

Keywords: Neuron, Uncertainty, Waterwheel.

1.Introduction

The neuron network model is more limited with binary. (J.J.De Groote & D.M.L.Barbato.2008). And the weakness of the neural network to operate the network needs training so that when the amount of data is large, and the time spent for the training process is very long (T.Sutojo et.al.2011). And a very critical point in the Neural Network creation of the form of activation function and the determination of the number of neurons in the hidden layer. Both of these will determine whether the learning process of Neural network will be converged (convergent) or not. (Yandra Arkemam.2012). And a Neural Network model looks good is determined by the relationship between neurons in the network architecture (T.Sutojo et al.2011). Furthermore, varied input issues and linguistics become an important thing to be solved on the neural network by grouping it in real time and it takes a fuzzy logic model. (David Zhang and Sankar K. Pal.2016). Can also use the Fuzzy Set Mamdani (MFS) method to represent linguistic meaning in solving the given problem. (Mojtaba Asadi.2016). Also Fuzzy Probalistic Expert System can be used for system training by using linguistic variables that can be understood by experts. (Mehran Amiri et all..2016).

And neural network has the ability to effectively modeling non-linear system with mapping between input and output. (Jagdish Chandra Patra.2016). Then also in case of input of natural signal or random video required learning algorithm more than 2 layer for its completion. (Strukov Farnood Merrikh Bayatet all.2016). Furthermore, this neuron model will be tested on a rotary control model design on Waterwheel with variable: Dissolved Oxigen, Temperature, salinity and water PH. A combination of techniques drawn from fuzzy logic and neural networks can design a more effective control system. In addition, neural network can be used to select the rule for Fuzzy Logic control in accordance with environmental conditions

different. And to build a fuzzy-neural network system is designed a system that has an input-output relationship as a fuzzy reasoning unit. (Shou-Heng Huang.1994).

2. Proposed Algorithm Method

2.1 Neuron Model

Neurons are the information processing units that form the basis for the operation of the Neurall Network. Neuuron consists of 3 forming elements:

1. The set of units connected to the connection path. The pathway has different weights or strengths. A positive value will amplify the signal and the negative will weaken the signal it carries. The number, structure and pattern of relationships among these units will determine the network architecture and network model that is formed.

2. A summing unit that will sum up the signal inputs that have been multiplied by their weight.

3. The activation function will determine whether the signal from the neuron input will be forwarded to another neuron or not. (Jong Jek Siang.2005).

These neurons are presented as models of biological neurons and as a conceptual component for ranges that can perform computational tasks. In the human brain, a certain neuron collects signals of stimulation from other neurons through dendrites. Signals coming and received by dendrites will be summation and sent through the axon to the final dendrite in contact with the dendrites of the other neurons. This signal will be received by another neuron if it meets certain thresold values. In this case, the neuron is said to be activated. The workings of the human brain can be simplified into models of neurons (Fig.2.2.1).

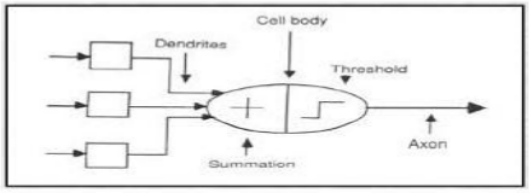

Fig. 2.1 Neuron Model

Learning in the human brain occurs when there is a relationship between one neuron with another that occurs adaptively and dynamically. And there are three important basic components when creating a functional model of biological neurons. First, the neuron synapses are modeled as weights. The lack of a link between the input and the neuron is determined by the weight value. The negative weight value reflects the resistor connection, while the positive values indicate the connection of the cell stimuli. The second component is the sum of all modified entries by each weight. This activity is called a linear combination. The third component acts as a function of activating the amplitude of the output of the neuron. Neural networks are generalizations of mathematical models with the following assumptions.

1. Information processing occurs in neurons.
2. The signals are sent between the neurons through the connecting of dendrites and axons.
3. Liaison between elements has a weight that will increase or decrease the signal.
4. To determine the output, each neuron has an activation function that is imposed on the sum of all its inputs. The larger output will be compared with certain thesold values. (T.Sutojo.2010). Based on the mathematical model, whether or not a neural network model is determined by the following things.

1. Network architecture, which is an architecture that determines patterns between neurons.
2. Learning method (learnig method), which is the method used to determine and change the weights.
3. Activation function

2.2 Model Uncertainty

The Uncertainty Model is one of Fuzzy Logic which is the foundation that provides the high capability of the final computing with the related coordinated distributed resources and ensures the delivery of computing resources as expected. And its performance can be assessed in terms of different criteria that must be considered simultaneously in the scheduling process. Fuzzy Logic is a collection of phrases. arithmetic expressions allow mapping of inputs assigned to an output. involves components of variables, membership functions, Fuzzy Logic operators and "if-then" rules (Zadeh 73). And when compared with conventional logic, the advantage of fuzzy logic is its ability to process reasoning in language so that in its design does not require complicated mathematical equations. Some of the reasons we can explain why we use fuzzy logic are easy to understand, tolerate improper data, capable of modeling very complex nonlinear functions, able to build and apply expert experiences directly without having to go through training process, able to cooperate with conventional control techniques, and based on natural language.

3.1 Discusion and Conclusion

3.1.1 Input Data

The input data is seen from table 3.1 relation between PH, temperature, dissolved oxygen and salinity.

X1	Y1	Z1 (PH)	W1

(Temperature/°C)	(DO(mg/l))		(Salinity)
0	14,62	7,5	34,9
1	14,22	7,48	34,8
2	13,83	7,46	34,7
3	13,46	7,44	34,6
4	13,11	7,42	34,5
5	12,77	7,40	34,1
6	12,45	7,38	34,2
7	12,14	7,36	34,3
8	11,84	7,34	34,2
9	11,56	7,32	33,18
10	11,29	7,30	33,16
11	11,03	7,28	33,14
12	10,78	7,26	34,1
13	10,54	7,24	34,35
14	10,31	7,22	34,6
15	10,08	7,20	34,7
16	9,87	7,18	34,8
17	9,66	7,16	34,9
18	9,47	7,14	35,0
19	9,28	7,12	35,2
20	9,09	7,10	35,2
21	8,91	7,08	35,2

22	8,74	7,06	35,1
23	8,58	7,04	34,9
24	8,42	7,03	35,1
25	8,26	7,01	35,3
26	8,11	7,01	35,4
27	7,97	7,00	35.5
28	7,83	6,69	35,6
29	7,69	6,98	35,7
30	7,56	6,97	35,8
31	7,43	6,96	35,9
32	7,30	6,96	4,00
33	7,18	6,94	4,10
34	7,06	6,94	4,20
35	6,95	6,93	4,21
36	6,84	6,91	4,22
37	6,73	6,90	4,23
38	6,62	6,90	4,24
39	6,51	6,91	4,25
40	6,2	6,92	4,26

Table 3.1 The relationship between PH and temperature. Matrix 40 x 4 (Hendri Setiawan.2015).

3 The degree of acidity (pH) of water less than 6.5 or acidic pH increases corrosivity in metallic substances, causing discomfort and may cause some chemicals to be toxic to health (Sutrisno, 2006). And reference the results of testing color, temperature, mph and salinity (Fig.3.1).

Criteria	Testing
Color	Cloudy
Temperature (^{0}C)	26
pH	7,6
Salinity	1,5
Colour	Clear
Temperature(0C)	26
pH	7,4
Salinity	0,5

Table.3.2 Test results Color, temperature, pH and Salinity (Hasrianti & Nurasia.2013).

3.1.2 Test case:

Input data on square meter of pond from 4x12 matrix:

No	X1 (Temperature/oC)	Y1 (DO(mg/l))	Z1 (PH)	W1 (Salinity)
1	20	9,09	7,10	35,2
2	21	8,91	7,08	35,2
3	22	8,74	7,06	35,1
4	23	8,58	7,04	34,9
5	24	8,42	7,03	35,1
6	25	8,26	7,01	35,3

7	26	8,11	7,01	35,4
8	27	7,97	7,00	35,5
9	28	7,83	6,69	35,6
10	29	7,69	6,98	35,7
11	30	7,56	6,97	35,8
12	31	7,43	6,96	35,9

3.1.3 Degree of Membership.

a. Degree of membership PH

The curve for degree of membership (μ) in the variable PH consists of three fuzzy sets namely Acid, Basa, Neutral.

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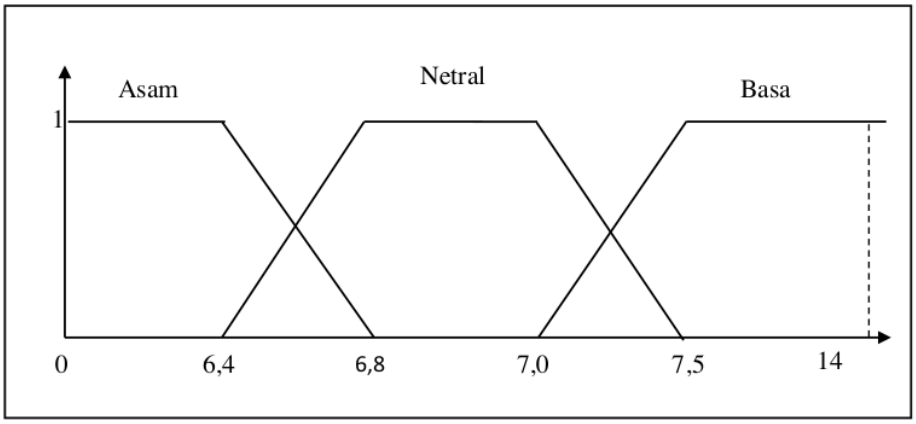

Fig.3.1 Degree of Sensor Membership PH

The degree of acidity of a substance (pH) is shown on a scale of 0-14.

- Solutions with pH (0-6,4) are acid.
- Solutions with a pH (6.5-7.5) are neutral.
- Solutions with pH (7,6-14) are Basa.

The value of PH water membership:

0 ; $x \geq 6,8$ 0, ; $\leq 7,0$

μ *Acid* [*x*]= $(6,8 - x) / (6,8 - 6,4)$, $6,4 \leq x \leq 6,8$ **μ*Basa* [*x*] =** $(x - 7) / (7,5 - 7,0)$; $7,0 \leq x \leq 7,5$

1; $x \leq 6,4$ 1; $x \geq 7,5$

10

0; $x \leq 6,4$ or $x \geq 7,5$

μ*Neutral* [*x*] = $(x - 6,4) / (6,8 - 6,4)$; $6,4 \leq x \leq 6,8$

1; $x \geq 6,8$ or $x \leq 7,0$

$(7,5 - x) / (7,5 - 7,0)$; $7,0 \leq x \leq 7,5$

b. Degree of Temperature membership

The curve for degrees of membership (μ) in the temperature variable consists of three fuzzy sets of heat, medium, cold.

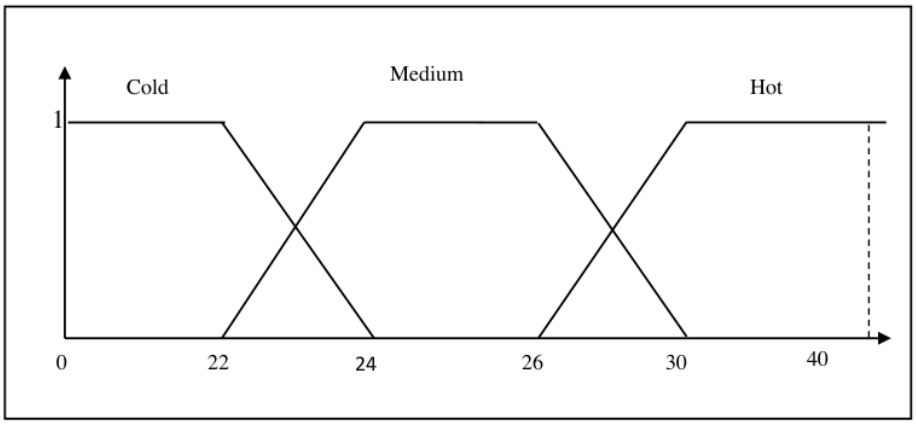

Fig.3.2 Degree of Temperature membership

The value of Temperature membership:

0 ; $x \geq 22$ 0, ; ≤ 26

μ *Cold* [*x*]= (24 - *x*) / (24 – 22), 22≤ x ≤24 **μ*Hot* [*x*]** = (*x*- 26) / (30 – 26); 26 ≤ x ≤ 30

1; $x \leq 24$ 1; $x \geq 30$

0; $x \leq 22$ or $x \geq 30$

μ*Medium*[*x*] = (*x*- 22) / (24 – 22); 22 ≤ *x* ≤ 24

1; $x \geq 24$ or $x \leq 26$

(30 - *x*) / (30 – 26); 26 ≤ *x* ≤ 30

c. The value of Salinity membership:

The curve for degree of membership (μ) in the variable consists of three fuzzy sets ie low, medium, high.

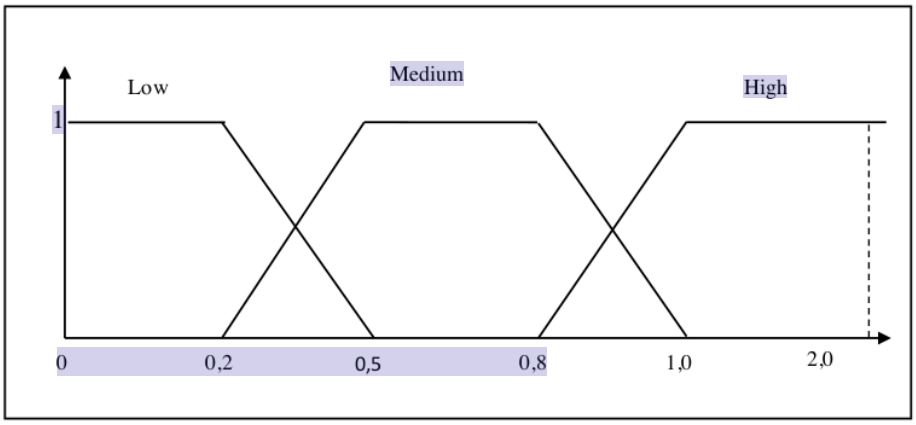

Fig.3.3 The value of Salinity membership

The value of Salinity membership:

0 ; $x \geq 0,2$ 0, ; ≤ 0,8

μ *Low* [*x*]= (0,5 - *x*) / (0,5 – 0,2), 0,2 ≤ x ≤ 0,5 **μ*High* [*x*]** = (*x*- 0,8) / (1,0 – 0,8); 0,8 ≤ x ≤ 1,0

1; $x \leq 0,5$ 1; $x \geq 1,0$

0; $x \leq 6{,}4$ or $x \geq 7{,}5$

μ*Medium* [*x*] = $(x - 22) / (24 - 22)$; $22 \leq x \leq 24$

1; $x \geq 24$ or $x \leq 26$

$(30 - x) / (30 - 26)$; $26 \leq x \leq 30$

d.Degree of membership of Disolved Oxygen

The curve for degree of membership (μ) on the variable consists of three fuzzy sets ie small, medium, large.

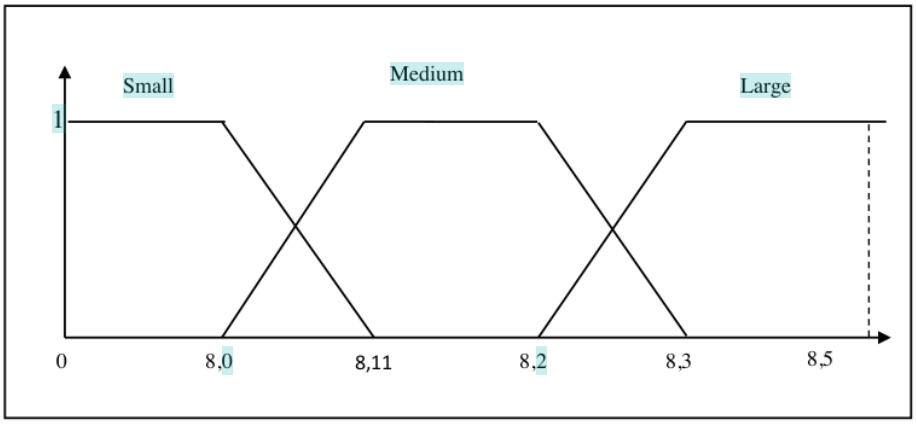

Fig.3.4 Degree of membership of Disolved Oxygen

The value of Salinity membership:

0 ; $x > 8{,}0$

μ *Small* [*x*]= $(8{,}11 - x) / (8{,}11 - 8{,}0)$, $8{,}0 \leq x \leq 8{,}11$

1; $x \leq 8{,}0$

0 ; $\leq 8{,}3$

μ*Large* [*x*] = $(x - 8{,}2) / (8{,}3 - 8{,}2)$; $8{,}2 \leq x \leq 8{,}3$

1; $x \geq 8{,}3$

0; $x \leq 8{,}0$ or $x \geq 8{,}3$

μ*Medium* [*x*] = $(x - 0{,}2) / (0{,}5 - 0{,}2)$; $0{,}2 \leq x \leq 0{,}5$

1; $x \geq 8{,}11$ or $x \leq 8{,}2$

$(8{,}3 - x) / (8{,}3\text{-}8{,}2)$; $8{,}3 \leq x \leq 8{,}2$

Furthermore, based on water PH criteria, temperature, salinity and dissolved oxygen For input matrix using with Fuzzy value.

No	X1 (Cold)	Y1 (DO/ Large)	Z1 (PH/Neutral)	W1 (Salinity/Tinggi)
1	1	1	0.8	1

$(7{,}5 - x) / (7{,}5 - 7{,}0)$; $7{,}0 \leq x \leq 7{,}5$, so μNetral [x] = 0.8

Inputs generated include: x1 = 1, x2 = 1, x3 = 0.8 and x4 = 1, converted into binary numbers. For value x3 = 0.8, converted into binary to:

0,8x2 =1.6

0,6x2= 1,2

0,2x2=0,4

So x4 = (. 110) 2 ,. So the input into the neuron becomes x1 = 1, x2 = 1, x3 = .110, x4 = 1, which will be processed in the neuron model will multiply by each weight and processed each layer. With training and testing will produce output on target.

4. Conclusion:

1.For input values that are not worth binary or decimal form are converted into binary form to be multiplied by weights and processed each layer through training and testing.

2. The existence of uncertainty model approach such as Fuzzy logic can be a solution to solve varied inputs.

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