

Modeling and Predicting Human Behavior in Social Networks with the Neuro-Fuzzy Systems

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Abstract

According to the development of science and technology, every day the progress made in various fields and disciplines. The Internet and its related technologies have become very popular in human life in recent decades. Expansion of Internet facilitates remote communication and the emergence of virtual communities. Virtual communities are known as the virtual social networks, behave as a community and in it, we can see the interaction of people towards each other. Here, data analysis is very important in order to predict some behavioral characteristics with the assumption that such powerful tools like intelligent algorithms are also available. In this paper, we used the advantage of intelligent algorithms in order to extract the available knowledge in social networks and we also discussed the individual's behavior in the specific field. For this purpose, different models and methods have been evaluated. Results indicated that using Neuro-Fuzzy Systems can be the best approach for anticipating human behavior in social networks.

Keywords:

Human Behavior; Neuro-Fuzzy Systems; Social Network; Neuro-Fuzzy Networks

1. Introduction

Human achievement of the industry and new technologies in addition to the benefits and prosperity that has brought has also some damages. Although many inventions and innovations are created to ensure the welfare and strengthening human values, but sometimes it can damage the health of individuals and make changes in their social behavior. Internet availability is not limited to computers or laptops nowadays. Even mobile phones with internet facility are available at affordable process helping indirectly the internet to reach a maximum number of users. In the recent years, everything is related or trying to relate Internet. There are several advantages to the use of the internet. Internet has become a platform to share knowledge between different communities. Arguably one of the most influential web services on the Internet in recent years is the social networking Internet which created an evolutionary change in the social system in

many countries (Ghasem Zadeh, 2011). Changes in a social system are undeniable. In fact, due to more virtual social relation, we can imagine a great society which in there people show some different action because they can be incognito. In society, we have a deal with social behavior such as the manner of eating food, which in Iran it's almost different with other countries. This behavior follows specific rules, and individuals don't make bones about it in their own society. But when they entered in a different society, they want to act like those people but it is temporary and it doesn't make their personality. Involving in different social groups can change our social behavior. But education approach is under the influence of a society culture. In this paper, we investigated the human behavior in social networks. There are several social networks which in each one, people show different actions due to the aim of that social network. So, there will be so many analyses by considering different criteria. In the same vein, the model of human behavior proposed and implemented in the papers are described.

Modeling of human behavior

The modeling of human behavior aims to investigate the human behavior and reaction when confronting different events and form the behavior in form of mathematics formula so that systems are created by formula without human intervention and they spontaneously display logical reaction. Designing such systems is difficult because they are to be adapted with human behavior and can be implemented in a limited extent because people react differently against a similar fact. An individual displays various reactions to an event over the time (Severn, 2003).

Behavior consists of a set of activity types. The human is always involved with doing a task like walking, working, eating and so on. Human do more than a task in a certain time in most cases like walking and speaking. He may decide to do another activity at any moment (ibid).

The modeling of social network

Model in social networks is a summary of facts. It is utilized to describe a general case. Model means sample and example of something. Modeling is simulation. In smaller scale of an object, Simulation is larger. Model may imply a device to speculate. Thus, modeling is creating a system and device to think (Pour Soleimani, 2010). The simplest form of a model is a device to explain how the existences process is evolved and how they are interacted. Estimation of a part or the whole features of a larger system can be attained using a model. Models are classified into the following categories:

- Physical model
- Mental model
- Mathematics model

Physical model

This type of a model is a smaller scale of a large system such as a model of a bridge made by engineers.

Mathematics model

This type consists of describing a system by employing mathematics tools like symbols and theorem. The models given for social networks are mathematics models. The models of social networks illustrate a social network by mathematics tools (graph and matrix).

Features necessary for simulation of social networks

As previously mentioned, social networks are modeled by mathematics tools like graphs and matrix. Modeling of social networks aims to propose a graph that is the most adaptation to our desired social system. The proposed model often seeks to simulate the topologic structure of the social networks. Simulation tools are heads and wings.

The available contribution of the research is divided into two groups and deducted from two various viewpoints as given below:

First group

The novelty is found in the attitude of social network analysis in human behavior. The characteristics of the individuals' behavior are examined more than the relationships among people because the objective is analyzing the individuals' behavior. Therefore, the individuals' personality is prioritized and more analyzed. The graphs of social networks and the relationship among nodes are not the only factor to determine the analysis and conclusion. Thus, it has been tried to modify this attitude of the topic in order to properly make the best decision for analyzing the people behavior in the present research by innovating

and integrating the psychological and engineering attitude.

Second group

This group is the result of careful examining the methods generally mentioned in the previous section. By observing and investigating the applied methods, it is perceived that the available methods are statics and lack any dynamics and are somewhat examined in graph relationships. Regarding the daily science progress and invention of new methods, the adopted method is based on the topic so that it can properly calculate and indicate the stated viewpoint of the first group with the minimum error. In fact, the implementation of the main issue and achieving the desirable result direct us to the intelligent methods.

Intelligent methods have diverse algorithms and diverse applications. But our goal to choose the main method is first to implement and utilize the qualitative data. Then we require using an intelligent method to modify the mistakes and achieve optimization (Pour Soleimani, 2010).

Generally, we seek to innovate and modify the viewpoint to investigate the topic in another perspective. Implementation of a method led to an optimized and reliable result would be the objective of the present study.

2. Materials and Methods

In this research, in order to achieve the final goal to examine the human behavior in cyber social networks, a method was adopted to fully adapt to the collected data type besides being intelligent. Fuzzy-Neuro method is considered as the best method for the considered issue because of several and diverse reasons as given below:

1. Continuity of data and fuzzy studied system
2. Modification and feedback in order to correct the mistakes
3. Weighting variables and selected feature
4. Ability to change the fitting function
5. changing network implemented after receiving feedback

Fuzzy system is actually based on scientific and principle system. The heart of a fuzzy system is scientific basic which build on "if-then" principles and is used by deduction motor. The principle is obtained by consulting with experts in the studied field. The artificial neural networks or in other word neural system networks are modern calculating method in order to machine learning (Weka), presenting

knowledge and using obtaining knowledge in order to anticipate the output response from complicated systems. The main idea of these networks is from bio-neural system in order to process the data, information and knowledge. The key element of the idea is to create new construct for information process system. The mixture of two methods is used in this paper which is conduct in combination. At first, some explanation about neural system is presented and then fuzzy system and at last combination of both of them is explained.

3. Simulation

For Simulation, we used the following equation:

$$y = \sin(3x), \quad x \in [-5,5]$$

Training data are at a distance of 0.1 from each other. Simulation test is repeated ten times with an interval of 0.12 to achieve the mean. Figure 1 and Figure 2 indicated these data.

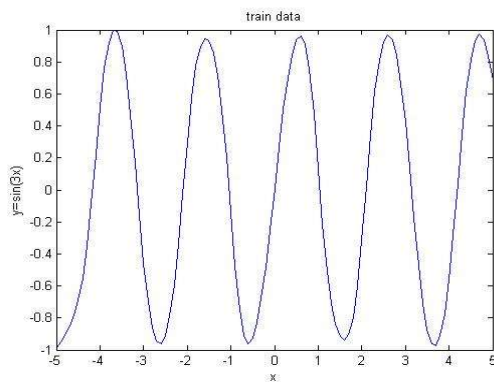


Figure 1. Training data

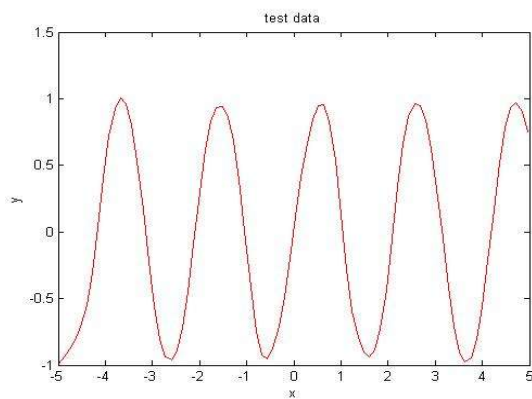


Figure 2. Test data

Combination Method: in this method we used the gradient descent and least square error. Two different common software are widely used in this study (WEKA, MATLAB) to implement the algorithms and test output. New data was collected because the evaluated data in the Database had the least correlation with the structure and the idea of this problem. Evaluation of Available Databases

First, we investigate the different databases. By analyzing different data centers, centers that had a high reputation for research work were selected. Table 1 illustrated the data of an active group in Telegram (the most favorable Iranian social network).

Table 1. Grouping

No.	Feature	
1	age	With number
2	gender	Male = 0, female = 1
3	Education	Diploma = 0, Advanced Diploma = 1, BA = 2, MA = 3
4	Literature	Classic = 0, modern literature = 1
5	Treatment	Serious = 0, joking = 1, nervous = 2, rude = 3

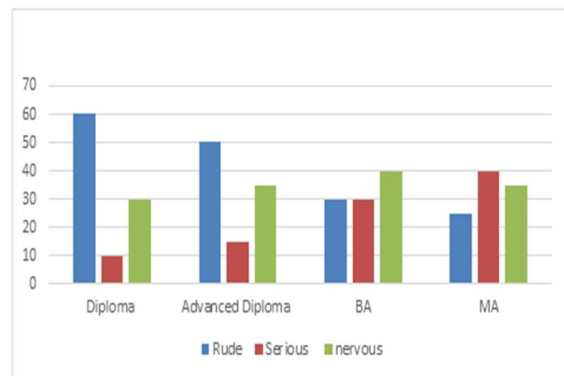


Figure 3: Category Data

Data preprocessing

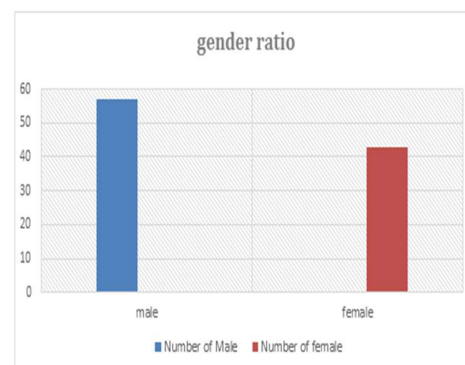
Here, based on the explanation of data and their specifications, data processing is necessary in order to evaluate data and even obtaining the right results. Data in the real world are incompatible, disturbed and imperfect. The aim of data cleansing processes is as the following: softening the confusion data, determining the skeleton and revising the incompatibility. Finally, the preprocessing of data occurs based on the following format:

Table 2. Data of issue

No.	data	Data Designation	Term
1	Numeric	Man:1 Woman: 0	Gender
2	Alphabet	NM:not M:yes	Married
3	Numeric	Any Number	Age
4	Alphabet	Engineering:1 Medical:2 literature: 3	Education
5	Numeric	Any	Number of Post
6	Numeric	Any	Number of Follower
7	Numeric	Any	Number of Following
8	Numeric	Any	Mean Num of post Description
9	Numeric	Any	Mean Num Of Tag
10	Numeric	Any	Last post time day
11	Numeric	Any	Number Of Post Personal
12	Numeric	Any	Mean Time Of Post
13	Numeric	Any	Max interval between two post
14	Numeric	Any	Min interval between two post
15	Numeric	Yes: 1 , No :0	Same Post
16	Numeric	Any	Max num Of Like
17	Numeric	Any	Num Of Pic Post
18	Numeric	Any	Num Mov Post
19	Numeric	Personal:1 No:0	Account Type
21	Numeric	General:1 Private:0	General Or Private
22	Numeric	info:1 , culture: 2 , sport:3 , philosophy:4 , politic: 5 , personal:6	Category

Evaluation of collected data based on the statistics view

The ration between sexes is shown in the following chart. We have tried to make a relative balance between sexes. In other words, the number of females is the equal with number of males. These collected data were 100 persons, which have distributed in the following chart.

**Figure 4.** Gender ratio

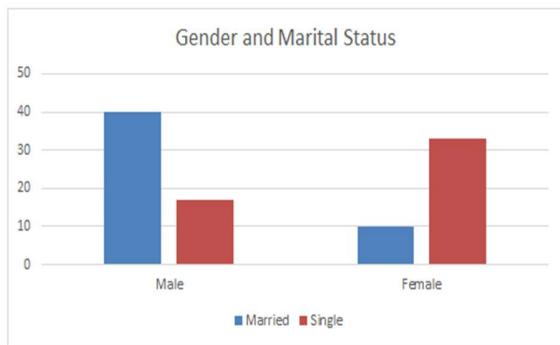


Figure 5 Genders and Martial Status

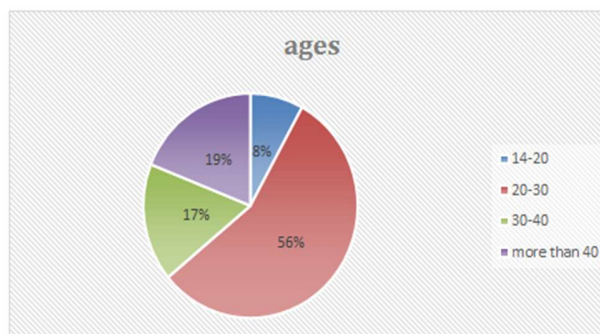


Figure 6 Ages

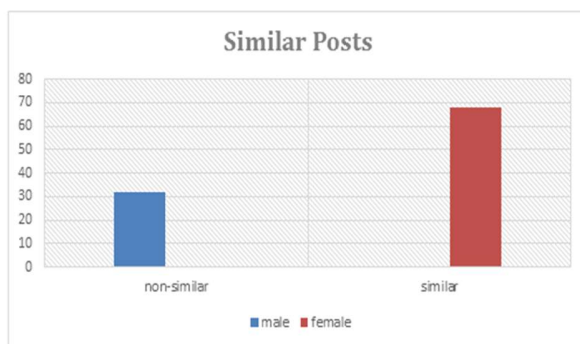


Figure 7 the number of Similar Posts

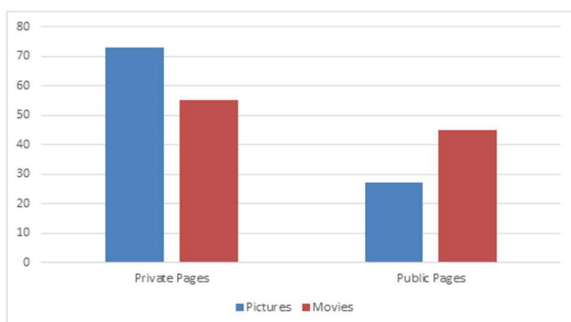


Figure 8 Public and Private

4. Conclusion

Human behavior is to the same complexity of creation, and according to the modeling of that behavior, the work is by far more complex and difficult. Modeling of human behavior is complex especially while working with computer soft wares which work only based on defaults and predetermined and specific routes.

A large part of researches is involved in social networks which includes their modeling and analysis. Electronic post traffic, patients' transference and criminal activities all can be modeled with social networks. A social network describes the actors and relations between them and events.

Many people have concluded that social networks are a key facilitator in collaborations. Social scientists have analyzed the effect of these networks through determining the particulars of important people who should be evaluated in order for accessing some goals.

Social network is a collection of individuals (or organization or other social entities) that has been correlated by means of a collection of social relations like information exchange, cooperation or friendship. Analysis of network occurs based on communications analysis in a society. Therefore, a network is determined as a collection of objects (or nodes) and a collection of relations.

Analysis of approach social networks is for studying the interaction of humanitarian networks, and communication structure or social networks' organizing is used for evaluating the patterns. Social network analysis and two mathematical and visual analyses show humanitarian relations among the individuals. Web can also be considered as a social network. Web middle plate social networks are constituted through connecting with other web pages and web-based social networks analysis is the same links analysis among pages. In social sciences, net includes a collection of actors (or nodes, factors or points or heads) which might have some relations (links, edges) with each other.

Finally, in this research, we deal with three social networks of Instagram, telegram and wiki, and finally, considering the facility in gathering the data, Instagram net has been chosen. 100 people's data have been collected in order to finally be able to categorize the manner of posting and intellectual tendency of individuals according to the existent particulars in their pages which have been extracted as feature.

Collected data have been divided to 7 main features using help and advice that finally the program should be implemented and output be discussed according to one of the features in categorization of the kind of posts in Instagram.

Some methods with high convergence speed and optimality of answer and two Weka and MATLAB soft wares have been used in implementation.

To achieve our goal, we deal with different approaches and use different methods. The first method that we considered for attaining our goal was using data analysis methods that finally, in chapter 3, output and the results of using these methods have been shown.

By comparing the obtained answers from different methods, we can consider the following conclusions: Neural networks' feedback, as compared to other data analysis methods, has more importance and priority. This is because, by comparing the intended approaches, relevant methods to neural network have higher categorization accuracy that this issue by itself justifies and guarantees the accuracy and reason of using neural networks in this research.

Also, by observing the results tables of chapter 5, we can conclude that pure statistical approaches which are in fact far from feedback and function statically, have by far worse results than other under evaluation methods, and they are not so suitable for finding knowledge and data-mining.

But, according to the fuzziness of data and the need for correction and back from error, there was a need for a method with high dynamic coefficient. Due to this reason, a combination of fuzzy method and neural network was used.

The Neuro-fuzzy method was adopted which led to achieve the best results. It was observed that the best results in terms of classification and lowest error can be attained by this method.

In conclusion, it can be stated that neurotic and fuzzy networks are one of the most efficient methods for covering fuzzification of data and attaining the lowest error. This method is classified in topics with high complexity and great number of variables so that it could allocate 88% (the lowest error among the available methods) of the data into cultural, sports, philosophy, political and personal groups (Rajabi, 2011). Thus, this method can be properly adopted for the present research.

References

- [1] Ghasem Zadeh, M. 2021. "The Role of Social Networking in logic and international developments", the portals of our policy, public Dplmasy and messengers
- [2] Severn, Joseph Werner. 2023. Theories of communication, Translation by Dehghan. Tehran: Tehran University.
- [3] Pour Soleimani, R. 2020. "Social networking opportunities and threats." Information and Library Science, RAHAVARD light. 31, pp. 14
- [4] Rajabi, Z, 2021. Representation of political tendencies with the Iranians in social networks. Case of study: Facebook.