3.1 Data Presentation, Analysis, Interpretations and Discussion of Findings

Data presentation, analysis, interpretations and discussion of findings are done in the order of research questions raised in the study:

The researchers sought to know the extent at which students are satisfied in the use of library information resources.

Table 1: Showing Students' Satisfaction Level with the Use of Library Information Resources. N=137

SN	Questionnaire Items		Very Highly Satisfied	Highly Satisfied	Partially Satisfied	Not Satisfied	Not Satisfied At All	St.D
	Students' Satisfaction Level with Printed Resources in the Library							
1	Printed books in my Institutional Library	F	36	57	31	10	3	3.82
		P	41.60%	26.30%	22.60%	7.30%	2.20%	
2	Printed journals, magazine and other periodicals.	F	26	58	38	12	3	3.67
		P	19.00%	42.30%	27.70%	8.80%	2.20%	
3	Reference materials in print format such as encyclopedias, Dictionaries, Directories, Yearbooks etc.	F	34	52	44	5	2	3.81
		P	24.80%	38.00%	32.10%	3.60%	1.50%	
4	Theses, Dissertations, Inaugural Lectures, convocation & Anniversary Lectures in Printed format in my institutional Library	F	31	42	45	16	3	3.60
		P	22.60%	30.70%	32.80%	11.70%	2.20%	
	Students' Satisfaction Level with Electronic Resources in the Library							
5	Available Electronic-Books in my institutions' library.	F	23	11	21	40	42	2.33
		P	16.80%	8.00%	15.30%	29.20%	30.70%	
6	Available Electronic Journals & other periodicals in my institutions' library.	F	25	36	12	20	44	2.31
		P	18.20%	26.30%	8.80%	14.60%	32.10%	
7	Electronic Reference materials/resources such as electronic encyclopedias, Dictionaries, yearbook etc.	F	27	35	45	24	6	3.39
		P	19.70%	25.50%	32.80%	17.50%	4.40%	
8	Relevant CD-ROMs in my institutions' library.	F	18	39	40	25	15	3.15
		P	13.10%	28.50%	29.20%	18.20%	10.90%	
9	Institutional Repository materials such as Electronic Theses, Dissertations, Inaugural Lectures, Convocation and Anniversary Lectures in my institutions' library	F	20	24	5	36	52	2.31
		P	14.60%	17.50%	3.60%	26.30%	38.00%	
10	Available Electronic Data bases use such as Ebsco-host, JSTOR, Elsevier Science Direct, AGORA, HINARI, OARE, Myilibrary, Emerald, etc via my institutions' library.	F	16	29	9	43	40	2.20
		P	11.70%	21.20%	6.60%	31.40%	29.20%	

Source: Field Survey, 2018

Table 1: showed the mean ratings of the extent to which students are satisfied with the use of library information resources in printed format. The data indicates that the mean ratings of Q1, Q2, Q3, and Q4, are 3.83, 3.67, 3.81, and 3.60 respectively. Based on the cut-off point of 3.00 for a five Likert scaling, all items were acceptable.

This is an indication that respondents are highly satisfied with the printed books, printed journals, magazine and other periodicals, reference materials in print format such as encyclopedias, dictionaries, directories, yearbooks etc, and are also highly satisfied with theses, dissertations, inaugural lectures, convocation & anniversary lectures in printed format that exist in their respective institutional library. This finding supports that of Joshi (2014), who found high-level of satisfaction in the use of library resources/infrastructures among faculty members/research scholars in Guru Jambheshwar University of science & Technology library.

Table 1: Also showed the mean ratings of the extent at which students were satisfied with the use of electronic resources in the library. The data indicates that the mean ratings of Q5, Q6, Q7, Q8, Q9 and Q10 are 2.33, 2.31, 3.39, 3.15, 2.31 and 2.20 respectively. Based on the cut-off point of 3.00 for a five Likert scaling; items Q7, and Q8 were acceptable indicating that respondents are, highly satisfied with the electronic reference materials/resources such as electronic encyclopedias, dictionaries, yearbook etc., and also highly satisfied with relevant CD-ROMs in my institutions' library.

However, items Q5, Q6, Q9 and Q10 were rejected, meaning that respondents are not satisfied with the available Electronic-Books, available Electronic Journals & other periodicals as well as Institutional Repository materials such as Electronic Theses/Dissertations, Inaugural Lectures, Convocation and anniversary lectures as well as available electronic databases use such as Ebsco-host, JSTOR, Elsevier Science Direct, AGORA, HINARI, OARE, Myilibrary, Emerald, etc via their institutional library. This non-satisfaction could be due to poor funding/irregular subscriptions to electronic databases and network/power problems.

The researchers also sought to know "the extent of students' satisfaction with the use of library information services.

Table 2: Showing the Extent of Students' Satisfaction with the Use of Library Information Services. N=137.

SN	Questionnaire Items		VHS	HS	PS	NS	NSAA	St.D	Total
	Conventional & Electronic Library Services								
1	Library use promotion/marketing Services	F	24	14	8	50	41	2.50	137
		P	17.5%	10.2%	5.8%	36.5%	29.9%		100
2	Library Users' Education Services	F	27	70	21	16	3	3.74	137
		P	19.7%	51.1%	15.3%	11.7%	2.2%		100
3	Library Students' Orientation Services	F	33	15	4	50	35	2.68	137
		P	24.1%	10.9%	2.9%	36.5%	25.5%		100
4	Students library tour services	F	24	22	6	41	44	2.40	137
		P	17.5%	16.1%	4.4%	16.1%	4.4%		100
5	Library Reference Services	F	31	7	6	52	41	2.69	137
		P	22.6%	5.1%	4.4%	38.0%	29.9%		100
6	Library books Reservation Services	F	35	54	29	15	4	3.74	137
		P	25.5%	39.4%	21.2%	10.9%	2.9%		100
7	Inter-Library Loan Services	F	31	28	43	26	9	3.34	137
		P	22.6%	20.4%	31.4%	19.0%	6.6%		100
8	Library Information Resources' Lending Services	F	29	58	26	19	5	3.64	137
		P	21.2%	42.3%	19.0%	13.9%	3.6%		100
9	Selective Dissemination of Information Services	F	23	24	1	59	30	2.58	137
		P	16.8%	17.5%	0.7%	43.1%	21.9%		100
10	Library Current Awareness Services (CAS)	F	23	18	5	57	34	2.55	137
		P	16.8%	13.1%	3.6%	41.6%	24.8%		100
11	Library Electronic Information Services such as email alerts on innovations/new developments	F	32	18	16	34	37	2.35	137
		P	23.4%	13.1%	11.7%	24.8%	27.0%		100
12	Library Abstracting &Indexing Services	F	37	56	34	8	2	3.86	137
		P	27.0%	40.9%	24.8%	5.8%	1.5%		100
13	Library Photocopying Services	F	35	39	38	12	13	3.52	137
		P	25.5%	28.5%	27.7%	8.8%	9.5%		100
14	Library Bindery Services	F	35	45	26	15	16	3.50	137
		P	25.5%	32.8%	19.0%	10.9%	11.7%		100
15	Library Staff and Users Relationship Services	F	15	11	29	28	54	2.53	137
		P	10.9%	8.0%	21.2%	20.4%	39.4%		100

Source: Field Survey, 2018

Table 2: showed the mean ratings of extent of Students' Satisfaction in the Use of Library Information Services. The data indicates respondents' mean ratings of Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q9, Q10, Q11, Q12, Q13, Q14, and Q15 are 2.50, 3.74, 2.68, 2.40, 2.69, 3.74, 3.34, 3.64, 2.58, 2.55, 2.35, 3.86, 3.52, 3.50 and 2.53 respectively. Based on the cut-off point of 3.0 for a five Likert scaling, items Q2, Q6, Q7, Q8, Q12, Q13, and Q14 were acceptable. This indicates that respondents were highly satisfied with some library services such as library Users' Education Services, books Reservation, Inter-Library Loan, Information Resources' Lending Services¸ Abstracting &Indexing, Photocopying and Library Bindery Services. This finding also agrees with the study of Tan, Chen and Yang (2017) who found that "library services experienced by users directly/positively influenced their high satisfaction level and loyalty to library services.

However, items Q1, Q3, Q4, Q5, Q9, Q10, Q11, and Q15 were rejected, indicating that respondents are not satisfied with Library use promotion/marketing Services, Students' Orientation Services, Students library tour services, Library Reference Services, Selective Dissemination of Information Services, Current Awareness Services, and Library staff/Users Relationship.

Lastly, the researchers seek factors challenging library use satisfaction among students.

Table 3: Showing Factors challenging Students' Satisfaction in the Use of Library

SN	Questionnaire Items		SA	A	D	SD	St.D	Total
Challenges Associated with Traditional Library Resources Use								
1	Lack/inadequacy of relevant books to my course of study	F	37	42	34	24	2.67	137
		P	27.0%	30.7%	24.8%	17.5%		100
2	More than enough books are already being provided by my Course lecturers to read, do my assignments & pass my exams (I have no need for library resources use)	F	26	33	45	33	2.38	137
		P	19.0%	24.1%	32.8%	24.1%		100
3	Lack of awareness on available books relevant to my course of study.	F	45	22	43	27	2.62	137
		P	32.8%	16.1%	31.4%	19.7%		100
4	Lack of skill to locate required books in the library	F	32	47	25	33	3.41	137
		P	23.4%	34.3%	18.2%	24.1%		100
5	Inadequate formal training on how to locate required books in the library	F	39	38	24	36	3.48	137
		P	28.5%	27.7%	17.5%	26.3%		100
6	Low level of support from library staff on library resources use.	F	36	42	25	34	3.46	137
		P	26.3%	30.7%	18.2%	24.8%		100
7	Unattractive library building/environment.	F	28	23	64	22	2.42	137
		P	20.4%	16.8%	46.7%	16.1%		100
8	Too much silence/quietness of library environment (library silence is more of grave-yard nature)	F	15	35	56	31	2.25	137
		P	10.9%	25.5%	40.9%	22.6%		100
9	Lack of group discussion sections in the library	F	35	32	46	24	2.57	137
		P	25.5%	23.4%	33.6%	17.5%		100
10	Lack of encouragement/motivation from lecturers to use library resources	F	27	37	47	26	2.47	137
		P	19.7%	27.0%	34.4%	19.0%		100
11	Poor library staff and users' relationship	F	35	45	24	33	3.42	137
		P	25.5%	32.8%	17.5%	24.1%		100

Challenges Associated with Modern/Electronic Library Use								
12	Inadequate electronic resources in my institution's library	F	28	58	25	26	2.64	137
		P	20.4%	42.3%	18.2%	19.0%		100
13	Slow internet connectivity (Low internet bandwidth).	F	33	52	24	28	2.66	137
		P	24.1%	38.0%	17.5%	20.4%		100
14	Insufficient/ restricted internet access time	F	45	54	26	12	2.96	137
		P	32.8%	39.4%	19.0%	8.8%		100
15	Irregular/Poor electricity supply	F	35	49	37	16	2.75	137
		P	25.5%	35.8%	27.0%	11.7%		100
16	My incompetency on how to effectively access library e-resources (Poor electronic information retrieval skill).	F	29	39	42	27	2.51	137
		P	21.2%	28.5%	30.7%	19.7%		100
17	Lack/inadequate formal training on how to access electronic information resources	F	27	48	31	31	2.52	137
		P	19.8%	35.0%	22.6%	22.6%		100
18	Non-availability of relevant electronic resources.	F	29	50	39	19	2.65	137
		P	21.2%	36.5%	28.5%	13.9%		100
19	Inconsistency/Irregular subscription to electronic databases	F	38	36	30	33	2.58	137
		P	27.7%	26.3%	21.9%	24.1%		100
20	Available electronic databases do not cover my field of study/needs.	F	19	49	41	28	2.43	137
		P	13.9%	35.8%	29.9%	20.4%		100
21	Indiscipline on time management, as I most often waste valuable time on social media use rather than library e-resources while I am online.	F	42	36	37	22	2.72	137
		P	30.7%	26.3%	27.0%	16.1%		100
22	Lack of awareness of available electronic information resources in my institutional library.	F	40	46	31	20	3.64	137
		P	29.2%	33.6%	22.6%	14.6%		100
23	Low level of support from library staff on how to access and use library electronic resources.	F	34	46	28	29	2.62	137
		P	24.8%	33.6%	20.4%	21.2%		100
24	Inadequate ICT/Computer devices to access library electronic resources.	F	42	44	35	16	2.82	137
		P	30.7%	32.1%	25.5%	11.7%		100
25	Poor maintenance of ICT/computer devices to access electronic information resources in my institution's library	F	31	48	33	25	2.62	137
		P	22.6%	35.0%	24.1%	18.2%		100

Source: Field Survey, 2018

Table 3: showed the mean ratings of factors challenging students' library use satisfaction. On challenges associated with traditional library resources use, the data indicates that the mean ratings of Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q9, Q10, and Q11 are 2.67, 2.38, 2.62, 3.41, 3.48, 3.46, 2.42, 2.25, 2.57, 2.47, and 3.42 respectively. Based on the cut-off point of 2.50 for a four Likert scaling. items Q1, Q3, Q4, Q5, Q6, Q9 and Q11 were acceptable indicating that respondents agreed that Lack/inadequacy of relevant books to my course of study, Lack of awareness on available books relevant to my course, Lack of skill to locate required books in the library, Inadequate formal training on how to locate required books, Low level of support from library staff on library resources use, Lack of group discussion sections in the library and Poor library staff and users' relationship. However, items Q2, Q7, Q8, and Q10, were rejected, indicating that respondents disagreed that more than enough books are already being provided by students' course lecturers to read, do my assignments & pass my exams, (have no need for library resources use), unattractive library building/environment, too much silence/quietness of library environment, and Lack of encouragement/motivation from lecturers to use library resources.

Table 3: also showed the mean ratings of factors challenging users' satisfaction in the use of library with regards to factors associated with modern/electronic library resources use. The data indicates that the mean ratings of Q12, Q13, Q14, Q15, Q16, Q17, Q18, Q19, Q20, Q21, Q22, Q23, Q24 and Q25 are 2.64, 2.66, 2.96, 2.75, 2.51, 2.52, 2.65, 2.58, 2.43, 2.72, 3.64, 2.62, and 2.82 respectively. Based on the cut-off point of 2.50 for a four Likert scaling, all items are acceptable indicating that respondents agreed that Inadequate electronic resources in respondents' institutional library, slow internet connectivity (Low internet bandwidth), Insufficient/ restricted internet access time, Irregular/Poor electricity supply, users' incompetency on how to effectively access library e-resources (Poor electronic information retrieval skill), lack/inadequate formal training on how to access electronic information resources, non-availability of relevant electronic resources, inconsistency/Irregular subscription to electronic databases, lack of awareness of available electronic information resources, low level of support from library staff on how to access and use library electronic resources, inadequate ICT/Computer devices to access library electronic resources and poor maintenance of ICT/computer devices to access electronic information resources. However, items Q20, is rejected, indicating that respondents disagreed that available electronic databases do not cover their field of study/needs. These findings are in agreement with those of Xu and Du (2018); Obinyan (2016:10); and Hossain (2014), expressed a lot of challenges confronting satisfactory use of library resources and services in several libraries to include: inadequate attention to users' information needs, library staff/users' communication gap, students' inability to understand library resources organization and retrieval systems, as well as poor information systems/service quality.

4. CONCLUSION AND RECOMMENDATIONS

The relevance of users' satisfaction to library resource and services use cannot be over-stressed. It determines survival/existence of libraries in tertiary institutions particularly users' satisfaction in the use of electronic resources and services in they had most of the unsatisfactory reports in the study due to our present electronic/digital driven world. Libraries must therefore brace-up in the collection and management of electronic information resources and services for improved users' satisfaction and service delivery while ensuring good staff and users' relationships among others.

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Enhancing Academic Planning In Tertiary Institutions Using Artifical Neural Network Predicition

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ABSTRACT

Higher education institutions are undergoing transformations in many parts of the world, which are population dependent. One major problem related to the human society is the issue of increasing population (Zhang *et al.*, 2015). Government institutions experience this problem more as they admit more students yearly than the private institutions. This is due to the inefficient technique employed in predicting the population of students (Bloom *et al.*, 2003). Artificial Neural Network (ANN) is an automated technique for forecasting information based on a learning procedure on previously existing data. It has the adaptive ability on robust data. ANN technique is employed in this paper. The aim of this research paper is to make a detailed forecast of admission of students into tertiary institutions with the use of ANN, and solve the problem of improper academic planning in tertiary institutions due to poor prediction, which had greatly affected the productivity of teaching and learning.

Keywords: Artificial Neural Network, Tertiary Institution, Learning, Academic Planning

1. BACKGROUND TO THE STUDY

Higher Institutions provides learning that encompasses advance learning in a desired chosen field of interest for profitable career advancement (Kagaari *et al.*, 2016). Higher education institutions such as colleges and universities are academic institutions that need to follow certain academic standards and conventions, which characterize academic work (Khaki *et al.*, 2005). Higher education institutions are undergoing transformations in many parts of the world, which are population dependent. One problem of the human society is the issue of increasing population (Zhang *et al.*, 2015). As it appears that the number of individuals with the quest for higher academic learning is on the increase yearly, the challenge of adequately meeting the need of this category of people is becoming more severe. Government institutions experience this problem more, as they have more students' admission yearly than the private institutions. The fact that larger portion of the financial responsibility is borne by the government necessitates a measure to address this issue; this is because of inefficient technique employed in predicting the population of students (Bloom *et al.*, 2003). Lack of planning and/or lack of proper management may lead to inefficiency or underperformance of individuals and their institutions. Policy Makers and academic planning departments in academic institutions across the globe need the prediction of student population for evaluating future demands, such as the capacity of lecture halls, capacity of teaching and non-teaching staffs, schedule of courses, and allocation of funds.

Artificial Neural Network (ANN) is an automated technique for forecasting information based on a learning procedure on previously existing data. It has the adaptive ability on robust data. Artificial Neural Network (ANN) has proven to be outstanding in its performance to provide full details on virtually any category in terms of age, gender, disability, college, department, level, accommodation etc. in an academic environment (Traore *et al.*, 2015). Artificial Neural Networks are the biologically inspired simulations performed on the computer to perform certain tasks like clustering, classification, pattern recognition, etc. They are usually presented as systems of interconnected "neurons" that can compute values from inputs by feeding information through the network. Like other machine learning methods, neural networks have been used to solve a wide variety of tasks that are hard to solve using ordinary rule-based programming, including computer vision and speech recognition. The aim of this research paper is to make a detailed forecast of yearly admission of students into tertiary institutions with the use of ANN.

2. STATEMENT OF PROBLEM

One foundational challenging issue in academic environment is adequate planning. Each plan must be focused on the expected number of students, which many times are inaccurate. This has led to gross insecurity in higher institutions of learning, because this is not well planned. The current approaches for predicting students' population is inefficient. The use of time series analysis for predicting is time consuming, theoretical and prone to error.

3. AIM AND OBJECTIVE

The aim of this research paper is to make a detailed forecast of admission of students into tertiary institutions with the use of ANN, in order to solve the problem of improper academic planning in tertiary institutions due to poor prediction, which had greatly affected the productivity of teaching and learning.
The objective of this research paper is to review related works to this study and forecast student admission population by employing ANN using prior data on MATLAB Tool Box.

4. RELATED WORKS

A number of works have been conducted relating to this research, which few will be reviewed in this section. Song (2015) carried out a review on three technical changes of population prediction. He came up with an argument that urban planning has an insolvable problem, which is ultimate. He stated that foundational issues for such problem are the linear planning, rational approach and development that are hyper-normal. An analysis was also done on the master plan research. He also introduced an exploration of Shanghai on study trend, technical analysis and institutional design transiting from the ultimate goal to the simulation of the multiple approaches. The research work was centered on urban-rural planning, and not centered on the academic environment. An automated approach that carries out the prediction was not considered for better efficiency and accuracy of the entire scenario.

Traore *et al.* (2015) applied ANN for forecasting near future reference transpiration value by using restricted climate information message retrieved from public weather forecast source using four ANN learning algorithm: Generalized feed forward, Linear Regression, Multilayer perceptron, and Probabilistic Neural Network. The result could assist irrigation districts to accommodate, in advance, the crop water demand to near-future requirements. The accuracy of the multilayer perceptron was high. The approach was centered on short-term forecast. Zhang *et al.* (2015) presented a Chebyshev-activation WASD neuronet approach for the population prediction. They intended to address the existing conflict between the rapid increase in population and the limited resources. They stated this as the cause for social and environmental issues in many countries. Their neuronet method was applied to the prediction of European population by conducting numerous numerical experiments for guaranteeing how feasible and valid the approach was.

They came up with a finding that there is a possibility of having the population decrease in the future. This approach did not consider the academic environment. Adeleye (2016) was able to determine the joint impact of traditional budgeting system on factors of investment decision processes in state-owned tertiary institution. He was able to find out the relationship between components of traditional budgeting system and coordination, monitoring, controlling of programmes and activities. The result could not be valid for Federal higher institutions, which had higher population rate. The approach also could not explicitly give a clear prediction of categorized student intakes.

Shang *et al.* (2016) proposed a statistical approach, which has multilevel functional data method, involving the modeling of mortality and migration of a population. They forecasted collectively the data involving both males and females. The uncertainty of the forecast had an association with each incorporated components via parametric bootstrapping. They got historical data from the United Kingdom between 1975 and 2009. The method showed a good level of accuracy for holdout data between 2001 and 2009. Each component of the population was smoothed using a tailored nonparametric smoothing technique, and is modeled as a continuous function of age to capture the patterns of variations across years. The education sector was not considered in the research work.

5. METHODOLOGY

This paper presents an artificial neural network (ANN) approach to predict student admission population into a higher institution of learning. This will aid the effective planning of the authorities in place, and their decision making. The methodology in this research work can be segmented into three major phases: input, processing and output. The input phase has to do with the segregation of the data into input and target data; the processing phase involves the testing, training and validation of the data; the output phase provides the prediction model to forecast further information.

6. DATA COLLECTION

The dataset utilized in this research work were obtained from the Yaba College of Technology, Yaba, Lagos State, Nigeria in West Africa. The categories of student data were centered on the total intake from 2015 to 2017.

6.1 Conceptual Procedure of the Methodology

ANN has an architecture that is layered (input, processing and output). It does its operation by learning and has the ability to adapt to its environment (Kantardzic, 2003). This set of input will be inputted into MATLAB ToolBox and the training will produce a regression graph with formula that would be used to make further predictions. The efficiency of the training is dependent on the number of neurons used. The expected target is represented into the formula to know the eventual expected number of students. Figure 1 shows the methodology procedure of the research work.

6.2 Input Phase

This phase of the prediction is concerned with the operation of the data employed in the research work. This phase separates the raw data into input data and target data. The input data include earlier section while the target includes the rest of the data. The decision to make which part input and which part output is dependent on the user, but it is better to use all except the last two records as input data. The last two records can then be target data. Input data can be described as normalized matrix, while target data can be described as result of corresponding row from input.

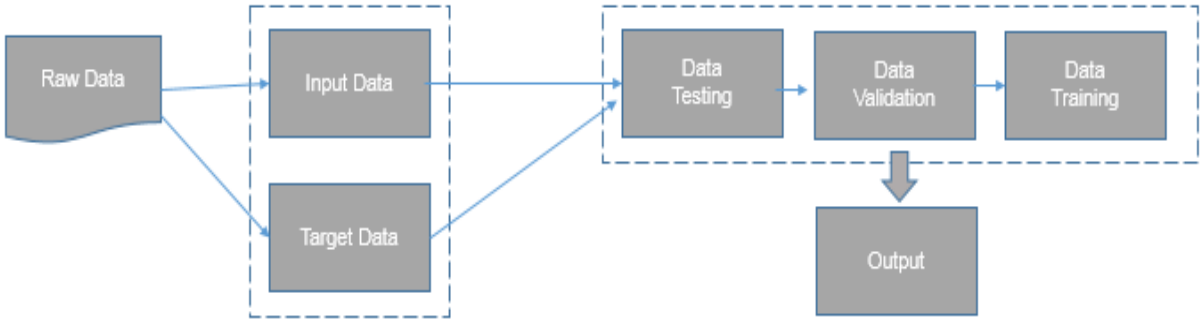

Figure 1: Research framework for the ANN prediction technique.

Algorithm of the ANN Input Phase

INPUT: raw data
OUTPUT: input data [][], target data[][]
PROCESS:

1. start
2. create matrix table (using m-variable)
3. select new variable
4. rename variable table
5. input required data into m-variable table for input data[][]
6. repeat step 2-4 for target data
7. input required data into m-variable for target data[][]
8. return input data[][]
9. return target data[][]
10. end process

6.2.2 Processing Phase

The processing phase of this work is sub-divided into three phases: testing, validation and training. Here, the input data that have been inputted will be tested by the neural network toolbox. The user decides the percentage of the data to be used in testing and measure to be validated. The test output and validation output is then used to decide if the training can be done or not. MATLAB has three toolbox to carry out artificial neural network training, which are the fitting tool, clustering tool and the recognition tool. In this research work, the fitting tool is best required and will be employed.

Algorithm for Processing ANN Prediction
INPUT: Input data matrix DIM[][], Target data matrix DTM[][]
OUTPUT: Regression result, evaluation result
PROCESS:

1. start
2. input DIM[][]
3. input DTM[][]
4. select test data percentage
5. select validation data percentage
6. choose number of hidden neuron to be used
7. train data
8. plot regression graph
9. return epoch
10. return evaluation result
11. return regression information
12. end process

6.2.2.1 Model of an Artificial Neuron

An artificial neuron is an information-processing unit that is fundamental to the operation of an ANN. The block diagram in Figure 2 is a model of an artificial neuron, which shows that it consists of three basic elements:

i. *A set of connecting links* from different inputs x_i (or synapses), each of which is characterized by a weight or strength w_{ki}. The first index refers to the neuron in question and the second index refers to the input of the synapse to which the weight refers. In general, the weights of an artificial neuron may lie in a range that includes negative as well as positive values.
ii. *An adder* for summing the input signals x_i weighted by the respective synaptic strengths w_{ki}. The operation described here constitutes a linear combiner.
iii. *An activation function* f for limiting the amplitude of the output y_k of a neuron.

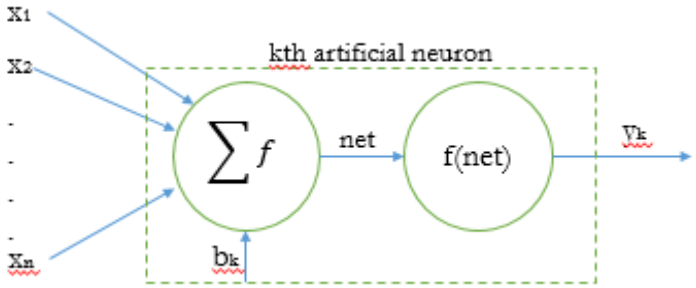

Figure 2: Model of an artificial neuron

The model of the neuron given in Figure 2 also includes an externally applied bias, denoted by b_k. The bias has the effect of increasing or lowering the net input of the activation function, depending on whether it is positive or negative. In mathematical terms, an artificial neuron is an abstract model of a natural neuron, and its processing capabilities are formalized using the following notation. First, there are several inputs x_i, i = 1, ..., m. Each input x_i is multiplied by the corresponding weight w_{ki}, where k is the index of a given neuron in an ANN. The weights simulate the biological synaptic strengths in a natural neuron.

The weighted sum of products $x_i w_{ki}$, for i = 1, ..., m is usually denoted as *net* in the ANN literature:

$$net_k = x_1 w_{k1} + x_2 w_{k2} + \cdots + x_m w_{km} + b_k \quad (1)$$

Using adopted notation for $w_{k0} = b_k$ and default input $x_0 = 1$, a new uniform version of net summation will be

$$net_k = x_0 w_{k0} + x_1 w_{k1} + x_2 w_{k2} + \cdots + x_m w_{km} = \sum_{i=1}^{m} x_i w_{ki} \quad (2)$$

Finally, an artificial neuron computes the output y_k as a certain function of net_k value:

$$y_k = f(net_k) \quad (3)$$

7. IMPLEMENTATION

The system comprises various phases based on the several sections required for the operations of the system. The data collected from the institution for the three academic sessions is shown in Table 1. This served as input into the implementation environment.

Table 1: Data Collected for the prediction

Session year	Number of Admitted Students
2015/2016	18,655
2016/2017	17,365
2017/2018	7,640

The first two academic sessions (2015/2016 and 2016/2017) were used as the input data while the last academic session (2017/2018) was used as target data. The sections employed in implementing the project work are:

i. Training
ii. Testing

Each section was viewed and described as it applies to the system one after the other. Figures 2 to 7 show the ANN interfaces of the implementation procedure.

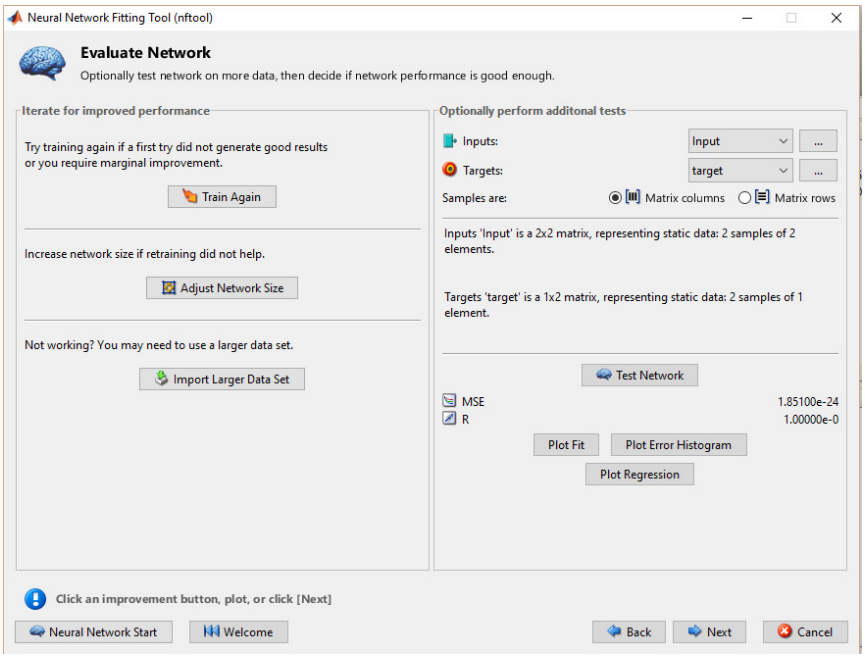

Figure 2: The ANN Interface on MATLAB Toolbox.

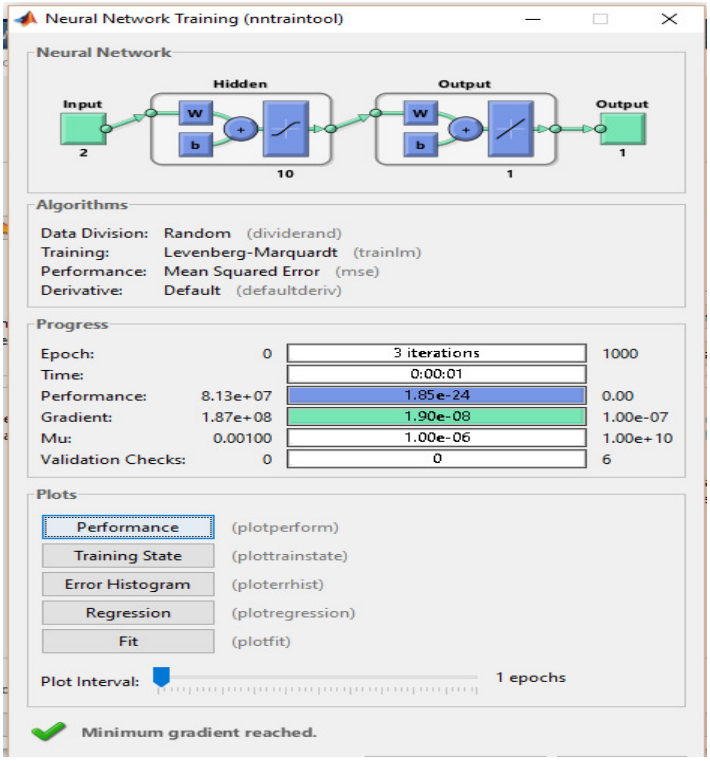

Figure 3: The ANN training interface.

8. RESULTS

Results obtained from the ANN implementation are presented in Figures 4 to 7 and Table 2:

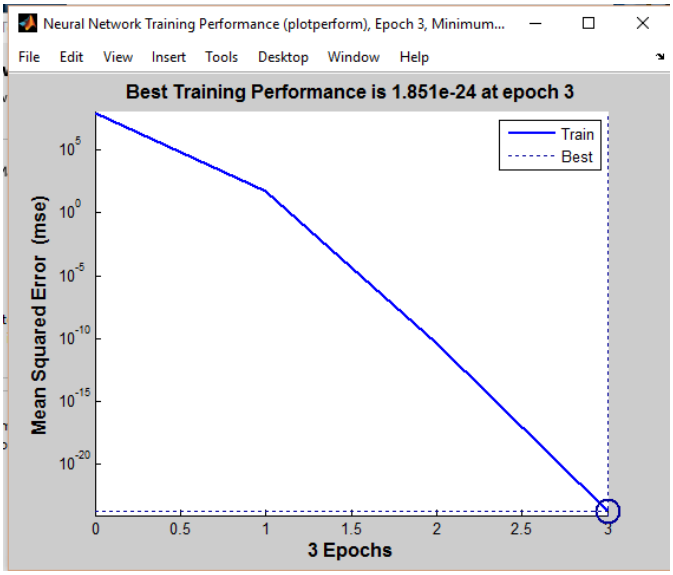

Figure 4: The training performance interface of the mean squared error.

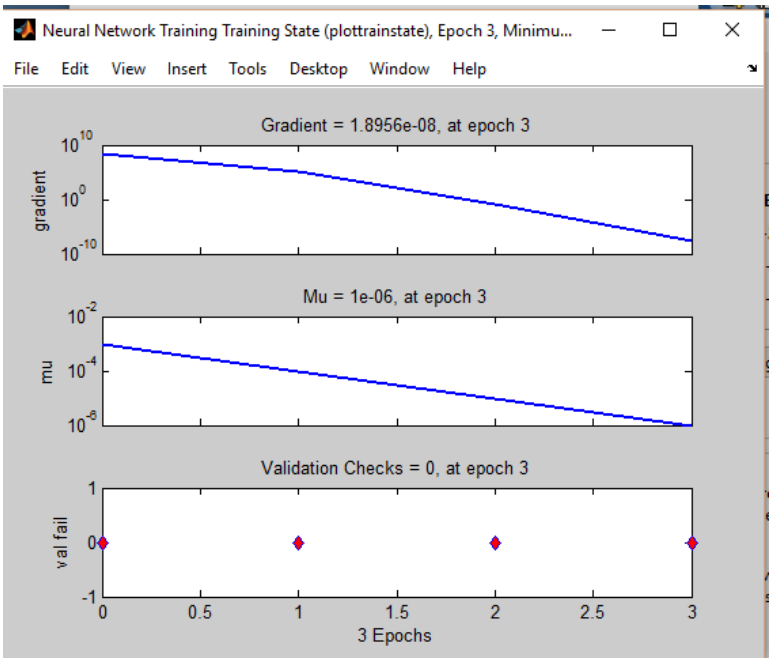

Figure 5: ANN training state result interface

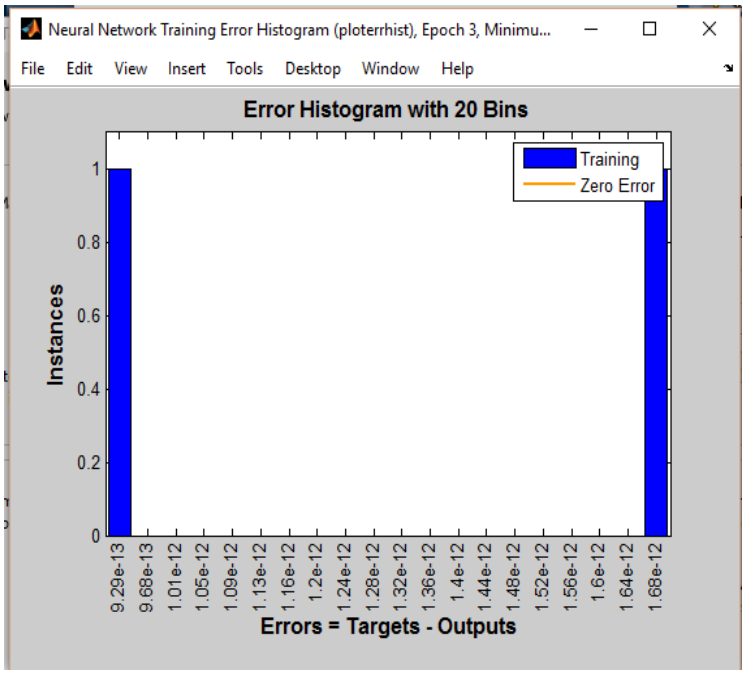

Figure 6: ANN training error histogram interface.

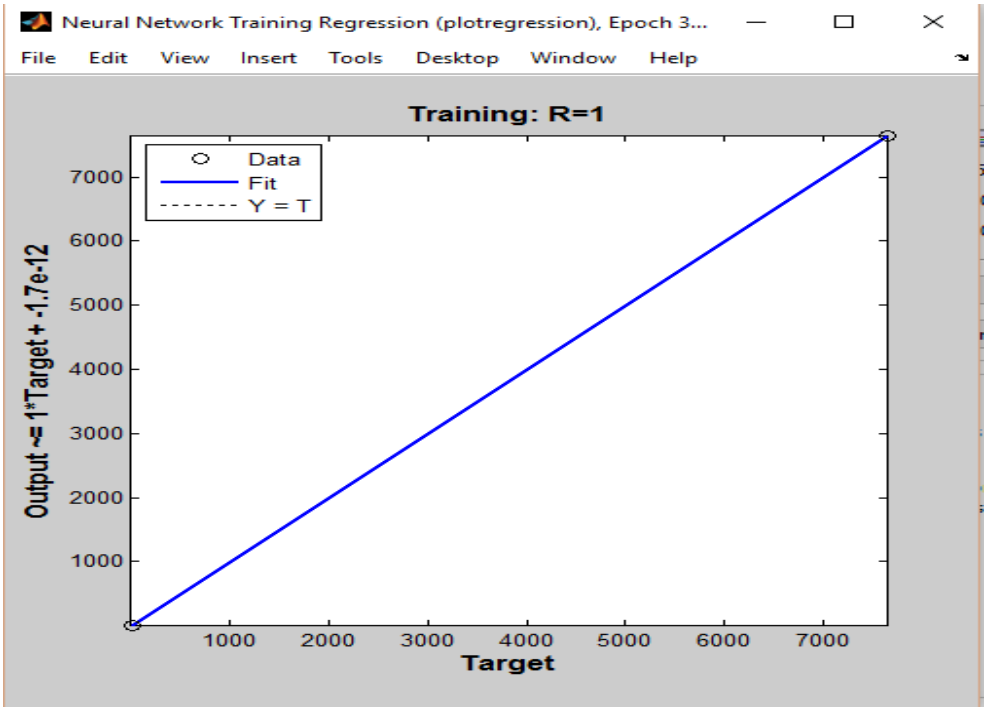

Figure 7: ANN training regression result interface.

Table 2: ANN Performance result

Iteration	3
Mean squared error	$1.851e^{-24}$
Gradient	$1.8956e^{-08}$
Mu	$1e^{-06}$
Regression	$1*Target+1.7e^{-12}$

The prediction for the next academic session can be done by using the regression formula. If the 2018/2019 academic session would be predicted, it will be done as follows:
$N(2018/2019) = Antilog [1(7,640) + 1.7e^{-12}] = Antilog [7,640 + 1.7e^{-12}] = 7,640$

This implies that the number of students in future years will remain around 7,640 in number.

8. CONCLUSION AND RECOMMENDATION

This paper carried out a training of academic data of admitted students into a tertiary institution to enable appropriate planning. Previous approaches employed to predict students' admission figure are error-prone; some of these means have been employed, but are not easily done in a quick and easy way. The Artificial Neural Network (ANN) approach was employed in this paper as a result of its immense beneficial properties, such as, fault tolerance, adaptively and robustness. This makes it easier for higher institutions to predict their yearly student intakes easily and faster, with a high level of accuracy and efficiency. It is therefore recommended that the approach and system be implemented into a tool suite and encouraged for use by educational institutions in Nigeria.

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