Social Network Analysis e-Learning Systems via Neutrosophic Techniques

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Abstract :
Conducting effective eLearning in the age of Social Networks is a big challenge. Education is currently conducted in highly controlled way. E-learning has emerged as an answer to provide freedom for learners in the way that face-to-face learning cannot deliver. Despite many advantages of e-learning, it does not provide the best learning experience due to many shortages, limitations, and challenges. The best learning experience might be available by combining in-class and online learning. One more feature that e-learning lacks is peers interaction. Peers interaction has been facilitated through social networks. Utilizing social networks in e-Learning has changed the way students percieves learning. Neutrosophy has been introduced by Smarandache as a new branch of philosophy. The purpose of this paper is to present a proposed Social Learning Management System that integrates social activites in e-Learning, and utilize a new set theory called the neutrosophic set to analyze social networks data conducted through learning activities.Results shows that recommendations can be enhanced through utilizing proposed system.

Keywords: *e-Learning, Data-Mining, Facebook, Social Media, Clustering, LMS, Neutrosophic Set*

1. Introduction

E-learning can be thought of as structured learning conducted over an electronic platform. One of the recommendations of Clayton Christensen's Disrupting Class is to take a "student-centric" approach to education, one that responds to students' unique learning styles and preferences.[1] This is difficult in face-to-face setting with our usual educational model as it is formed in very systematic "teacher-centric" way. Now-a-days, is indirectly designed to mold every student with the same method, on the same path, in same pace, and with teacher as the standard mold. E.A. Ross describes education as "the most effective means of control."[2] Teacher is the most significant agency, even in this era that many countries' governments are highly promoted "student-centric" as a key strategy for education. The word "program" is commonly used in terms of conducting curriculum. Such fact make many conclude that "education is all about control."[3] Ideally, education always means "right and freedom," as reaffirmed by many international organizations' articles such as UNESCO's.[4] It is such a big dilemma to set education in controlled way for making result with the freedom. Stanford University's Dr. Moe mentioned, in American Experiment luncheon in August 2009, "Technology is always an answer for education."[5] He particularly mentioned that technology is E-learning. E-learning is promised to give freedom to learners in many aspects, such as learning at any place and at any time. While many aim that E-learning is a revolutionize tool [6] for education, it has delivered lower impact than expected. [7] More than 70% of e-learning courses existed are designed to, more or less, duplicate face-to-face learning, which are more than half in presentation style.[8] BYU's Clark Gilbert observed that most existed e-learning style with "the lack of meaningful content and quality standards in many dot-com publications."[9] Most online courses are "flexible from a schedule standpoint, but not the best learning experience."[10] Good online

courses would require “innovative, first-rate course designs and strategies for engaging students.” Most online courses reflected the assumption that instruction is either all in the classroom or all from online. In fact, a hybrid course also effectively reaches to students with differing learning styles.[11] A combination of both online and in-class instruction allows the various learning activities to be conducted via more effective medium. Many activities traditionally done in classroom, such as listening to a lecture or taking a test, can be effectively conducted online. Even an instructor-led discussion may be better if it occurs both in-class and online, allowing shy students to make their points in the more anonymous online setting. Online technology is not just to make learning more efficient, but to enhance it by allowing students and professors to better prepare for face-to-face or online learning experiences. With all mentioned potentials, now-a-day, online learning is on the rise across all areas of education. For higher education in the U.S., 79% of students access course-specific materials at least once a week.[12] So, to achieve freedom in learning system, teacher control and peers interaction advantages. We propose system of learning management system(LMS) that incorporates within its beneath social networks and makes use of social network analysis in understanding students behavior and helps shaping their learning path.

2. Related work

Social networks are graph structures whose nodes or vertices represent people or other entities embedded in a social context, and whose edges represent interaction or collaboration between these entities [1]. As Clayton M. Christensen and Henry J. Eyring mentioned “most online courses allow students to work at their own pace but provided no student-to-student interaction” [1] until social media came along. In 2004, Mark Zuckerberg developed a website which was the first iteration of the facebook and social networking phenomena.[13] Social network has been raised to mutuality in very short ages from the tools for communication in the close circle to the medium of communication for all, thanks to rapid development of mobile communication and information technology. As of today, social network has developed to become a new and true definition of "sharing", “collaborating", and “conversation" in the new form. While social networking means conversation, share, and collaborate, it is naturally in opposite polar from highly controlled education. Therefore integrating social networking to existed controlled programs of e-learning suggests chaos, especially in already-unstable world of e-learning. [14] Social networks are highly dynamic, evolving relationships among people or other entities. This dynamic property of social networks makes studying these graphs a challenging task. A lot of research has been done recently to study different properties of these networks. Such complex analysis of large, heterogeneous, multi-relational social networks has led to an interesting field of study known as Social Network Analysis (SNA). Social network analysis, which can be applied to analysis of the structure and the property of personal relationship, web page links, and the spread of messages, is a research field in sociology. Recently social network analysis has attracted increasing attention in the data mining research community. From the viewpoint of data mining, a social network is a heterogeneous and multi-relational dataset represented by graph [15, 16]. Tools used to support social media in e-learning cover a wide range of different applications. They include discussion forums, chat, file sharing, video conferences, shared whiteboards, e-portfolios, weblogs and wikis. Such tools can be used to support different activities involved in the learning process. The question of organizing e-learning tools involves the problem of integration vs. separation and distribution. A logic in which each proposition is estimated to have the percentage of truth in a subset T, the percentage of indeterminacy in a subset I, and the percentage of falsity in a subset F, where T, I, F are defined above, is called Neutrosophic Logic in [17, 18, 19, 20, 21, 22, 23, 24,25]. We use a subset of truth (or indeterminacy, or falsity), instead of a number only, because in many cases we are not able to exactly determine the percentages of truth and of falsity but to approximate them: for example a proposition is between 0.30-0.40 true and between 0.60-0.70 false, even worst: between 0.30-0.40 or 0.45-0.50 true (according to various analyzers), and 0.60 or between 0.66-0.70 false. The subsets are not necessary intervals, but any sets (discrete, continuous, open or closed or

halfopen/half-closed interval, intersections or unions of the previous sets, etc.) in accordance with the given proposition. A subset may have one element only in special cases of this logic. Constants: (T, I, F) truth-values, where T, I, F are standard or non-standard subsets of the non-standard interval $]\,^{-}0, 1^{+}\,[$, where $n_{inf} = \inf T + \inf I + \inf F \geq {}^{-}0$, and $n_{sup} = \sup T + \sup I + \sup F \leq 3^{+}$.
Atomic formulas: a, b, c, … .
Arbitrary formulas: A, B, C, … .

3. Proposed Framework

Figure 1 presents our proposed Social LMS that incorporates social networks in the e-Learning system. Social LMS consists of two main components: Learning System, and Social Network. Proposed system incorporates traditional learning activities as depicted in figure 2.

1. ***Learning System*:**
   - Use LMS that is responsible for learning activates
   - Use synchronous and asynchronous e-learning
     - **Enable Synchronous e-learning** : any learning event delivered in real time to remote learners such as (E-mail, Comments, Downloadable learning materials)
     - **Enable Asynchronous e-learning**: learning situations in which the learning event does not take place in real-time such as (Multicast webinars, Tele-video conferencing, Chat)

2. ***Social Network*:**
   - Use relation-ship between teacher and students (one-to-many).
   - Use Graph theory clustering algorithm
   - Use video and voice conference and electronic posts and exams with high level quality

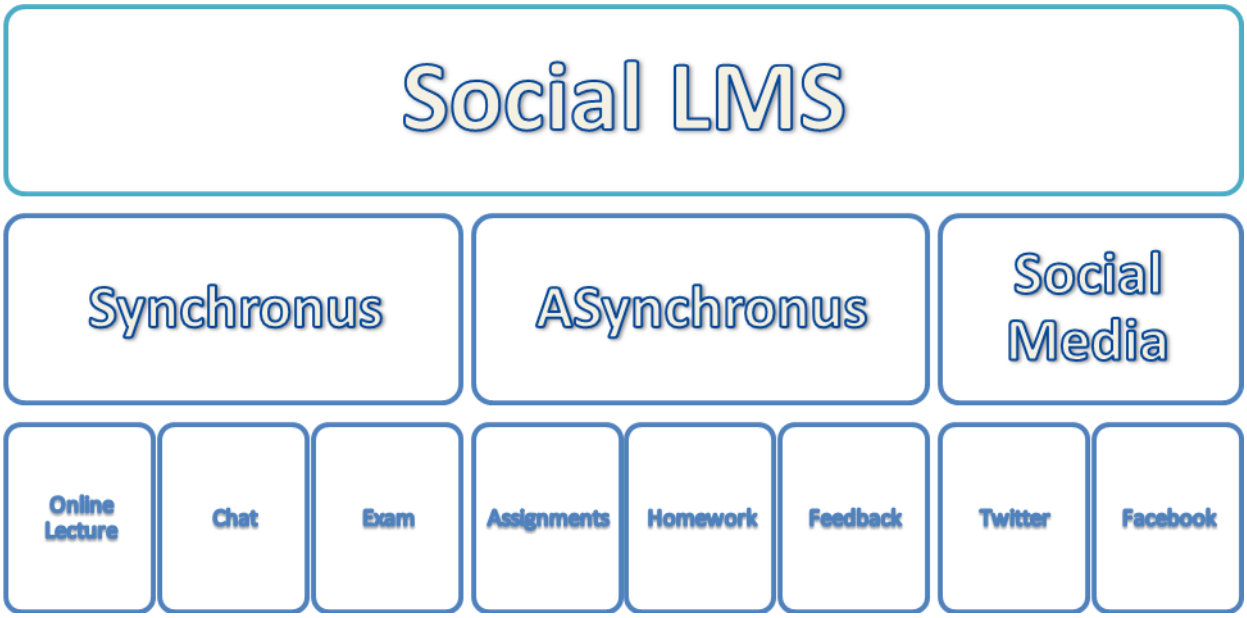


Figure 1: Social LMS Components

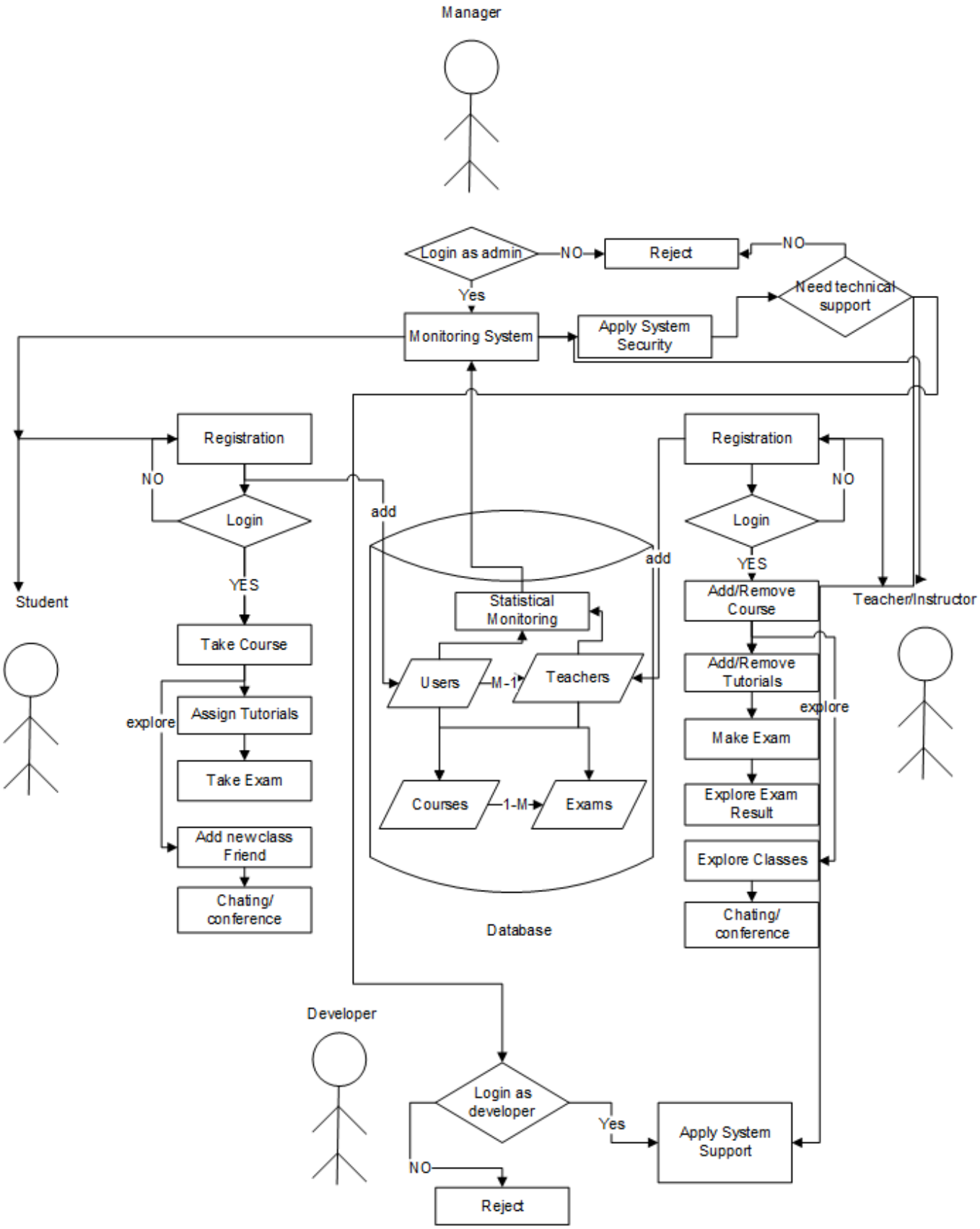


Figure 2: Traditional e-Learning Activities

In our proposed Social LMS, we utilize Graph Theory in analyzing the relations between students on social networks such as facebook and twitter. Basically Graph theory clustering algorithm uses objects and links among objects (data classes) to make clustering analysis. Similarly social network also includes objects and links among these objects. [16] Figure 3 presents a sample of social network representation using nodes and edges.

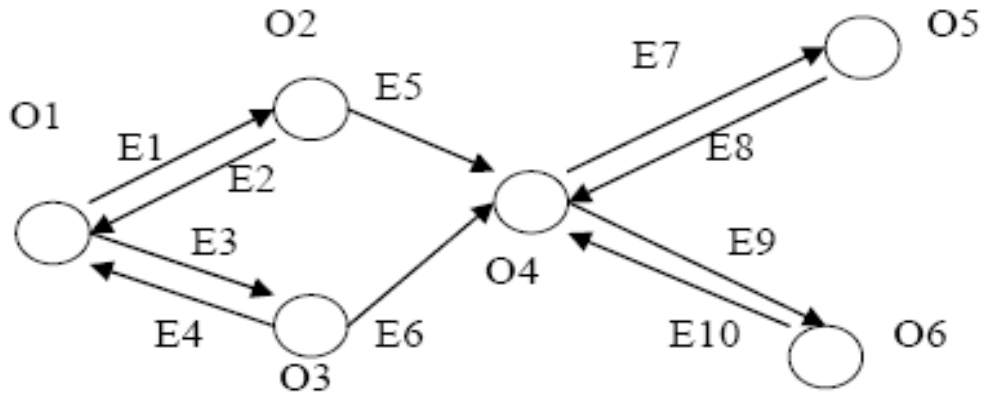


Figure 3: A sample of social network

In view of the same pre-condition, the Business System Planning (BSP) clustering algorithm can be used in social network clustering analysis. According to graph theory, social network is a directed graph composed by objects and their relationship. In figure 3, the circle in the figure represents an object; the line with arrow is an edge of the graph, and it represents directed link between two objects, so a social network is a directed graph. In figure 3, Let Oi be an object in social network (i = 1...m), let Ej which means directed link between two objects, be a directed edge of the graph (j = 1...n).

After definition of objects and directed edges, also define reachable relation between two objects. There are two kinds of reachable relation among objects, shown as following:

1) One-step reachable relation: if there has directed link from Oi to Oj through one and only one directed edge, then Oi to Oj is a one-step reachable relation. For instance in figure 1 there has a directed link from O1 to O2 through the directed edge E1, O1 to O2 is one-step reachable relation.

2) Multi-steps reachable relation: if there has directed link from O i to O j through two or more directed edges, then O i to O j is a multi-steps reachable relation.

For instance in figure 3 has a directed link from O1 to O4 through directed edges E1 and E5, then O1 to O4 is a 2-steps reachable relation.

To Generate edge creation matrix and edge pointed matrix, we can consume the following steps. Figure 4 shows an example of a graph that will have graph theory applied upon. First according to the objects and edges in the graph, define two matrixes Lc and Lp. Let Lc be a m× n matrix which means the creation of edges. In the matrix, Lc (i, j) =1 denotes object Oi connects with the tail of edge Ej , which means that

object Oi creates the directed edge Ej . L (i, j) c =0 denotes Oi doesn't connect with the tail of edge Ej , which means Ej isn't created by object Oi .

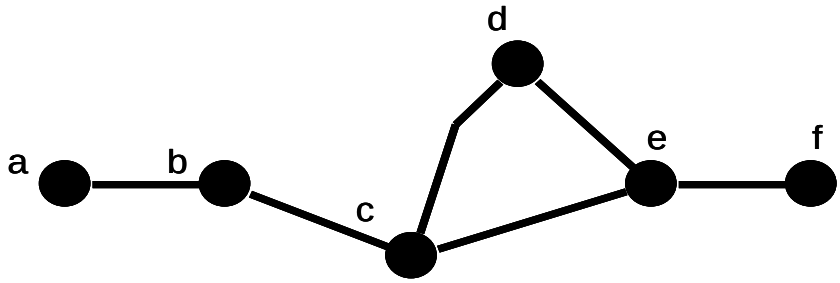


Figure 4: example of graph theory

	a	b	c	d	e	f
A	0	1	0	0	0	0
B	1	0	1	0	0	0
C	0	1	0	1	1	0
D	0	0	1	0	1	0
E	0	0	1	1	0	1
F	0	0	0	0	1	0

Figure 5: Adjacency matrix for graph in Figure 4.

4. Experimental Results and Comments on Results

We have developed an Excel package to be utilized for calculating Neutrosophic data and analyze them. We have used Excel as it is a powerful tool that is widely accepted and used for statistical analysis. Figure 6 shows Class Diagram of the implemented package. Figure 7 presents a working example of the package interface calculating the complement. Our implemented Neutrosophic package can calculate Intersection, Union, and Complement of the Nuetrosophic set. Figure 8 presents our Neutrosphic package capability to draw figures of presented Neutrosphic set. Figure 9 presents charting of Union operation calculation, and figure 10 Intersection Operation. Nuetrosophic set are characterized by its efficiency as it takes into consideration the three data items: True, Intermediate, and False. It is believed that integrating Neutrosophic calculation in e-Learning will yield more accurate results in the overall learning process for different activities as will be followed in the future work.

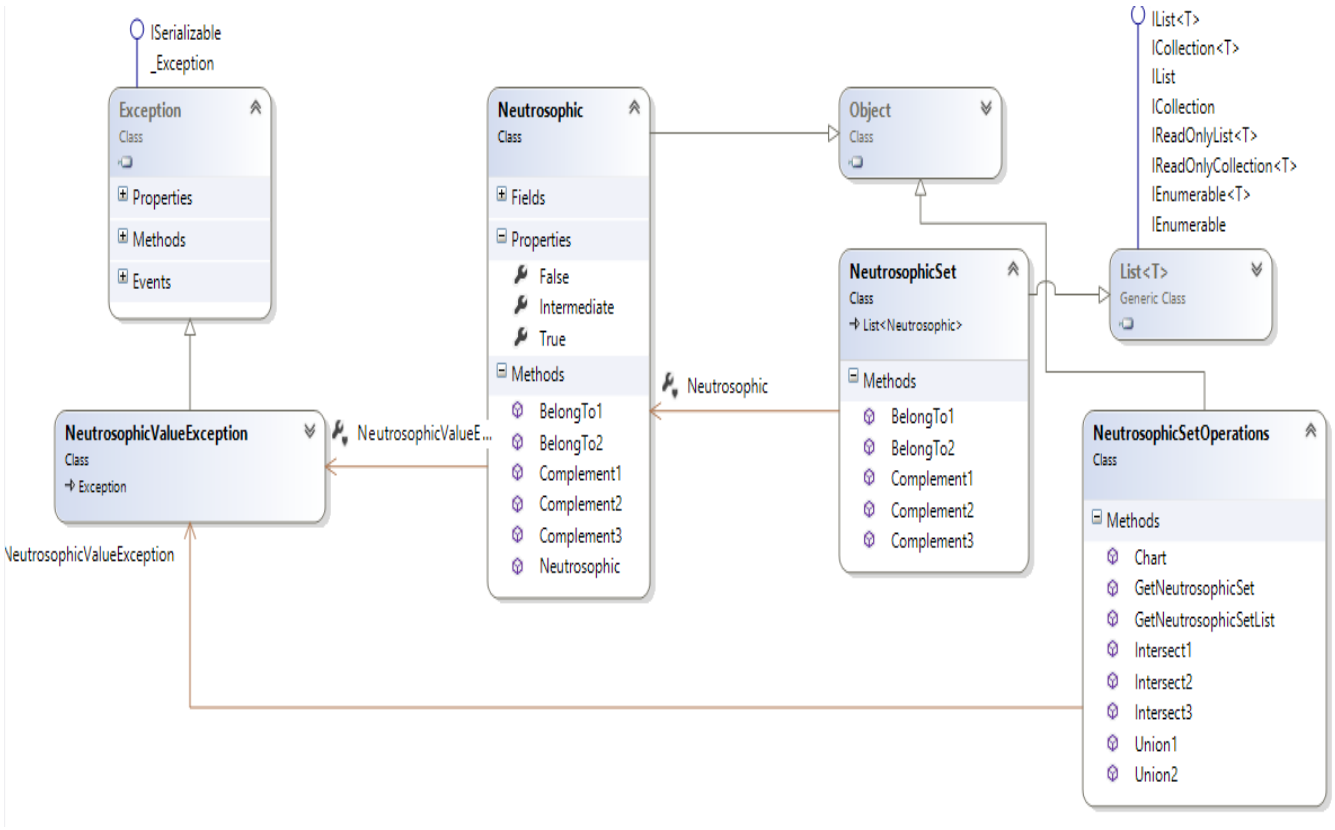
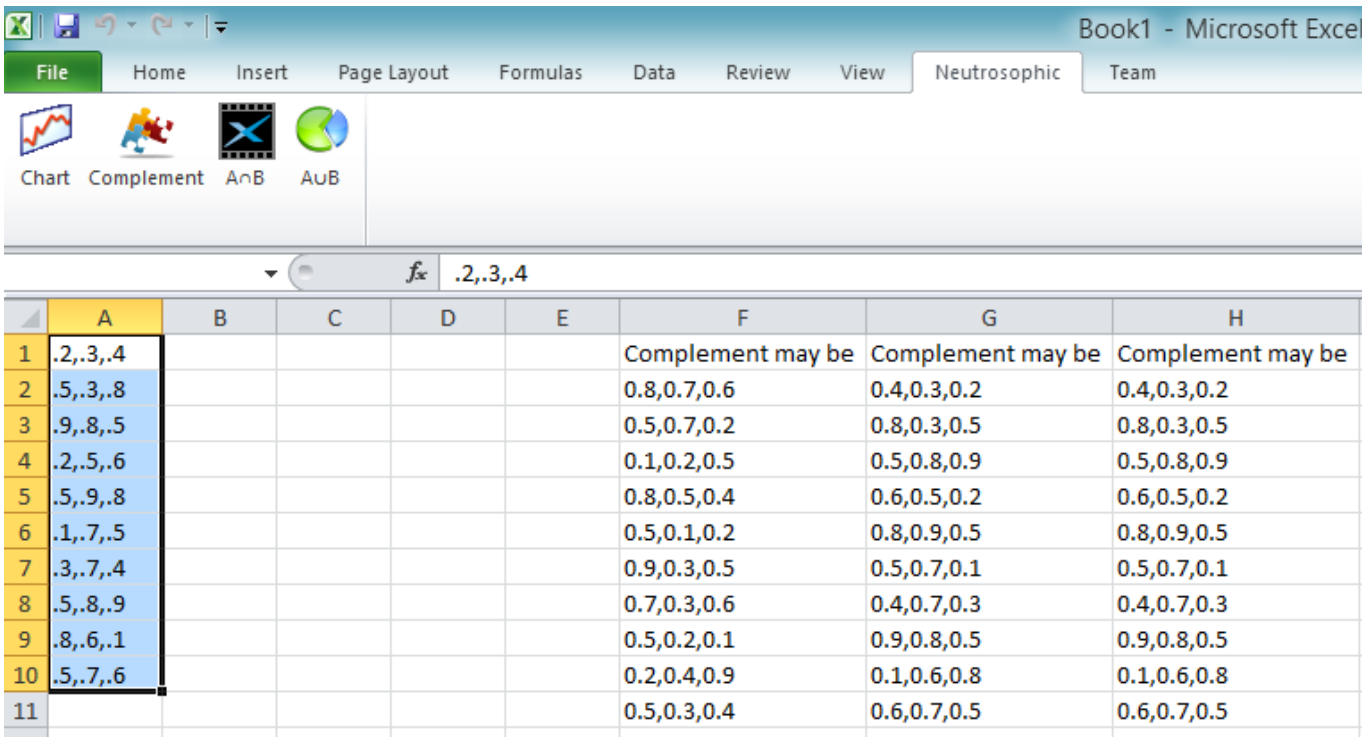


Figure 6: Neutrosophic Package Class Diagram



	A	B	C	D	E	F	G	H
1	.2,.3,.4					Complement may be	Complement may be	Complement may be
2	.5,.3,.8					0.8,0.7,0.6	0.4,0.3,0.2	0.4,0.3,0.2
3	.9,.8,.5					0.5,0.7,0.2	0.8,0.3,0.5	0.8,0.3,0.5
4	.2,.5,.6					0.1,0.2,0.5	0.5,0.8,0.9	0.5,0.8,0.9
5	.5,.9,.8					0.8,0.5,0.4	0.6,0.5,0.2	0.6,0.5,0.2
6	.1,.7,.5					0.5,0.1,0.2	0.8,0.9,0.5	0.8,0.9,0.5
7	.3,.7,.4					0.9,0.3,0.5	0.5,0.7,0.1	0.5,0.7,0.1
8	.5,.8,.9					0.7,0.3,0.6	0.4,0.7,0.3	0.4,0.7,0.3
9	.8,.6,.1					0.5,0.2,0.1	0.9,0.8,0.5	0.9,0.8,0.5
10	.5,.7,.6					0.2,0.4,0.9	0.1,0.6,0.8	0.1,0.6,0.8
11						0.5,0.3,0.4	0.6,0.7,0.5	0.6,0.7,0.5

Figure 7: Neutrosophic Package Interface and Calculating Complement

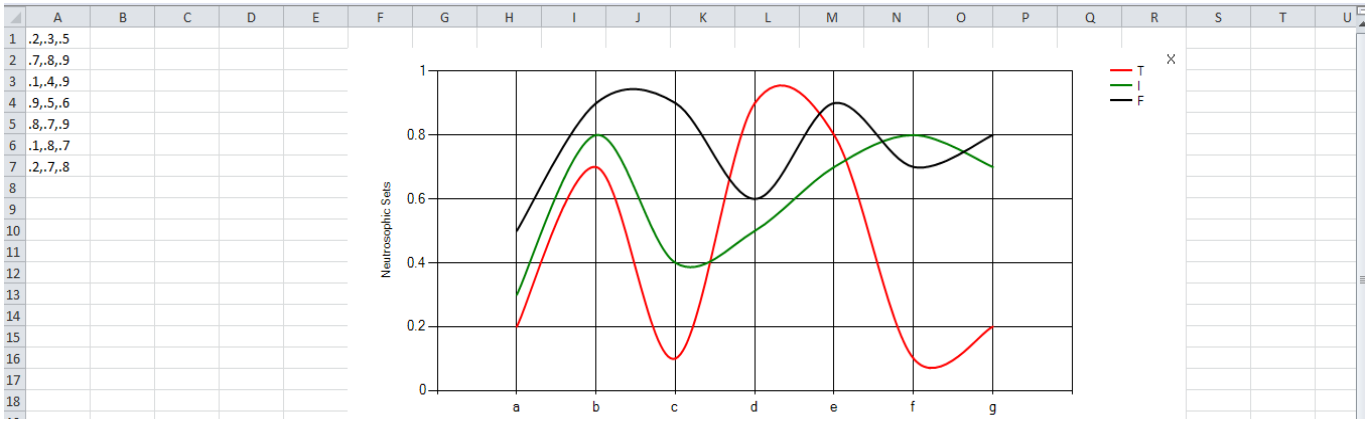


Figure 8: Neutrosophic Chart

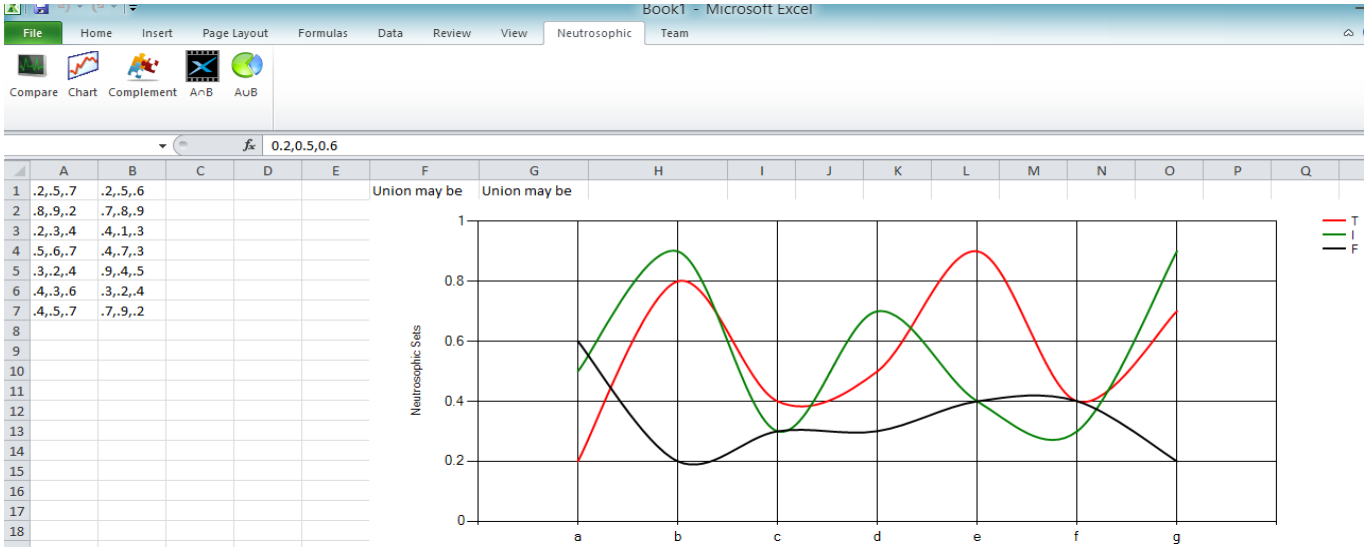


Figure 9: Neutrosophic Package Union Chart

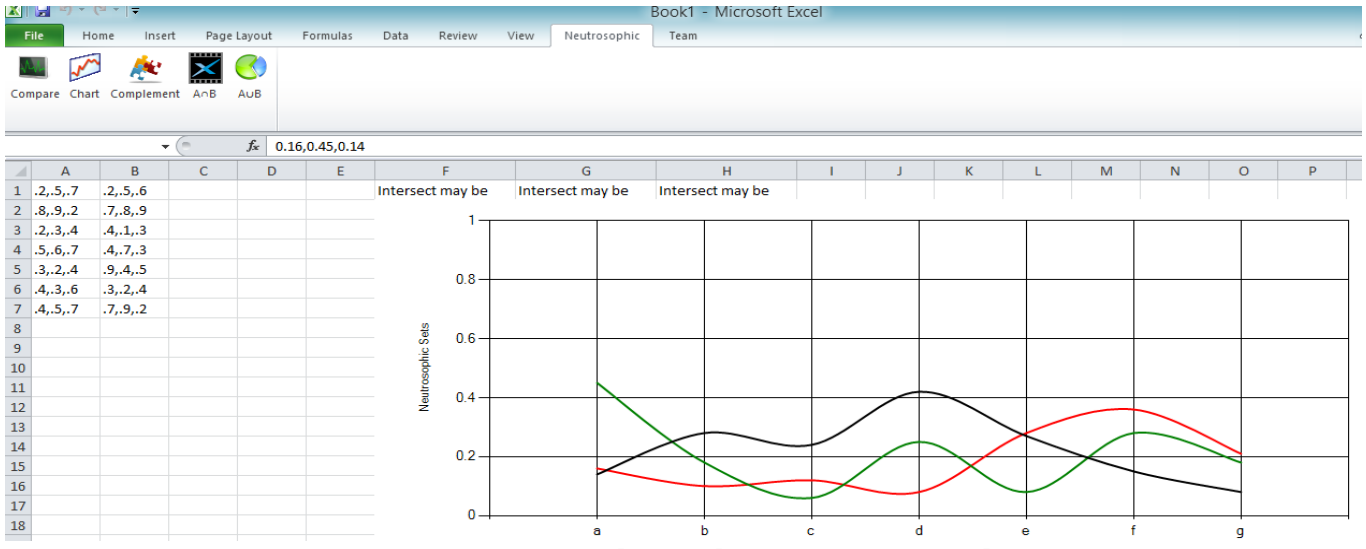


Figure 10: Neutrosophic Package Intersection Chart

5. Conclusion and Future Work

e-Learning is moving rapidly towards integrating social network activities in presented enhanced learning experience to students. Social Netowkrs are dominating nowadays, and students spend long times there. In this paper, we presented an effective e-Learning model that integrates social networks activities in e-Learning. We have presented a proposed effective e-Learning system that utilizes a newly presented Neutrosophic set in analyzing social network data integrated in e-Learning. Identifying relationships between students is important for learning. Future work include incorporating the results we have achieved in customizing course contents to students, and recommending new learning objects more suitable for personalized learning.

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