



## MODEL ESTABLISHING THE POTENTIAL CLIENTS USING ARTIFICIAL NEURAL NETWORKS

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### ABSTRACT

One of the most important and dominant topics in management studies is to find more effective solutions and tools for complicated management problems. The tools used to make management decisions have undergone a massive change with the advancement of computer and communication technology. These tools have Artificial Neural Networks (ANNs and SPSS). In this article we describe the basics of neural networks as well as a review of selected work done in computer science with the application of ANNs. New models, RBFNN and GRNN are used for data classification and ANN is used for algorithm design methods. The well-known data of marketing information system (MkIS) is used to train the ANN and to train the algorithms and test them. The goal is to develop the proposed design to improve the performance of high accuracy in the marketing information system and to investigate the training of the machine learning algorithm using real world sample data. Selecting right-sized datasets by selecting suitable dataset size from experiments. ANNs experiments show promising results on the dataset of the marketing information system. In addition, the decision model is based on an artificial neural network model consisting of three layers, the first layer being represented by seven neurons, new technology. Support system for internal records, marketing intelligence, market research, and marketing decision making. The second layer as the hidden layer with 75 neurons, and the third layer as the output layer represented by two neurons called the competitive advantage. In addition, the 300 collected data first converted to numerical data to represent the real data to be used for modelling the intelligent decision model, also, the collected data divided into part in which 80% of the data used of training artificial neuron network model, and 20% used for testing the proposed model.

### 1. Introduction

All industries including banking have an underlying structure fundamental economic and technical characteristic which give rise to competitive forces. A firm can improve its position within an industry through its choice of strategy. Competitive strategy, then, not only responds to the environment but also attempts to shape the environment in its favour (Kerzner, 2017). As competitive conditions become ever more turbulent, the value of developing and sustaining competitive advantage appears to be increasing exponentially (Jeucken & Bouma, 1999). Competition in the banking sector has been growing for years, the importance of developing an effective competitive strategy seems to be continually increasing (Borio, Gambacorta, & Hofmann, 2017; Davenport & Harris, 2017; Hertin & Al-Sanjary, 2018). One central measure of organizational effectiveness is continuously engaging in the differentiation of organizational products. Efficiency, an actualization of customer-centric products and services, and constraint of the fixed costs of doing business can also help to obtain a sustainable competitive advantage within the marketplace. Commercial banks play an important role in economic growth and social support in the state of Libya. The Libyan government offered a package of laws and regulations that encouraged banks to contribute to economic and social development. The most important question is to what extent these laws and regulations were applied in practice in Libya. Based on the assumption that social accounting is a contextual concept/construct, the researcher needs to theorize and contextualize social accounting (Duffey, 2018; Foss & Saebi, 2017). Hence, the Libyan environment must be considered carefully, especially the banking sector. Understanding the particular Libyan context could contribute to the design of an accounting suited to the Libyan environment. Claims that commercial banks view product differentiation as their most important and strategic resource (Zhao, Fisher, Lounsbury, & Miller, 2017).

While the favours by pointing out that in an economy, where the only certainty is uncertainty, the only sure origin of lasting competitive advantage is differentiation (Jones, 1984). Many markets are quite saturated with various firms endeavouring toward like core competencies consequently organizations are forced to dissect their business processes to determine what product to develop and offer to the market and achieve a sustainable competitive advantage (Charter & Tischner, 2017). The competitive strategy can be understood as the activities a company undertakes to gain a sustainable competitive advantage in a particular industry (Charter & Tischner, 2017). Where, few researchers assume that there are mostly three generic types of competitive strategy (based on two basic types of competitive advantage): cost leadership, differentiation and focus on certain target segments (which itself is either anchored through low-cost or differentiation). Companies following a differentiation strategy strive to create and market unique products for varied customer groups

(Charter & Tischner, 2017). Additionally, marketing deals with clients more than any other business function, where building client relationship based on client value and satisfaction is the heart of modern marketing (Ottman, 2017). Marketing is defined as the process of creating, promoting, distributing, and selling the goods, services, and ideas to facilitate satisfying exchange relationship with clients in a dynamic environment (Jenkins, Ford, & Green, 2018). Marketing information system MkIS, helps in analysing product features with customer data, creating and testing promotion plans, evaluating channel and pricing options, gaining instant feedback on concepts and plans, and moving marketing plans rapidly into production (Berman & Thelen, 2018; Mumbower, Garrow, & Higgins, 2014; Nugroho & Al-Sanjary, 2018). Model of a marketing information system has four parts, which are marketing intelligence, internal records, marketing research, and marketing decision support system MDSS (Bharadwaj, 2018; Eryigit, 2014).

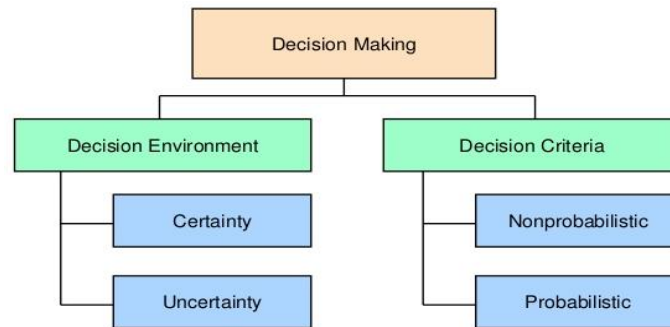


Figure 1: Decision making overview

Marketing information system technology is IT within the marketing information system MkIS. The distinction is important as MkIS do not have to contain any IT; they can be completely manually based. In reality, most MkIS within financial institutions contains some IT, although the sophistication varies greatly (Sekaran & Bougie, 2016). Nevertheless, when using the technology, it will be easier to connect all the departments, at the same time there will be no unnecessary information, thus, leading to a better decision making by the firms when faced with either day to day problems, or for a certain problem. According to the above information, all the components of the MkIS have a relation to the decision-making process. The study will concentrate on the use of the MkIS technology in the working banks in Libya in the decision-making process.”

“The banking industry is one of the influential industries in Misurata, and many different banks are working in Libya nowadays, and the competition is high. Libya: An Introduction to its context: The State of Libya is a sovereign state in the Maghreb region of North Africa, bordered by the Mediterranean Sea to the north, Egypt to the east, Sudan to the southeast, Chad and Niger to the south, and Algeria and Tunisia to the west. The country is made of three historical regions. Also, the geography and population, Libya is located midway along the north coast of Africa. It is the fourth largest African country; it is one-fifth the size of the USA, and about the size of the UK, Germany and France combined.

## 2. Related Work

The Several existing works are available, (Mandeep, 2008; PAMUK, YURTAY, & YAVUZYILMAZ, 2015), presents the data obtained from 3.760 people were used for the training process and the data obtained from 752 people were used for the testing process. As classifiers, Feed Forward Neural Networks (FFNN), Probabilistic Neural Network (PNN) and k Nearest Neighbour (kNN) were used. At the end of the study, success ratios of different algorithms were compared by Receiver Operating Characteristics (ROC) analysis method (PAMUK et al., 2015).

Additionally, (Martínez-López & Casillas, 2013, 2013) presents intelligent systems have particular potentialities and strengths to support decisional situations faced by companies, especially those of a strategic nature, where good strategic intelligence is necessary. Also, mentioned, we carry out an historical literature review of artificial intelligence-based systems applied to marketing, covering a time period of several decades (from the 1970s to the present day), with special focus on applications to industrial marketing (Elbahri et al., 2019; Martínez-López & Casillas, 2013).

In (Hakimpoor, Arshad, Tat, Khani, & Rahmandoust, 2011), present a finding more effective solution and tools for complicated managerial problems is one of the most important and dominant subjects in management studies. With the advancement of computer and communication technology, the tools that are using for management decisions have undergone a massive change. Artificial Neural Networks (ANNs) are one of these tools that have become a critical component of business intelligence (Hakimpoor et al., 2011).

## 3. Artificial Neural Network

Artificial Neural Networks (ANNs) are distributed information-processing systems and powerful general-purpose software tools, composed of many simple computational elements interacting across weighted connections. Inspired by the architecture of the human brain, ANNs exhibit certain features such as the ability to learn complex patterns of information and generalize the learned information (Jonassen & Grabowski, 2012) and are used for a number of data analysis tasks such as prediction, classification and clustering. They are based on abstract simplified models of neural connections. Simulated artificial neural networks (also referred to as parallel distribute processing models, adaptive

systems, connectivity models, or simply neural networks) seek to simulate the human brain structure, human thinking and human learning in a machine. They are computer-based representations of mathematical models that are composed of a large number of simple, highly interconnected units, called processing elements (Garnham, 2017). In structure, a neural network is made up of many processing nodes called neurons, which accept values from other neurons through input arcs. The neurons process these inputs using a transfer function and then release the output to other neurons using output arcs (Jurrus et al., 2010; Vadivellu & Al-Sanjary, 2018).

#### 4. Methodology

The main objectives of this paper are to develop the proposed design to improve the performance of high accuracy in the marketing information system and to investigate the training of the machine learning algorithm using real world sample data. Selecting right-sized datasets by selecting suitable dataset size from experiments. ANNs experiments show promising results on the dataset of the marketing information system. Figure 2, shows the decision model based artificial neural network model consist of three layers, such first layer represented by seven neuron “new Technology, Internal Records, Marketing Intelligence, Market Research, , and Marketing Decision Support System”, Second layer as hidden layer with 75 neuron, and third layer as Output layer represented by two neuron “Competitive Advantage”.

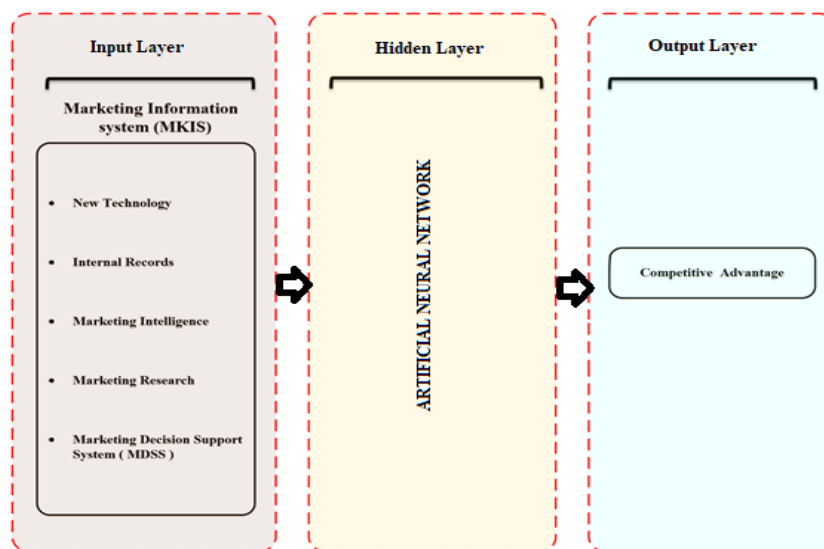


Figure 2: The conceptual framework decision model based artificial neural network model

The 300 collected data first converted to numerical data to represent the real data to be used for modelling the intelligent decision model. In Table1, shows samples of the collected data divided into part in which 80% of the data used of training artificial neuron network model, and 20% used for testing the proposed model.

#### 5. Result

Different types of artificial neural networks (ANN) have been successfully implemented in a wide range of fields and they have shown a great performance in the fitting of non-linear functions and recognition of complicated patterns. In the current study, the radial basis function network (RBFNN), and general regression neural network, (GRNN) were used to predict the classification diabetes problem. The proposed architecture for ANN algorithms models used in current study is demonstrated in Figure 3. Generally, the structure of ANN algorithms consists of Multilayers: an input layer, hidden layer, and an Output layer in a multilayer neural network. Firstly, the input variables from the source are introduced in the input layer, then the hidden layer processes the signals sent by the input layer and finally the output layer deliver the results which have been predicted by ANN to the external receptor. It is well known that each layer has a number of neurons and the role of each neuron transmits the input values and process them to the next layer. Furthermore, all layers have biases and weight factor produced from the previous layer. The weight factor ( $W_{ii}$ ) is defined as the interaction between ANN layer; it can amend the transferred signals values. By adjusting the weight values of the ANN model, the optimal parameters can be selected since while the ANN is governed by used algorithm technique.

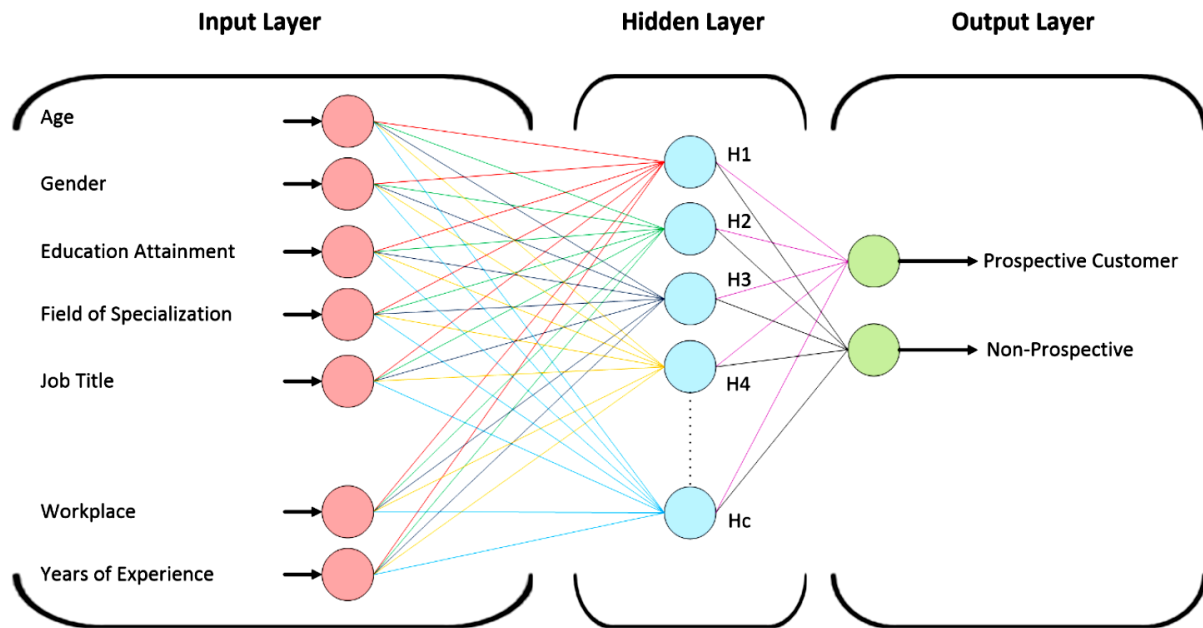


Figure 3: The decision model based artificial neural network mode

Model Establishing the Potential Clients Using Artificial Neural Networks. Figure 1, shows the decision model based artificial neural network model consist of three layers, such first layer represented by seven neuron “Age, Gender, Educational Attainment, Field of Specialization, Job Title, Workplace, and Years of Experience”, Second layer as hidden layer with 25 neuron, and third layer as Output layer represented by two neuron “Prospective Customer, and Non-Prospective Customer”. The 300 collected data first converted to numerical data to represent the real data to be used for modelling the intelligent decision model as show in Table 1, show samples of the collected data divided into part in which 80% of the data used of training artificial neuron network model, and 20% used for testing the proposed model.” The network is trained ten times and the performance goal is achieved at different epochs as shown in Figures 4. Whereas, Figure 4, show the performance of training process in which the error minimizes to 0.0485417.

Table 1: Model establishing the potential clients using artificial neural networks

Age Group		Gender		Educational Attainment		Field of Specialization	
Real data	Represent	Real data	Represent	Real data	Represent	Real data	Represent
18-24	1	Male	1	PhD	4	Engineering, Computer Engineering, Electrical engineering	1
24-30	2	Female	0	Master	3	Information technology, Electronics & Telecom, Media, Artificial Intelligent.	2
30-37	3			Bachelor	2	Accounting, Economy, Accounting, Business Admin	3
38-50	4			Diploma	1	Physics, Applied Science, Science, Languages, Teacher	4
60	5			High School	0	Shara'a, Law, Islamic Education	5
Years of Experience		Workplace		Job Title			
Real data	Represent	Real data	Represent	Real data	Represent	Real data	Represent
Less than 5 years	0	Local	0	Student, Graduated			0
5-10 years	1	Local and International	1	Lecturer, Teacher, Senior Lecturer, Assistant Lecturer			1
10-15 years	2			Management Employ, Employ, Assistant Management			2
15-20 years	3			Social Specialist, Consultant, Engineer, Technician, General practitioner, Data processing			3
20 years and more	4			Director, Deputy Director, Marketing Manager			4

In Table 2, show the performance of ANN with different number of neurons in hidden layer in which clear the error reduce with increasing number of neurons. However, the best number of neurons for this model was 75 neurons.

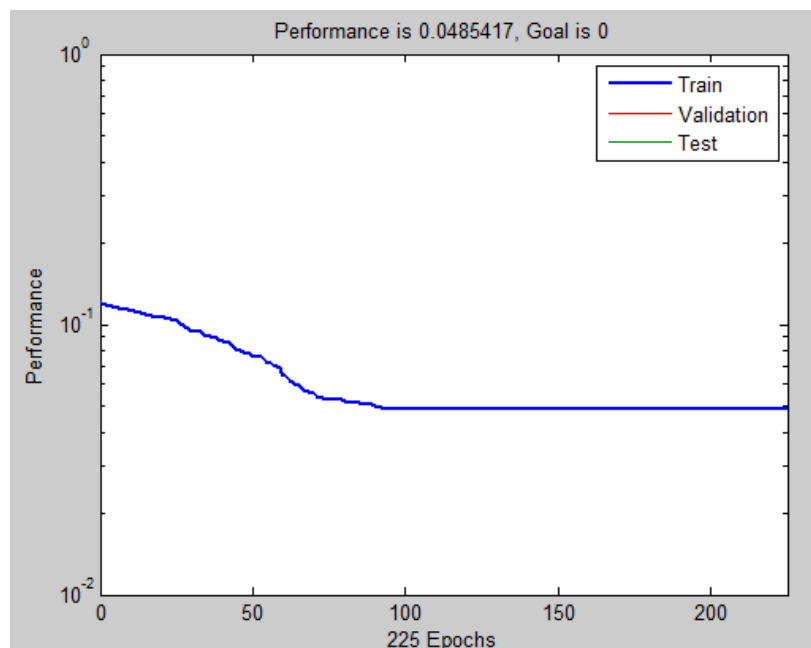


Figure 4: The performance of training

Table 2: The performance of ANN with different number of neurons in hidden layer.

Neurons	Mean square Error (MSE)
0	0.121597
25	0.102795
50	0.0761592
75	0.0525934
100	0.0485931
125	0.0485417
150	0.0485417
175	0.0485417
200	0.0485417
225	0.0485417

In Figure 5, show the comparison of real data and predicated by decision making neural network in which the proposed model work superior as real data.

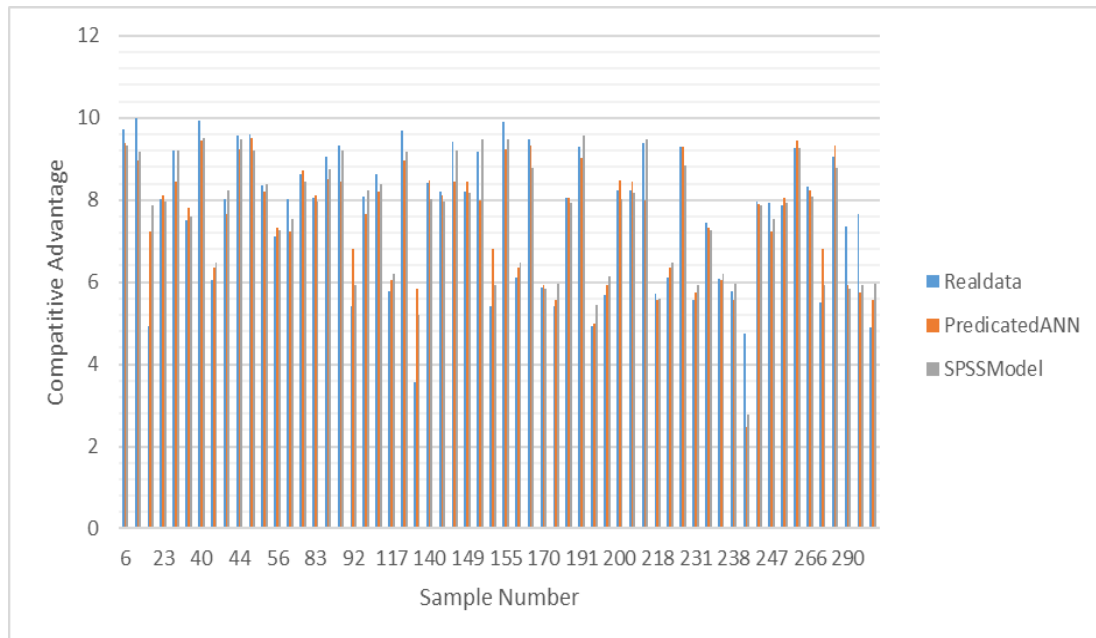


Figure 5: Comparison of real data and predicated.”

Table 3: Model establishing the potential clients using artificial neural networks

Sample	Real data	Predicated ANN	SPSS Model
6	9.72	9.3825	9.33128
10	9.98	8.9533	9.16158
16	4.92	7.2375	7.86895
23	8.02	8.105	7.96949
28	9.21	8.45	9.22107
37	7.5	7.81	7.59032
40	9.94	9.4525	9.5232
41	6.06	6.355	6.46384
42	8.03	7.666	8.22677
44	9.57	9.25	9.48207
52	9.61	9.5025	9.19442
54	8.37	8.1933	8.37184
56	7.11	7.31	7.27011

Sample	Real data	Predicated ANN	SPSS Model
67	8.03	7.24	7.53254
81	8.62	8.7125	8.45229
83	8.04	8.105	7.96949
84	9.04	8.5125	8.75343
88	9.32	8.45	9.22107
92	5.42	6.81	5.9226
102	8.08	7.666	8.22677
114	8.62	8.1933	8.37184
117	5.79	6.0433	6.21723
195	5.7	5.9275	6.14874
200	8.25	8.48	8.03729
209	8.23	8.45	8.17203
211	9.38	8	9.472
218	5.72	5.575	5.59427
221	6.1	6.355	6.46384
228	9.3	9.2975	8.85142
231	5.58	5.74	5.94066
236	7.45	7.31	7.27011
236	7.45	7.31	7.27011
237	6.07	6.0433	6.21723
238	5.79	5.58	5.95582
240	4.76	2.46	2.76845
243	7.96	7.905	7.8859
247	7.93	7.24	7.53254
249	7.87	8.05	7.94634
258	9.27	9.435	9.27815
266	8.32	8.2275	8.09732
272	5.49	6.81	5.9226
283	9.06	9.333	8.77081
290	7.37	5.9166	5.8359
291	7.65	5.74	5.94066
298	4.89	5.58	5.95582

## 6. Conclusion

In this study, the role of Marketing Information Systems Technology in the decision-making process and summarizes the following conclusions based on the data analysis by used SPSS and ANN and findings. And described the artificial neural networks model as well as a review of selected work done in computer science with the application of ANNs. New models, RBFNN and GRNN are used for data classification and ANN is used for algorithm design methods. The well-known data of marketing information system (MkIS) is used to train the ANN and to train the algorithms and test them. Due to the importance of the MkIS, further research can be carried on; The role of MkIS on the performance of the employees, The effect of MkIS on strategic decisions of the firms. The use of MDSS in determining the marketing mix, The effect of database marketing on the firm's market share. The effect of MkIS on product and service development.

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