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Original Article

The Applications of Neural Networks Involve Analyzing Data that Influences Factors in the Development of Learning Digital Circuits with the NX-100 Board Model

Tavat Ruamsub[1], Tipaporn Supamid[2]

[1]*Faculty of Engineering and Technology, Computer Engineering and Information, Rattana Bundit University, Thailand.*
[2]*Department of Computer Engineering, Faculty of Engineering, Kasem Bundit University, Thailand.*

[2]*Corresponding Author : tipaporn.sup@kbu.ac.th*

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Abstract *- The purpose of this project is to apply neural networks to the analysis of data related to variables impacting the evolution of education in the field of computer engineering and technology. In particular, the NX-100 digital circuit experiment kit is the subject of this investigation. We look at a sample dataset that was gathered from Rattana Bundit University students who were enrolled in Microprocessor courses and Digital 1 subjects and had a normal status. The NX-100 digital circuit experiment kit tested normally for every participant, which made data collecting simple. The instructor's exercises were followed in order to administer the tests, which were done using the NX-100 digital circuit experiment kit. The researcher is prepared to offer thorough data for a variety of subject analyses. The research focuses on the following areas: 1. Give a summary of the responders in general. 2. Report on aspects of microprocessor/computer architecture and digital circuit experimentation, such as the Model NX-100. 3. Using the NX-100 digital circuit experiment kit, provide information on the components involved in developing educational materials for computer engineering and technology. 4. A report on the software and hardware used in computer engineering and technology education, with additional information drawn from articles on the subject from Rattana Bundit University. Nevertheless, the following details are included to provide an overview of the study's findings: 1) Study details: 4.78 is the median value. 2) Personnel data: 4.99 is the median score. 3) The median value of the data on internet access points and computer services is 4.82. 4) The median score for data on test formats and the advancement of education is 4.99. 5) The median value of the information on internationalization is 4.99. The researcher draws the conclusion that most respondents primarily agreed with the question statements, which are arranged in descending order of median significance based on the material that has been presented.*

Keywords *- Microprocessor, Innovation in Microprocessors, Model NX-100 digital circuit experiment kit.*

1. Introduction

The development of solid-state technology and digital computer technology in the 1970s led to the emergence of microprocessors. This begs the question: How can digital computers effectively handle and process data by carrying out computer program instructions? Basic elements, including memory, input/output devices, and computational circuits, are necessary for smooth operation. Together, these elements provide the architecture which sets the structure for information delivery. Interestingly, microprocessor design closely resembles that of a digital computer. Since both run on the same program, a microprocessor and a digital computer are essentially the same thing. To comprehend the workings of microprocessors, a deeper investigation into the history of digital computers is required. Studying the development of solid-state circuits helps us better understand microprocessors, which are essentially solid-state circuits. Digital computers were first created for the military in the middle of the 1940s and subsequently found use in industry and science. A work on pulse circuits—high-speed digital computers—supported military applications and offered new perspectives during World War 2. Following the war, a great deal of research was devoted to developing solid-state materials. Solid state technology led Bell Labs scientists to a major breakthrough in 1948 with the invention of the transistor. Digital computers are made up of many circuits. The first digital computers were built with vacuum tubes and were very big. The internal circuits of the vacuum tubes became overheated as a result of their extended use. Despite this, there was just a specific place for data storage on early computers; there was no allocated room for programming. Computers began to use patching, a novel technique for receiving program commands, in the late 1940s and early 1950s. In order to process data, the programmer had to connect cables to the machine using the

patch-cord method. The only memory on the machine is used to store data. Programs are saved on computers in modern computing, indicating that the workings of the machine are kept in memory. Computer architecture is the process of designating the location of data, identifying work processes, or determining data for processing; all of these tasks are carried out using techniques that determine the position of the data.

Modern technology develops inventions and procedures that can be applied in work systems, enabling revolutionary changes and advances in job performance. It does this by utilizing knowledge, tools, concepts, principles, processes, and scientific works. Furthermore, microprocessor innovation is a complex process that involves technological development and analysis. With a specific focus on the microprocessor, this process hopes to encourage the creation of innovative hardware and software products. These developments may result in the production of novel hardware forms or instruments that are subsequently released onto the market.

The NX-100 digital circuit experiment kit is intended to be used as a specialist tool to help analysts, scholars, and researchers with their thought, analysis, and research processes. Its main objective is to aid in the creation of new inventions. With the help of this kit, users can use a variety of tools to develop varied microprocessor prototypes, significantly contributing to the realization of contemporary inventions in the current technological landscape.

2. Related Theories and Research

2.1. Technology

Technology encompasses the translation of knowledge from the natural sciences into practical applications. It serves as a method for practicing and applying this knowledge to assist in work and solve diverse problems. This, in turn, leads to the development of materials, equipment, tools, machines, and even abstract knowledge. Such advancements may involve the creation of various systems or processes with the ultimate goal of making human life easier and more convenient. In essence, technology encompasses the products and solutions developed by humans to facilitate work and address diverse problems. This includes tangible items like equipment, tools, machines, and materials, as well as intangible elements such as various processes. Technology is the practical application of scientific knowledge, bringing tangible benefits to humanity. It harnesses scientific understanding to create a variety of things, optimizing their functionality for maximum advantage. This distinction highlights a fundamental difference between technology and science. Unlike science, technology is intricately linked to economic factors, encompassing the buying and selling of goods. In contrast, scientific knowledge serves as a communal resource, globally distributed without any commercial exchange. In summary, modern technology is built upon the foundation of scientific knowledge.

Jatuporn Rawengjit and Muthita Martmool studied computer service problems in the classroom in 2561, concentrating on a Rajamangala University of Technology Suvarnabhumi case study. Lecturers from six faculties—Education, Industry, Science and Technology, Engineering and Architecture, Business Administration and Information Technology, Liberal Arts, and Agricultural Technology and Agro-Industry—made up the sample group. Faculty-based stratified random sampling was used in the selection procedure, and the final sample size of 254 people was established by comparing proportions. A closed-ended questionnaire divided into three sections served as the assessment tool: materials and equipment, computer systems in the classroom, and computer service providers. The questionnaire was designed to assess service recipients' fundamental computer skills.

Kanakarn Phanniphong, Wongpanya S. Nuankaew, Patchara Nasa-Ngium, and Pratya Nuankaew in 2023. The COVID-19 impact led to hybrid learning with online and onsite services. This research aimed to cluster learners based on behaviors, develop a predictive model for clusters, and assess its effectiveness. The study included 24 students from a Technology for Business Application course at the University of Phayao. Machine learning techniques (e.g., K-Means, Decision Tree, Naïve Bayes, KNN, Neural Networks, Generalized Linear Model, Support Vector Machine) were used and evaluated with cross-validation and confusion matrix methods. Results showed appropriate clustering into three groups correlating with learning achievement, achieving high predictive model accuracy (96.67% ±10.54% S.D.). Dissemination of findings is important for the public interest.

2.2. Microprocessor

A microprocessor is a chip serving as the central processing unit of a microcomputer. The term "microprocessor architecture" refers to the internal structure of the microprocessor. When comparing different microprocessors, options include the 8-bit single-chip microprocessor, known as the 8051, and the 32-bit microprocessor, identified as the 80486. Analyzing the numeric designations (8051 and 80486) suggests that the addition of these numbers might imply similar methods and internal structures in these microprocessors.

Kittisak Angkhanawin studied the creation of an experimental kit and assessed the effectiveness of controlling a robot with a microcontroller board in 2020. The study conducted on Microcontrollers and Interfaces revealed that the expert panel thoroughly assessed the experimental kits, resulting in an extremely high evaluation score. Students also conveyed a great deal of satisfaction. The experimental set's efficiency tests yielded an average score of 8.78 out of 92.36, exceeding the 80/80 threshold. In conclusion, it is thought that the created experimental set will improve the efficiency of instruction in the area of microprocessors and interfaces.

The 2015 research study by Tseng-Lung Huang and Shuling Liao sought information about the Technology Acceptance Model and the idea of experiential value. With a focus on consumer inventiveness, the goal was to investigate the variables impacting sustainable relationship behavior with reference to the usage of augmented reality and the Internet of Things (ARIT). Online shoppers who are very creative place a high priority on qualities like beauty, utility, and superior customer service. Conversely, those with weaker degrees of creativity typically place more emphasis on enjoyment and convenience.

2.3. Microprocessor Innovation

The efficiency of the NX-100 digital circuit experiment set is the main focus of microprocessor innovation. In order to complete this evaluation, students studying computer engineering and technology will use the NX-100 digital circuit set, which includes a numerical control LED light circuit that can be adjusted using the microprocessor board. The initiative's goals go beyond evaluation; they also include improving and updating instructional materials to conform to modern technology requirements. In the classroom, it also acts as a catalyst to enhance the learning process for both teachers and pupils. The research tools include the Digital circuit experiment kit, model NX-100, and instruments for efficiency assessment. This encompasses an evaluation form completed by five experts, assessing the appropriateness of the experimental set. Additionally, a satisfaction questionnaire was administered to the sample group of students enrolled in the course "Microprocessors and Digital 1" within the Bachelor of Engineering Program at the Department of Computer Engineering and Technology, Rattana Bundit University, with a total of 67 participants.

The 2020 study by Kittisak Ungkanawin examined how system quality and technology innovation affect digital marketing effectiveness in the Thailand 4.0 age, particularly in the online trade industry. Three main goals were sought after by the study: 1) examine the strategic factors of technological innovation and quality in Thailand's digital marketing systems; 2) assess the effectiveness of digital marketing within internet trading in the Thailand 4.0 era; and 3) use structural equation modeling to determine how innovation, technology, and system quality affect digital marketing effectiveness in the Thailand 4.0 era. The study used a quantitative approach to its investigation. Interestingly, the study found that, in the Thailand 4.0 era, organizational technological innovation has a major role in the positive effectiveness of digital marketing. In the Thailand 4.0 era, the efficacy of digital marketing is indirectly influenced by the processes of communication, innovation and technological features, and corporate decision-making. The study determined a number of variables, including technological innovation, organizational innovation, and technology quality, that are impacted by the spread of innovative technology. It is noteworthy that both innovation and communication depend heavily on technology. Additionally, in the Thailand 4.0 era, a few variables indirectly enhance the efficacy of digital marketing. This beneficial impact is brought about by the broad adoption of technological innovation and a decision-making process that optimizes its application. In this particular setting, quality, innovation, and technology are important influencing elements. Furthermore, the findings demonstrated that organizational factors—with a particular focus on quality, innovation, and technology—have a direct impact on the spread of technical advances. These elements have a direct impact on how decisions about innovation are made as well.

In 2020, Sharnil Pandya put forth a research technique that sought to provide a workable framework for quickly informing homeowners or other members of the community about thefts that were underway, especially those involving unlawful access to property. In order to identify research gaps, a thorough examination of current systems was carried out in order to accomplish this goal. The problem with the existing systems is that they cannot identify intruders until after the theft has taken place, and they have trouble telling human objects apart from non-human ones. The concepts and applications of smart home solutions are expanding with the integration of Wireless Sensor Networks (WSNs) with the Internet of Things (IoT) and Cognitive Internet of Things.

In 2021, Sureshkumar Jha, Rohan Sawant, Parth Shinde, Rakhi Kalantri, and Shagufta Rajguru presented a system that might be used in real-time situations to efficiently track, recognize, and tag certain items or persons. The idea is to take into account the arrangement of cameras in a specific setting or area. Through these cameras, users are able to monitor intruders who seek to avoid discovery by learning how the surveillance system works. The solution is implemented in any site where people's movements are tracked by the system, which records and stores data. However, if it infringes on someone's privacy, it is acceptable to forgo recording their movements. To improve the identification and mapping of a particular subject on the user interface, the researchers created and examined a distributed algorithm. Lastly, real-time demonstrations or ongoing algorithm training are used to evaluate the distributed system's robustness and performance.

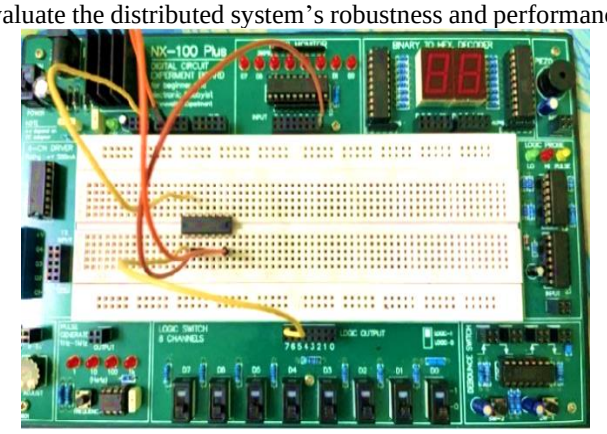

Fig. 1 Digital circuit experiment set, model NX-100

2.4. Digital Circuit Experiment Kit, Model NX-100

The Digital Circuit Experiment Kit, model NX-100, is an electronic circuit experiment board that resembles a thick white plastic sheet. The plate features a large number of holes arranged in a contiguous pattern, each containing an electrical conductor. These conductors are connected according to a defined operational configuration. During experimentation, users can insert the pins of IC devices or electronic components into the internal conductors, allowing the circuit to connect through these electrical pathways. Additionally, wires may be inserted into the holes to establish connections within the electrical circuit. This is illustrated in the following example:

The paragraph is clear and coherent. However, I would suggest a slight modification for better flow and clarity: Figure 1 illustrates the use of a digital circuit experiment set, model NX-100, for testing a board equipped with 1 IC numbered 7404 and 4 wires. The main objective of this test was to confirm whether the wires and IC could function as electrical conductors within the board, establishing connections between circuits through electrical pathways. Furthermore, the evaluation aimed to determine the feasibility of inserting wires into the holes to create connections within an electrical circuit. The test results can be summarized as follows: the system successfully performs normal on-off testing of the electrical system.

In a different study published in 2020, Decha Puangdaoruang explores the real-time digital PID controller developed with the Z180CPU assembly language software. The topic of discussion is how to build the control program with real-time behavior, including integral terms and interrupt approaches with an anti-windup mechanism. Presenting the findings of real-time PID control testing, the paper also discusses the size and duration needed to run the control program.

3. Research Methods

The research design entails a survey study utilizing descriptive research methods, employing questionnaires as tools for data collection. The main objective is to investigate the factors influencing microprocessor technology. The survey research followed these sequential steps: 1) determination of the population and sample. 2) selection of translators. 3) creation of data collection instruments. 4) conducting data collection. 5) performing data analysis. 6) utilizing tools in data analysis. 7) applying statistical methods in data analysis.

3.1. Defining the Population and Sample

The population for this research comprised 30 first- and second-year students in Bangkok Province, selected as a sample through random population sampling. These students are enrolled in both public and private sectors and are currently studying between their 1st and 2nd years. The researcher employed a simple random sampling method.

3.2. Variables Studied

The independent variable in this study is the area where students are studying. The dependent variables encompass fundamental factors influencing the quality of learning about microprocessor technology.

3.3. Research Tools

A questionnaire was the research tool employed in this study. The questionnaire is broken up into these four sections.

Part 1: Personal information required for completing the questionnaire.
Part 2: Inquiries focusing on microprocessor /computer architecture factors and experimental considerations for digital circuits, with a specific emphasis on model NX-100.
Part 3: Interrogations addressing the development of teaching methodologies using the NX-100 digital circuit experiment kit within the realm of computer engineering and technology.
Part 4: Queries related to the equipment and tools employed in teaching computer engineering and technology.
Part 5: Interrogations exploring the landscape of computer engineering and technology in Thailand.
Part 6: Results of data analysis using the application of neural networks.

3.4. Data Collection

To disseminate questionnaires, the researcher sought the assistance of computer engineering and information technology school instructors. Under the supervision of Bangkok's public and commercial sectors, the data collection procedure involved enlisting the assistance of first- through third-year students at Rajamangala University of Technology Tawan-Ok, Rattana Bundit University, and other universities. Forms were disseminated and gathered from November 1, 2022, to November 30, 2022.

3.5. Data Analysis

Analyzing information about basic factors that affect learning about microprocessor technology to improve quality. The operations are as follows.

1. Verify the completeness of the received questionnaires, ensuring all 30 copies are complete.
2. Analyze fundamental information about the respondents, including their area of study.
3. Examine information about the basic factors influencing the quality of learning about microprocessor technology. Calculate the average for each aspect, group-wise, and provide the aggregate results in a table that goes with the presentation.

4. Conduct a comparative analysis by calculating the average for each aspect, sorted by group and overall. Present the results in the form of a table for the presentation, categorized by gender.
5. Analyze the open-ended questionnaire data regarding suggestions for researchers, group the responses, and present the results for descriptive data analysis.

3.6. Instruments for Analyzing Data

The purpose of the Statistical Package for the Social Sciences (SPSS) is to analyze statistical data in different formats. Because SPSS Version 26 can handle the necessary data analysis and is ready to offer services, it was chosen for this study.

3.7. Statistics used to Analyze Data

The researcher has analyzed the data using statistical values for analysis as follows:

1. Percentage
2. Average

4. Research Results

This research offers a comprehensive summary of the test results, with an emphasis on employing neural networks to analyze and identify variables related to improving teaching and learning for students studying computer engineering and technology using the NX-100 digital circuit experiment kit. The summarized results illuminate key trends, challenges, or advancements observed during the investigation. According to the data presented in Table 1, the findings pertaining to the gender distribution of the participants are outlined. Within the first section, which focuses on the Personal Data of the Respondents, examination of Items 1 and 2 demonstrated that 72.00 percent of the participants who opted for option 1 were identified as male, whereas 28.00 percent of those who selected option 2 were classified as female.

As illustrated in Table 2, the findings pertain to the duration of academic pursuit by the participants. Within the section denoted as Part 1, focusing on the Personal Information of the Participants, the examination of Items 1 and 2 in a descending sequence unveiled that a total of 2.00 percent of individuals who selected Alternative 1 were in their inaugural year of study. In contrast, the remaining 98.00 percent were enrolled as second-year students. As per Table 3, the outcomes pertain to the microprocessors and computer architecture of the respondents. Within Part 2, the inquiries concerning microprocessor technology garnered median ratings of 4.9975, 4.9700, and 4.9675 in a decreasing sequence. This suggests a prevailing consensus among the respondents in strong concurrence with the assertions outlined in said inquiries.

Part 1: Personal information to answer the questionnaire.

Table 1. The results regarding the gender of the respondents

Respondent's gender					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Sex	1.00	20	72.0	72.0	72.0
	2.00	10	28.0	28.0	28.0
	Total	30	100.0	100.0	

Table 2. The results regarding the respondents' years of study

Academic year					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Year	1.00	2	02.0	02.0	02.0
	2.00	28	98.0	98.0	98.0
	Total	30	100.0	100.0	

Part 2: Questions about microprocessor/computer architecture factors and digital circuit experiment factors, model NX-100

Table 3. The results about respondents' microprocessors and computer architecture

Microprocessors/Computer Architecture							
Detailed Information	**N**	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**	**Kurtosis**	
						Statistic	**Std. Error**
1. There should be a data register.	30	1.00	5.00	4.035	0.78122	0.637	0.243
2. Should have memory.	30	2.00	5.00	4.255	0.79785	-0.923	0.243
3. There should be a sequence of controls.	30	4.00	5.00	4.998	0.05000	40.000	0.243
4. There should be a command decoder.	30	4.00	5.00	4.968	0.17755	26.143	0.243
5. There should be a command counter in the program.	30	4.00	5.00	4.970	0.17080	28.737	0.243

Table 4. The results regarding the NX-100 digital set for answers

Digital experiment set model NX-100							
Detailed Information	**N**	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**	**Kurtosis**	
						Statistic	**Std. Error**
1. There should be 8 sets of logic switches using high-quality sliding switches.	30	4.00	5.00	4.9950	0.07062	0.480	0.243
2. There should be 8 logic monitor channels.	30	3.00	5.00	4.7850	0.45198	3.018	0.243
3. There should be a pulse generator circuit.	30	3.00	5.00	4.7675	0.52834	3.982	0.243
4. There should be a circuit to decode binary numbers into hexadecimal.	30	4.00	5.00	4.9975	0.05000	4.000	0.243
5. It should have an LED driver.	30	3.00	5.00	4.7850	0.45198	3.018	0.243
6. There should be a teaching book.	30	4.00	5.00	4.0350	0.78122	0.637	0.243
7. There should be a wire connected to the circuit.	30	3.00	5.00	4.7850	0.45198	3.018	0.243
8. It should have a 9/12 V adapter.	30	4.00	5.00	4.8175	0.38674	0.727	0.243
9. Should have IC.	30	4.00	5.00	4.8225	0.38257	0.875	0.243

Part 3: Questions about factors for developing teaching with the NX-100 digital circuit experiment kit for computer engineering and information technology.

Table 5. The results of the study

Study							
Detailed Information	**N**	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**	**Kurtosis**	
						Statistic	**Std. Error**
1. The content of the courses studied meets the needs of computer engineering and information technology students.	30	2.00	5.00	4.0950	0.79218	0.095	0.243
2. The course content is modern.	30	3.00	5.00	4.7850	0.45198	3.018	0.243
3. Receiving the development of intellectual skills, being able to apply knowledge to Solve problems creatively, correctly and appropriately.	30	1.00	5.00	4.0350	0.78122	0.637	0.243

Table 6. The results about the personnel

Personnel							
Detailed Information	**N**	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**	**Kurtosis**	
						Statistic	**Std. Error**
4. Teachers have knowledge, abilities, and expertise in the subject content.	30	4.00	5.00	4.9925	0.08639	129.975	0.243
5. Teachers have methods for measuring and evaluating results.	30	4.00	5.00	4.9900	0.09962	96.224	0.243
6. Suitability of the advisor system.	30	4.00	5.00	4.9825	0.13129	52.834	0.243

Table 7. The results about the providing computer services and internet access points

Providing computer services and internet access points							
Detailed Information	**N**	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**	**Kurtosis**	
						Statistic	**Std. Error**
7. Sufficiency of computers.	30	4.00	5.00	4.8175	0.38674	0.727	0.243
8. The wireless network system covers every part of the university.	30	4.00	5.00	4.8225	0.38257	0.875	0.243
9. Computer and network problem consulting services are provided by computer center staff.	30	4.00	5.00	4.8175	0.38674	0.727	0.243

Table 8. The results of the models of testing and development of learning and teaching

Models of testing and development of learning and teaching							
Detailed Information	**N**	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**	**Kurtosis**	
						Statistic	**Std. Error**
10. There should be a lot of equipment per experiment. Analyze experiments.	30	4.00	5.00	4.9900	0.09962	96.224	0.243
11. There should be guidelines for working in a step-by-step format.	30	4.00	5.00	4.9650	0.18401	23.921	0.243
12. Have a prototype or model of results to accompany the experiment.	30	4.00	5.00	4.9950	0.07062	197.480	0.243

Table 9. The results of internationalism

Internationalism							
Detailed Information	**N**	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**	**Kurtosis**	
						Statistic	**Std. Error**
13. Can be tested and accepted	30	4.00	5.00	4.9875	0.11124	75.974	.243
14. Have reliable hardware	30	4.00	5.00	4.9900	0.09962	96.224	.243

Part 4: Questions about equipment and tools used in teaching computer engineering and technology.

Table 10. The results of the teaching and learning support

Teaching and learning support							
Detailed Information	**N**	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**	**Kurtosis**	
						Statistic	**Std. Error**
15. There are appropriate teaching equipment.	30	3.00	5.00	4.7625	0.54021	3.866	0.243
16. Suitability of classroom size and number of students.	30	3.00	5.00	4.8025	0.48897	5.385	0.243
17. Cleanliness and orderliness of the classroom.	30	3.00	5.00	4.7925	0.46366	4.062	0.243
18. Sufficiency of materials and equipment used in the laboratory.	30	3.00	5.00	4.7850	0.48411	4.178	0.243

As per the data presented in Table 4, the outcomes pertaining to the NX-100 digital kit are outlined. The second section delves into inquiries revolving around the NX-100 digital experimental kit, unveiling median figures of 4.9975, 4.9950, and 4.9925 in a descending sequence. This suggests that a prevailing number of participants exhibited a high level of concurrence with the assertions posited in these inquiries. Based on Table 5, the findings regarding the investigation are presented. The data pertaining to education provided in Section 3 indicated median figures of 4.7850, 4.0950, and 4.0350 in a decreasing sequence, implying a high level of agreement among the participants with the statements posed in those inquiries.

As per Table 6, the outcomes concerning the personnel are detailed. Within Section 3, as per the personnel chart, median figures of 4.9925 - 4.9900 and 4.9825 were identified in a descending sequence. The implications of these findings indicate that most participants exhibited strong agreement with the assertions outlined in the inquiries. Based on Table 7, the findings pertain to the provision of computer services and internet access locations. Within Section 3, the table reveals median figures of 4.8225 and 4.8175 in descending sequence for computer services and internet access sites, respectively. These results suggest that a significant proportion of participants in the specified cohort expressed strong concurrence with the provided query. According to Table 8, the findings pertain to the testing and development models within the realm of learning and teaching. Within Part 3, there is a reference to a table that showcases the test format as well as the progress in learning and teaching, with median values of 4.9950, 4.9900, and 4.9650 arranged in a descending sequence. This pattern indicates a strong inclination towards agreement among the majority of participants regarding the provided question statement. Based on Table 9, the findings concerning internationalism in Part 3 reveal median values of 4.9900 and 4.9875 in descending sequence as per the internationalization table. These results signify a notable consensus among most participants towards the stated question. According to the data presented in Table 10, the findings pertaining to the provision of teaching and learning support are delineated. Within Part 4 of the study, the tabulated results from the teaching support section reveal median ratings of 4.8025, 4.7925, and 4.7850 in a descending sequence. This trend indicates a prevailing consensus among the participants within the cohort, demonstrating strong agreement with the proposed queries.

Part 5 : Questions about computer engineering and technology in Thailand.

In Part 5, we employed open-ended questions to collect respondents' opinions:

1. What are your thoughts on computer engineering and technology in Thailand?
2. Are you aware of any job opportunities in the field of computer engineering and technology? Please share details about your knowledge or experience.
3. What is your stance on the establishment of computer engineering and technology programs in Thailand, and how do you propose integrating these programs with other science subjects?

The findings from Part 5, based on the aforementioned open-ended questions, revealed the following:

1. Respondents expressed the view that computer engineering and technology are increasingly intertwined with various businesses, including the computer industry, science, and engineering.
2. Respondents indicated that computer engineering and technology programs have already been established at some universities.
3. Respondents suggested aligning computer engineering and technology fields with computer science, information technology, and other related computer-oriented disciplines.

Part 6: Results of data analysis using the application of neural networks

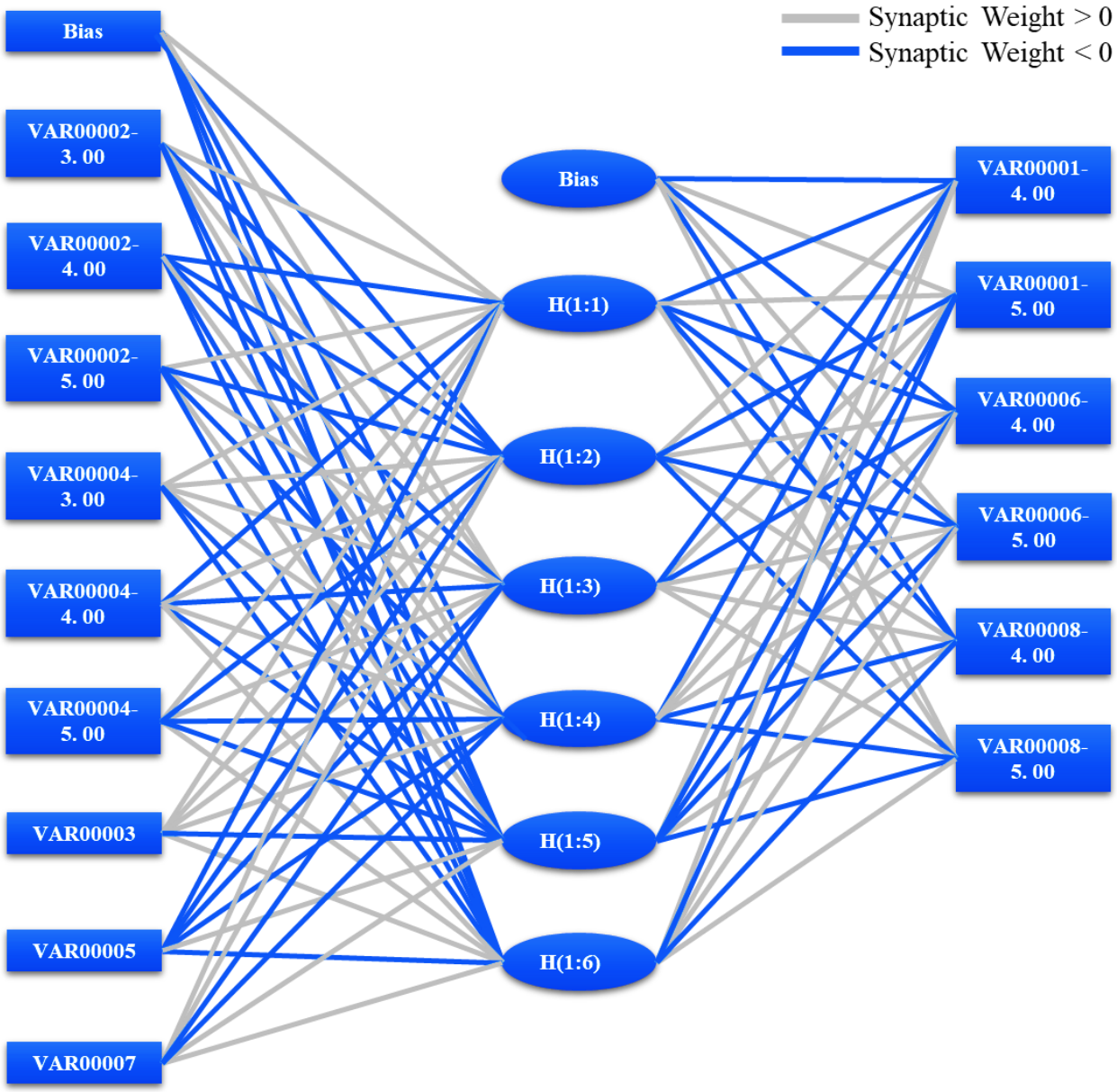

Fig. 2 The outcomes of applying neural networks to analyze data

Figure 2 illustrates the results of using neural networks for data analysis. The data analysis from image 1 using a neural network algorithm revealed that B0 (Bias) correlates with the need for an octal counter and an LED driver in a binary-to-hexadecimal decoder circuit.

In accordance with the requirement for a binary-to-hexadecimal decoder as H1:1, it is proposed that a pulse signal production circuit with a relationship expressed as H1:5 and H1:6 be included with an octal counter. This is in line with the necessity for an octal counter, which is stated as H1:5 and H1:6, and correlates with the requirement for an LED driver and a binary-to-hexadecimal decoder.

Moreover, the connection represented as H1:6 indicates that a binary-to-hexadecimal decoder corresponding to the LED driver should exist. In addition, an octal counter and a pulse signal generator circuit with relationships stated as H1:6 should be present.

Correlating with the need for a binary-to-hexadecimal decoder as H1:3 and H1:5, and with the binary-to-hexadecimal decoder and LED driver, respectively, with a relationship expressed as H1:3 and H1:5, and with additional teaching materials, this is consistent with the requirement for a binary-to-hexadecimal decoder and LED driver with a relationship expressed as H1:2, H1:4, and H1:5.

5. Summary of Research Results

Using the NX-100 digital circuit experiment kit in computer engineering and technology, the research sought to explore the uses of neural networks in information analysis connected to teaching and learning development. The research objectives were to study digital circuit boards, investigate the theory and operational steps of microprocessors, and explore the theory and operational steps of computer architecture. The following conclusions were drawn.

In Part 1, focusing on personal information gathered from the questionnaire, it was discovered that 72.00 percent of the respondents were male, and additionally, 98.00 percent were second-year students.

Part 2 addressed questions about microprocessor/ computer architecture factors and experimental factors of the NX-100 digital circuit. The researcher summarized the findings as follows:

1. Microprocessor Technology: A control sequence with a median value of 4.9975 is recommended.

2. Digital Circuit Experiment Set (Model NX-100): A circuit for decoding binary numbers into hexadecimal numbers should have a median value of 4.9975, and the summarized information, the researcher observed that the majority of respondents agreed most with the provided question statement.

Part 3 focused on questions concerning factors for developing teaching with the NX-100 digital circuit experiment kit for computer engineering and technology. The researcher summarized the findings as follows:

1. Study Information: The up-to-date nature of the course content received a median value of 4.78.

2. Personnel Information: The teacher's knowledge, ability, and expertise in the subject content, along with the suitability of the advisor system, received a median value of 4.99.

3. Information on Computer Services and Internet Access Points: The wireless network system covering all parts of the university received a median value of 4.82.

4. Information on Testing Formats and Development of Learning and Teaching: The presence of a prototype or model of results for use in experiments received a median value of 4.99. and

5. Information on International Aspects: Having reliable hardware received a median value of 4.99.

Moreover, from the summarized information above, the researcher found that groups of respondents most strongly agreed with the question statements in descending order of median.

Part 4, which addressed questions about equipment and tools used in teaching computer engineering and technology, it was found that the appropriateness of the classroom size and the number of students supports teaching and learning. The median value was 4.80, indicating that the group of respondents most strongly agreed with the provided question statement.

Part 5, which focused on questions about computer engineering and technology in Thailand, revealed that respondents expressed their opinions on the increasing involvement of computer engineering and technology with various businesses, including the computer industry and universities.

However, the researcher discovered that computer engineering and technology fields are already established, and some courses are similar or closely related.

Furthermore, it was determined that computer engineering and technology should be closely aligned with computer science, information technology, and computer engineering. Nevertheless, the researcher successfully

summarized the research results and analyzed the data according to the research objectives:

1. In studying the digital circuit experiment board, it was found that both instructors and students could understand the NX-100 digital circuit experiment kit correctly and were capable of performing the test according to the exercises in the test set.

2. In studying the theory and sequence of microprocessor operations, it was found that the respondents possessed knowledge and expertise regarding microprocessors.

3. In studying the theory and procedures of computer architecture, it was found that the respondents had knowledge and expertise in computer architecture. The median value of 4.99 indicates that the respondents most strongly agreed.

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