



Implementation of the Backpropagation Method to Predict the Percentage of Women as Professionals on the Island of Sumatra

Tata Rizky Amalia¹, Solikhun²

¹STIKOM Tunas Bangsa, Indonesia

²AMIK & STIKOM Tunas Bangsa, Indonesia

ARTICLE INFO

Article history:

Received Jun 09, 2022

Revised July 09, 2022

Accepted August 28, 2022

Keywords:

Artificial Neural Network
Backpropagation
Performance
Professional

ABSTRACT

This study aims to obtain information on the best algorithm from the two algorithms that will be compared based on the smallest/lowest performance value or MSE value, which can later be used as a reference and information for solving women's problems as professional workers on the island of Sumatra. The data used in this study are women as professional workers (percent) 2012-2021 at the Central Statistics Agency (BPS). The algorithm used is Backpropagation Neural Network. Data analysis was carried out using the Artificial Neural Network method using Matlab R2011b(7.13) software. In this review, 5 structural models were used, namely: 4-10-1, 4-15-1, 4-20-1, 4-25-1, 4-30-1, out of five models.

This is an open access article under the [CC BY-NC](https://creativecommons.org/licenses/by-nc/4.0/) license.



Corresponding Author:

Solikhun

AMIK & STIKOM Tunas Bangsa

Jl. Sudirman, No.1, 2 & 3, Banjar, Pematang Siantar City, North Sumatra, 21142, Indonesia

Email: solikhun@amiktunasbangsa.ac.id

1. INTRODUCTION

Female professionals, as part of the workforce in general, have certain physical and mental qualities that make them unique in relation to male specialists. Nowadays, women are expected to be independent, far from looking weak and even though they can adapt to the increasingly wild competitive environment. The potential of female experts is in a troublesome position, this happens because the man-centric culture is still strong, although the correspondence issues of orientation, privilege and opportunity have been felt locally, but unfair practices are still experienced. In articles 5 and 6 of the Regulation of the Republic of Indonesia no. 13 of 2003 "every expert has the same open door and without separation to look for a new field of work.

Broadly speaking, there are three inspirations that encourage women to take part in the world of work, namely: 1). The financial component is to track extra pay. 2). Social elements, especially to work on economic welfare in the eyes of the community. 3). Self realization towards family and society (Nasution et al., 2020).

Strengthening women being developed is very important considering that women are taking on an important role coming soon to a country (Bhutta et al., 2005). When a woman is activated, especially in non-industrialized countries, she can make positive improvements in her family and surroundings (Kar et al., 1999). Women workers are very important in resilience and furthermore in increasing family wages (Anker, 1983); (Kelly, n.d.). Even Todaro (1994) states that knowledgeable mothers can improve conditions for their children and can increase human resources for society in the future. The empowerment of women should be made possible through wealth guidance, improved health, increased education, and increased women's finances (Hung et al., 2012).

2. RESEARCH METHODS

2.1 Data collection

This research using data Women as professional workers (Percent) on the island of Sumatra. Data sources from the Agency Center for Statistics (BPS) 2021.

Table 1. Women as Professionals (Percent)

Province/City	Woman as a Professional (Percent)									
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Aceh	52.12	53.14	53.28	52.43	51.7	54.71	54.69	53.92	52.73	54.42
North Sumatra	51.62	50.67	52.46	53.47	52.59	52.46	54.51	54.16	54.26	53.95
West Sumatra	54.19	55.32	57.05	56.75	58.17	57.64	55.48	55.36	58.97	59.09
Riau	46.46	49.12	52.94	49.24	52.45	53.67	51.95	51.18	52.58	55.44
Jambi	48.62	49.35	48.88	48.66	49.79	51.91	53.58	51.36	50.51	51.56
South Sumatra	49.34	51.32	52.09	53.31	52.37	49.25	53.66	55.28	54.37	56.15
Bengkulu	50.07	51.66	50.75	52.27	50.91	48.99	49.02	52.67	51.9	51.31
Lampung	51.21	49.14	51.08	46.24	54.13	50.52	50.48	50.75	53.05	53.06
Kep. Bangka Belitung	45.73	47.03	47.87	49.64	48.99	49.36	48.94	53.15	51.7	54.1
Kep. Riau	46.22	42.97	38.43	46.41	45.81	41.63	37.98	43.16	46.12	47.79

2.2 Backpropagation Algorithm

Calculation backpropagation is a managed evaluation calculation and is often used by perceptrons with various display screens to change the load on the secret cluster (Cynthia & Ismanto, 2017). Backpropagation is a simple and basic iterative computation that generally performs good, even with complex information (Wanto, 2018). The reason for backpropagation is to adjust the load to prepare the brain organization to properly handle the erratic contribution to produce (Devireddy & Rao, 2009). Layered perceptrons can be prepared using backpropagation calculations. The goal is to read the load for all relationships in a complex organization (Dutton et al., 1997). The basic blunder capability in the weight space is determined using a slope reduction strategy. The resulting weights that offer basic error capabilities are the answer to the learning problem (Mochammad Haldi Widiyanto, 2021).

2.3 Artificial Neural Network

Artificial Neural Network is one of the fake pictures of people which generally seeks to reflect the impelling encounter in the human psyche. The term artificial is used here because this neural network is carried out using a PC program that can complete various estimation processes during the educational experience (Andrijasa & Mistianingsih, 2016).

2.4 Professional

Professional, shows two things. To begin with, the individual who has the calling; for example, "he's an expert". Second, the presence of individuals in managing their business according to their calling. In the following sense, the term proficient appears differently in relation to "nonprofessional or novice" (Sururi, 2002).

2.5 Research Framework

The Framework is the fundamental theoretical design used to overcome or deal with confusing issues. This term is often used, among other things, in the field of programming reusable, as well as in the executive field to illustrate an idea that allows the treatment of different types or elements of a business homogeneously. As for the skeleton research work can be illustrated in the following figure:

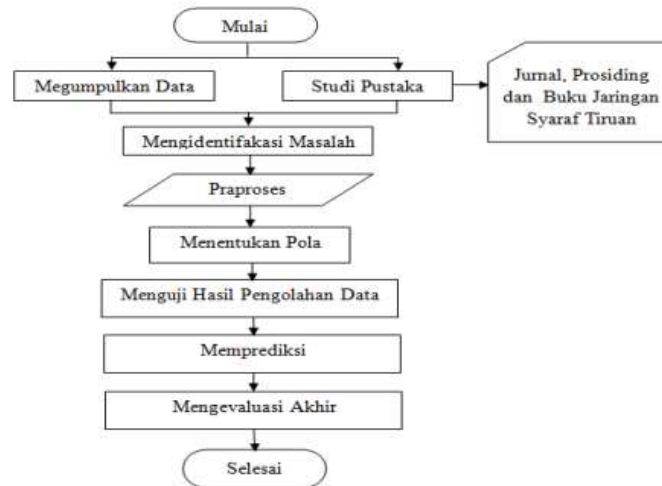


Figure 1. Research Framework

2.6 Data Used

The data sources used are women as professional workers in 2012-2021. The training data uses data from 2012-2015 and 2016 is the target. On the other hand, data testing using data from 2017-2020 and 2021 is the target (Oh et al., 2021). Next meeting with testing the consequences of data handling by testing using programming Matlab R2011b (7.13.) And until the final assessment stage, the goal is to see if the results formed are correct (Thomas & Harden, 2008)

2.7 Data processing

Before information handled, the information is standardized first using Sigmoid (never reaches 0 or 1), this information will later be transformed to an information between 0 to 1 before trying training and testing using an artificial neural network. The formula used to perform normalization is:

$$x' = \frac{0.8(x-a)}{b-a} + 0.1 \quad (1)$$

Information :

(x' = Normalized data, x = Data to be normalized, a = Lowest data, b = Highest data)

Table 2. Data on Initial Training for 2012-2015/Target for 2016

Province/City	Woman as Power Professional (Percent) (Training Data)				
	2012	2013	2014	2015	2016(Target)
Aceh	52.12	53.14	53.28	52.43	51.7
North Sumatra	51.62	50.67	52.46	53.47	52.59
West Sumatra	54.19	55.32	57.05	56.75	58.17
Riau	46.46	49.12	52.94	49.24	52.45
Jambi	48.62	49.35	48.88	48.66	49.79
South Sumatra	49.34	51.32	52.09	53.31	52.37
Bengkulu	50.07	51.66	50.75	52.27	50.91
Lampung	51.21	49.14	51.08	46.24	54.13
Kep. Bangka Belitung	45.73	47.03	47.87	49.64	48.99
Kep. Riau	46.22	42.97	38.43	46.41	45.81

Table 3. Normalization 2012-2015 Training Data/2016 Target

No.	2012	2013	2014	2015	2016
1	0.6548	0.6961	0.7018	0.6674	0.6378
2	0.6345	0.5960	0.6686	0.7095	0.6739
3	0.7387	0.7845	0.8546	0.8425	0.9000
4	0.4254	0.5332	0.6880	0.5381	0.6682
5	0.5130	0.5426	0.5235	0.5146	0.5604
6	0.5421	0.6224	0.6536	0.7030	0.6649
7	0.5717	0.6362	0.5993	0.6609	0.6058
8	0.6179	0.5340	0.6127	0.3165	0.7363
9	0.3958	0.4485	0.0363	0.5543	0.5280
10	0.4157	0.2840	0.1000	0.4234	0.3991

Table 4. Initial Testing Data for 2017-2020 / 2021 Target

Province/City	Women as Professionals (Percent) (Testing Data)				
	2017	2018	2019	2020	2021(Target)
Aceh	54.71	54.69	53.92	52.73	54.42
North Sumatra	52.46	54.51	54.16	54.26	53.95
West Sumatra	57.64	55.48	55.36	58.97	59.09
Riau	53.67	51.95	51.18	52.58	55.44
Jambi	51.91	53.58	51.36	50.51	51.56
South Sumatra	49.25	53.66	55.28	54.37	56.15
Bengkulu	48.99	49.02	52.67	51.9	51.31
Lampung	50.52	50.48	50.75	53.05	53.06
Kep. Bangka	49.36	48.94	53.15	51.7	54.1
Belitung					
Kep. Riau	41.63	37.98	43.16	46.12	47.79

Table 5. Normalization of Testing Data for 2017-2020/Targrt for 2021

No.	2017	2018	2019	2020	2021
1	0.7340	0.7333	0.7041	0.6590	0.7230
2	0.6487	0.7264	0.7132	0.7170	0.7052
3	0.8450	0.7632	0.7586	0.8955	0.9000
4	0.6946	0.6294	0.602	0.6533	0.7617
5	0.6279	0.6912	0.6071	0.5748	0.6146
6	0.5271	0.6942	0.7556	0.7211	0.7886
7	0.5172	0.18	0.6567	0.6275	0.6052
8	0.5752	0.5737	0.5839	0.6711	0.6715
9	0.5313	0.5153	0.6749	0.6199	0.7109
10	0.2383	0.1000	0.2963	0.4085	0.4718

3. RESULTS AND DISCUSSIONS

3.1 Architectural Design and Results

Architecture used and results which is obtained in This research can be seen in the table below.

Table 6. Network Architecture

Characteristics	Specification
Input Data	4
Hidden Layers	10,15,20,25,30
Goal	0.01
Maximum epoch	1000
Learning Rate	0.1

Table 7. Training Results and Test

Model	Epoch	Mse
4-15-1	74	0.00549583
4-30-1	121	0.01054370
4-45-1	174	0.01470704
4-60-1	109	0.01985139
4-75-1	340	0.07773210

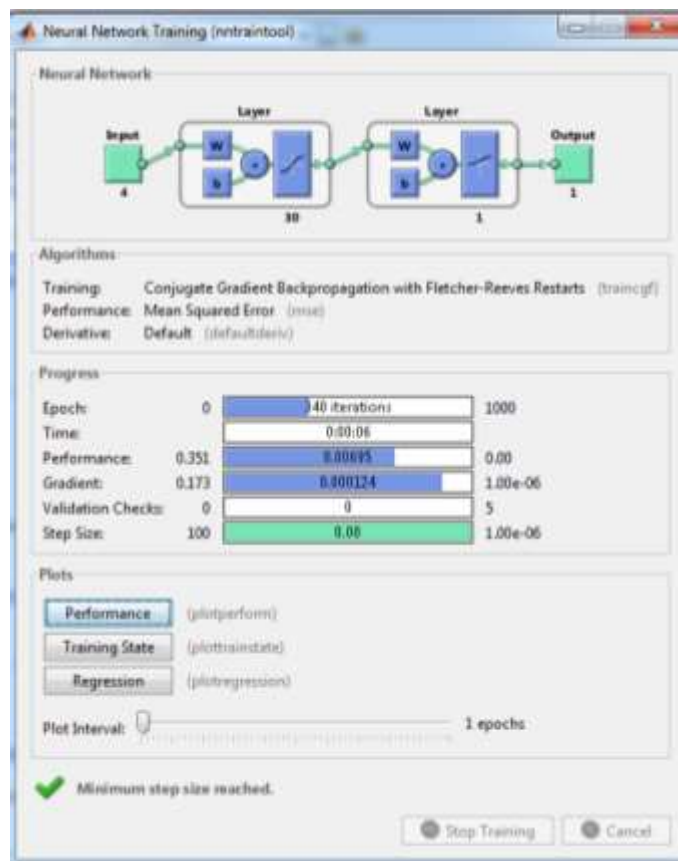


Figure 2. Results of Training Data With Architecture 4-30-1

Based on the results of training and testing, the Model architecture 4-30-1 is the best architecture with epochs of 340 iterations with a fairly fast time of 6 seconds.

Table 8. Best Architectural Model 4-30-1

Training Data				Testing Data				
Target	actual	Error	SSE	Target	actual	Error	SSE	Results
0.6378	0.6380	-0.0002	0.00000004	0.7230	0.4518	0.2712	0.07356152	1

Target	Training Data			Target	Testing Data			Results
	actual	Error	SSE		actual	Error	SSE	
0.6739	0.6737	0.0002	0.00000003	0.7052	0.5855	0.1197	0.01433068	1
0.9000	0.9004	-0.0004	0.00000016	0.9000	0.9979	-0.0979	0.00958441	1
0.6682	0.6686	-0.0004	0.00000017	0.7617	0.2858	0.4759	0.22645885	1
0.5604	0.5600	0.0004	0.00000015	0.6146	0.3148	0.2998	0.08990259	1
0.6649	0.6648	0.0001	0.00000002	0.7886	0.4342	0.3544	0.12558774	1
0.6058	0.6061	-0.0003	0.00000011	0.6052	0.9566	-0.3514	0.12350766	1
0.7363	1.0000	-0.2637	0.06955271	0.6715	0.6597	0.0118	0.00013883	1
0.5280	0.5280	0.0000	0.00000000	0.7109	0.9696	-0.2587	0.06692812	1
0.3991	0.3992	-0.0001	0.00000001	0.4718	0.6893	-0.2175	0.04732063	1
		Amount	0.06955339			Amount	0.77732104	100%
		MSE	0.00695534			MSE	0.07773210	

Description: 1 = True / True 0 = False / False

4. CONCLUSION

Given the exploration that has been carried out, in this study several objectives can be obtained, namely: (1)Of the five compositional models used for testing, the best technique is obtained which produces an emphasis value of 340, with a period of 00:06, and an MSE of 0.07773210, namely Design 4-30-1. (2) In testing the five structures described above, different consequences of the accuracy of the backpropagation calculations are made. (3)The architectural model decision is very interesting to get the ideal level of performance.

ACKNOWLEDGEMENTS

We would like to thank all those who have contributed to this research, so that the research can be carried out properly.

REFERENCES

- Andrijasa, M. F., & Mistianingsih, M. (2016). Penerapan Jaringan Syaraf Tiruan Untuk Memprediksi Jumlah Pengangguran di Provinsi Kalimantan Timur Dengan Menggunakan Algoritma Pembelajaran Backpropagation. *Informatika Mulawarman: Jurnal Ilmiah Ilmu Komputer*, 5(1), 50–54.
- Anker, R. (1983). Female Labour Force Participation in Developing Countries: A Critique of Current Definitions and Data Collection Methods. *International Labour Review*, 122.
- Bhutta, Z. A., Darmstadt, G. L., Hasan, B. S., & Haws, R. A. (2005). Community-based interventions for improving perinatal and neonatal health outcomes in developing countries: a review of the evidence. *Pediatrics*, 115(Supplement_2), 519–617.
- Cynthia, E. P., & Ismanto, E. (2017). Jaringan syaraf tiruan algoritma backpropagation dalam memprediksi ketersediaan komoditi pangan provinsi riau. *Rabit: Jurnal Teknologi Dan Sistem Informasi Univrab*, 2(2), 83–98.
- Devireddy, S. K., & Rao, S. A. (2009). HAND WRITTEN CHARACTER RECOGNITION USING BACK PROPAGATION NETWORK. *Journal of Theoretical & Applied Information Technology*, 5(3).
- Dutton, J. E., Ashford, S. J., O'neill, R. M., Hayes, E., & Wierba, E. E. (1997). Reading the wind: How middle managers assess the context for selling issues to top managers. *Strategic Management Journal*, 18(5), 407–423.
- Hung, A., Yoong, J., & Brown, E. (2012). *Empowering women through financial awareness and education*.
- Kar, S. B., Pascual, C. A., & Chickering, K. L. (1999). Empowerment of women for health promotion: a meta-analysis. *Social Science & Medicine*, 49(11), 1431–1460.
- Kelly, J. (n.d.). *Women, History, and Theory: The Essays of Joan Kelly - Joan Kelly - Google Buku*.
- Mochammad Haldi Widiyanto. (2021). *Analisis Performa Algoritma Backpropagation Jaringan Syaraf Tiruan | BINUS UNIVERSITY BANDUNG - Kampus Teknologi Kreatif*. 1 April.

- Nasution, Y. S. J., Syahriza, R., & Marliyah. (2020). Analisis Partisipasi Tenaga Kerja Perempuan dalam Pemenuhan Kesejahteraan Keluarga di PTKIN seSumatera. *Kafaah: Journal of Gender ...*, 10(2), 145–158.
- Oh, D.-Y., Buda, S., Biere, B., Reiche, J., Schlosser, F., Duwe, S., Wedde, M., von Kleist, M., Mielke, M., & Wolff, T. (2021). Trends in respiratory virus circulation following COVID-19-targeted nonpharmaceutical interventions in Germany, January-September 2020: Analysis of national surveillance data. *The Lancet Regional Health-Europe*, 6, 100112.
- Sururi, S. (2002). Meningkatkan Profesionalisasi Guru Dan Kepala Sekolah. *Meningkatkan Profesionalisasi Guru Dan Kepala Sekolah*, 11.
- Thomas, J., & Harden, A. (2008). Methods for the thematic synthesis of qualitative research in systematic reviews. *BMC Medical Research Methodology*, 8(1), 1–10.
<https://www.academia.edu/download/83668768/pdf.pdf>