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An Intelligent Method of Information Provisioning in an Academic Social Network

[Swapnil S. Ninawe and Pallapa Venkataram]

Abstract— **The rapid development of communication and networking has lessened geographical boundaries further to social networking, which enables to set up relations among people who share common interests, activities or connections. In social networks, actors (or people) often want to acquire information based on their activities, education, role, etc. The social network concept handles human relationships in networks efficiently to achieve the information provision. Due to advent of social networks, the need for flexible, adaptable and rapid response time to information provision has become increasingly important. An academic social network is grouping of a specific academic faculty group members at different levels. For example, a communication group in a research institution could have the members like professor, faculty, research students, graduate students, project staff, lab assistants, etc. At each level group members, they need relevant information on the projects currently leading on elsewhere. Hence, we feel that any one of the group member searches for related research information for his level appropriately, the system intelligently makes other group members aware of developments on the issues. For example, a professor gets some information in a concept based environment, on the other hand, the system should be providing relevant lab oriented information to lab assistant. The information need to be provided suitable to actors with different requirements, hence, to enable such intelligent way of information provision, we need to consider various characteristic features of actors such as personal information, professional information, etc. Traditional networks provide static information which are not actor adaptive, and they do not use characteristic information of actors and their profile parameters to provide dynamically adapted information. In this paper, we present an Intelligent Method of Information Provisioning in an Academic Social Network (IMIPASON) by considering actor's characteristic features like activity, education, qualification, etc., which reflects on the web queries generated by actors. In this method, we classify academic group of actors based on their hierarchical relations with respect to academic activities. In the case of any group of actors raises a web query, the proposed system generates appropriate queries for rest of the actors who need information based on the activities of the entire group. The designed IMIPASON is tested over an Academic SOcial Network (ASON) which constitutes a set of actors related to the academic profession. The system generates appropriate queries for all the actors if any one of them desires the information. We have simulated different sets of academic actors and tested the system. Results were obtained for the accuracy of our proposed IMIPASON model, and the average service time required for generating queries for a set of actors.**

***Keywords*— information, actor, relation, level, social network**

Swapnil S. Ninawe and Pallapa Venkataram
PET Unit, Department of ECE,
Indian Institute of Science, Bangalore, India

I. Introduction

A social network [1-2] is a social structure among individuals known as actors or organizations. The social network also defines a group of actors connected by a set of relationships that are continuously changing. After constructing a social network, its ultimate goal is sharing knowledge. Social networks have influenced actors of different regions to share the information due to the advancement in the information technology. The main goal of a social network is to make the information space, where actors can share information like thoughts, personal data, events, etc. Visibility of information [3], structural variations [4], and access [5] are significant characteristics of a social network.

With the increasing number of available information, and the growing need to collaborate and share the knowledge in academics, a challenge here is to develop a method which will give appropriate information to every member of the academic group so as to increase their knowledge with the latest developments. These are the factors which generate a growing interest in order to speed up and facilitate the intelligent method of information provisioning.

A. *Proposed Idea*

In this paper, we propose an Intelligent Method of Information Provisioning in an Academic Social Network (IMIPASON) which takes characteristic features of actors like activity, education, occupation, etc., into account along with relation among actors. Depending upon the relations built among the actors and characteristic features of an actor, the appropriate information is provided to actors.

B. *Organization of the paper*

The organization of the rest of the paper is as follows. First, in Section II, we discuss some of the existing works of information provisioning in a social network. Later, an Intelligent Method of Information Provisioning in an Academic Social Network (IMIPASON) is presented in Section III followed by simulation environment, simulation results and conclusion in Section IV, Section V and Section VI, respectively.

II. Some of the Existing Works

Very few works exist on information provision in a social network, where Web 2.0 and 3.0 were exploited [6], and showed that teaching and learning were co-created between the instructors and learners and viewed from the participative and service oriented approach. The relationship between the tie strength and information propagation in online social networks (OSNs) was investigated [7], and proposed a novel information diffusion model to simulate

the information propagation in OSNs. Investigation of the effects of two types of indicators, user attributes and social network attributes, and study on the accuracy of predicting the scale of information diffusion, and how to select an appropriate model that can fit real data better and have a higher accuracy was carried out [8]. Systematic characterization of both short-term and long term dynamics of influence diffusion in this model was provided [9], and illustrate that the steady state behaviors of the dynamics depend on three types of graph structures, which was referred to as balanced graphs, anti-balanced graphs, and strictly unbalanced graphs. The information diffusion behavior of social network by studying the behavior of infection flow in a social network was analyzed [10], where social network is modeled on the basis of two main parameters, number of nodes and average degree of the network.

We propose a method which considers characteristic features such as personal information, professional information, activities, etc. of the actors in order to provide appropriate information which suits the actors most in a social network.

III. Proposed Method of Information Provisioning in an Academic Social Network

We have designed an Academic SOcial Network (ASON) by considering the academic research persons like professor, principal scientist, senior scientist, junior scientist, research student, master student, undergraduate student, etc. We have built actors' characteristics in the ASON by examining their profession, activity, personal information, etc. Some of the actors' characteristic features are shown in Table I. In the ASON shown in Fig. 1, the relations among the actors are found to be hierarchical and equivalence based on the characteristics of the actors. The hierarchical relation is formed when actors exhibit decreasing nature of characteristics. For example, a professor, in an academic institution, possesses higher characteristics with respect to qualification, experience, role, activity, etc., on the other hand, a research student possesses lower characteristics as compared to a professor. The equivalence relation among the actors is formed when actors possess similar nature of characteristics. For example, the hierarchical relation exists among professor, principal scientist, junior scientist 3, and project assistant 2, at the same time, the equivalence relation exists among junior scientist 1 and junior scientist 2.

With the increasing number of queries along with the growing need to share the knowledge in the Academic Social Network (ASON), it is necessary to provide appropriate information to the members of the ASON in order to enrich their knowledge. Hence, we propose an Intelligent Method of Information Provisioning in an Academic Social Network (IMIPASON) by adopting characteristic features of the members (see Table II) of the ASON. The system understands the level of information required from each categories of the academic group, and accordingly provides the technical information to augment their knowledge. We have provided the intelligent way of information provisioning which creates queries for each of the query placed by the academic group member. In the academic group, when a query (see Table III) is issued by any group member, it creates relevant sub queries (if necessary) for all the group members as per their level. To illustrate the information provisioning in the academic social network, we consider the following cases.

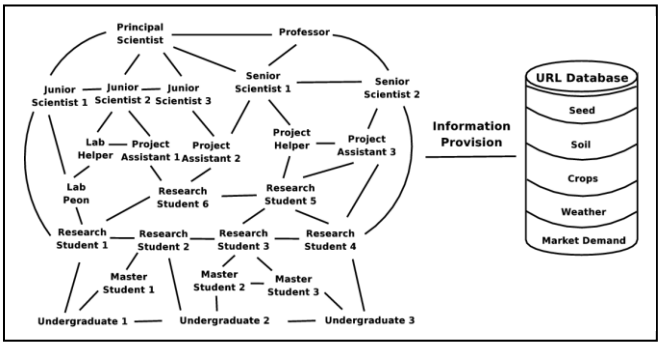

Figure 1. A typical application for the academic social network.

Case 1: Query placement by professor

In case of a professor, who is at level 1 in the ASON, with query as "Water Content of soil must be greater than 35% for the crop", the other actors of the group receive the information as follows.

1) Query reception by principal scientist

As principal scientist is at level 2, hence he receives query as "Water Content of soil must be good for the crop".

2) Query reception by junior scientist 3

Since, junior scientist 3 is at level 3, he receives query as "Soil should hold ample amount of water".

3) Query reception by project assistant 2

As project assistant 2 is at level 4, therefore he receives query as "Soil testing".

4) Query reception by research student 6

Project assistant 2 is at level 5, so he receives query as "Soil testing".

Case 2: Query placement by junior scientist 2

In case of junior scientist 2, who is at level 3 in the ASON, with query as "Water harvesting from rainfall must be 15 mega liters per season", the other actors of the group receive the information as follows.

1) Query reception by principal scientist

As principal scientist is at level 2, hence he receives information as "Water harvesting from rainfall must be 15 mega liters per season".

2) Query reception by project assistant 1

Since, project assistant 1 is at level 4, he receives information as "Water harvesting from rainfall should exceed 10 mega liters".

3) Query reception by research student 6

As research student 6 is at level 5, therefore he receives information as "Water harvesting from rainfall".

4) Query reception by research student 1

Research student 1 is at level 6, so he receives information as "Water harvesting season".

5) Query reception by professor

As professor is at level 1, hence he receives information as "Water harvesting from rainfall must be 15 mega liters per season".

TABLE I. CHARACTERISTIC FEATURES OF THE ACTORS USED IN THE IMIPASON

Characteristic Features	Sub Characteristics	Set
(1) Personally Identifiable Information	Name Address IP address Telephone number	{name of the actor} {home address of the actor} {0.0.0.0.0.0 to FF.FF.FF.FF.FF.FF} {telephone number of the actor}
(2) Professional Information	Education Occupation Qualification Role	{PhD, ME, MS, BE, BS} {administrator, banking, finance, businessman} {number of years spent in college, equipment handling, courses, conferences} {provider, collector, manager security, farmer}
(3) Activity	Current Past	{research activity, course teaching, session conduction, group seminar, meetings} {joint number of publications, research topics undertaken, conference attended}
(4) History	History of actors	{coordination, interactions, worked on similar project, research similarity}

TABLE II. ACTORS AND THEIR CHARACTERISTIC FEATURES USED IN THE ACADEMIC SOCIAL NETWORK

Actor	Characteristic Features
Professor	{Prof, No. 11(BR), 128.36.54.13, 080-9678, PhD and ME, administrator, conferences, provider, publications, interactions}
Principal Scientist	{PS, No.23(BR), 127.36.14.25, 080-4625, PhD and ME, administrator, collector, publications}
Senior Scientist 1	{SS1, No.12(BR), 127.25.16.12, 080-4631, PhD, academic, courses, provider, meetings, interaction}
Senior Scientist 2	{SS2, 54th main(BR),128.36.45.68.94, 080-4897, MS, collector, interactions}
Junior Scientist 1	{JS1, No.29(BR), 128.336.12.1, 080-2247,ME, conference, collector, publications}
Junior Scientist 2	{JS2, No.17(BR), 128.693.25.78, ME, collector, publications}
Junior Scientist 3	{JS3, No.25(BR), 128.36.56.85, 080-6983, MS, conference, publications, collector}
Research Student 1	{RS1, No. 63 R block (BR), 128.36.46.98, 080-3684, ME, research, publications}
Research Student 2	{RS2, No. 63 R block (BR), 128.36.46.62, 080-3684, ME, research, publications, collector, interactions}
Research Student 3	{RS3, No. 63 R block (BR), 128.36.46.61, 080-3684, ME, research, collector, interactions}
Research Student 4	{RS4, No. 63 F block (BR), 128.36.46.35, 080-3684, ME, research, collector, interactions, publications, meetings}
Research Student 5	{RS5, No. 63 F block (BR), 128.36.46.39, 080-3684, ME, research, publications, meetings}
Research Student 6	{RS6, No. 63 F block (BR), 128.36.46.58, 080-3684, ME, interactions, publications, meetings}
Master Student 1	{MS1, No. 26 M block (BR), 128.36.46.98, 080-3684, BE, seminar, meetings, coordination}
Master Student 2	{MS2, No. 26 M block (BR), 128.36.46.86, 080-3684, BE, meetings, coordination}
Master Student 3	{MS3, No. 26 M block (BR), 128.36.46.72, 080-3684, BE, seminar, coordination }
Undergraduate 1	{UG1, No. 12 U block (BR), 128.36.46.43, 080-3684, BS, interactions}
Undergraduate 2	{UG2, No. 12 U block (BR), 128.36.46.54, 080-3684, BS, seminar}
Undergraduate 3	{UG3, No. 12 U block (BR), 128.36.46.21, 080-3684, BS, coordination}
Project Assistant 1	{PA1, 22nd street(BR), 128.258.6.4, 080-5698, BE, conference}
Project Assistant 2	{PA2, No.102(BR), 129.63.44.55, 158-9685, BS, collector, publications}
Project Assistant 3	{PA3, 34th main(BR),128.36.52.65, 080-5693, MS, collector, conference, publications}
Project Helper	{PH, 58th main(BR), 169.25.67.145, 080-7896, BS, provider}
Lab Helper	{LH, No.66(BR), 125.36.56.36, 080-5423, interactions, coordination}
Lab Peon	{LP, No.130(BR), 126.38.64.25, 080-4568, coordination}

TABLE III. QUERIES OF ACTORS ALONG WITH SUBQUERIES AT DIFFERENT STAGES

Query at actors	I Stage	II Stage	III Stage	IV Stage
Query at Professor	Water Content of soil must be greater than 35% for the crop	Water Content of soil must be good for the crop	Soil should hold ample amount of water	Soil testing
Query at Principal Scientist	The furnace must be heated more than 1000K for the mould	The furnace temperature must be high for the mould	Furnace need to be heated for the mould	Laboratory testing
Query at Project Assistant 1	Market prices of crop will fall from 25% to 20% in next two months	Market prices of crop will fall from 25% to 20%	Market prices of crop will fall	Market prices of crop will fluctuate
Query at Junior Scientist 2	Water harvesting from rainfall must be 15 mega liters per season	Water harvesting from rainfall should exceed 10 mega liters	Water harvesting from rainfall	Water harvesting season

IV. Simulation Environment

We have considered 100 actors and five database (as shown in Fig. 1) to simulate the IMIPASON. Initially, all the actors are assigned with their personal information, professional information, etc. We provided information to actors based on their relation and level in the social network.

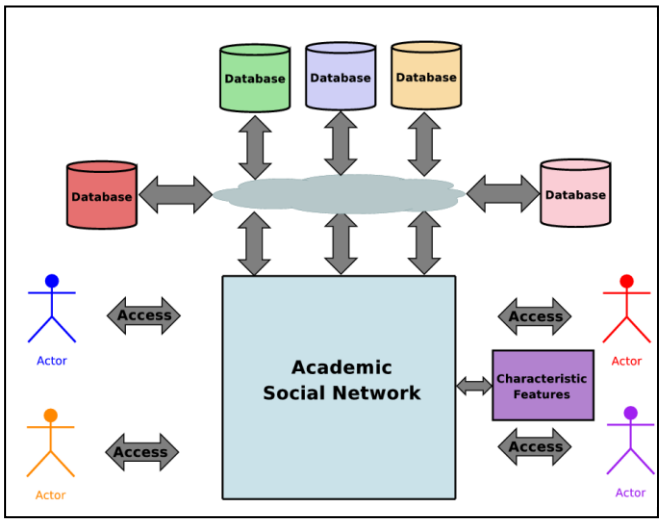

Figure 2. Simulation environment of the academic social network.

V. Simulation Results

We have simulated the IMIPASON model (on Java platform) and result is shown in Fig. 3, where the graph is plotted as average time taken for information provision against a set of actors, and shows that up to certain number of actors (34 actors) the average time for information provision is nearly equal but as the number of actors increases, there is significant exponential increase in the average time. Another graph (shown in Fig. 4) is plotted as level of an actor against the actor, and shows that the level of the actors varies from 1 to 4.

The graph (shown in Fig. 5) is plotted as number of queries of actors against time, and shows that the number of queries are varies from 15 to 35.

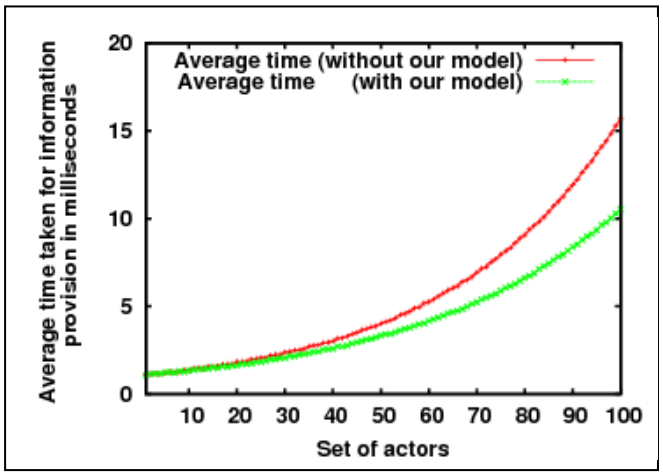

Figure 3. Average time taken for information provision vs Set of actors.

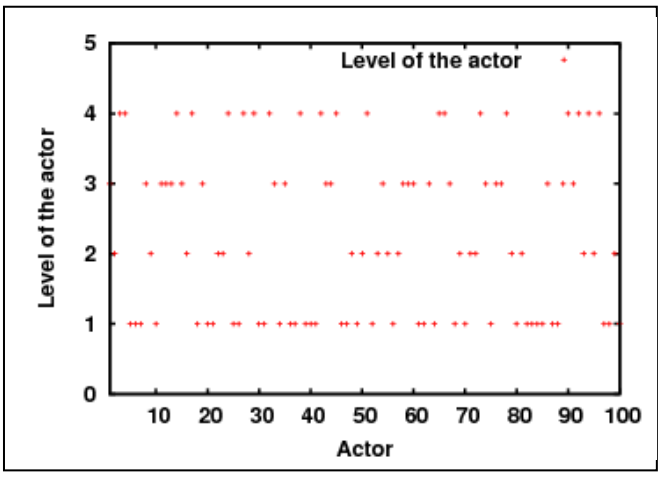

Figure 4. Level of the actor vs Actor.

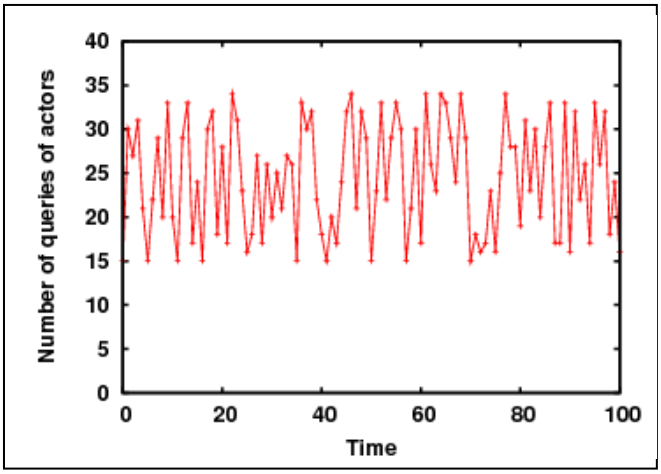

Figure 5. Number of queries of actors vs Time.

The graph is plotted in Fig. 6 as percentage of actors granted the information and shows that 88% of the actors are granted the access, on the other hand, 12% of the actors are denied.

The graph (Fig. 7) is plotted as average path length against number of actors, and shows that the average path length is varied from 0 to 4, approximately.

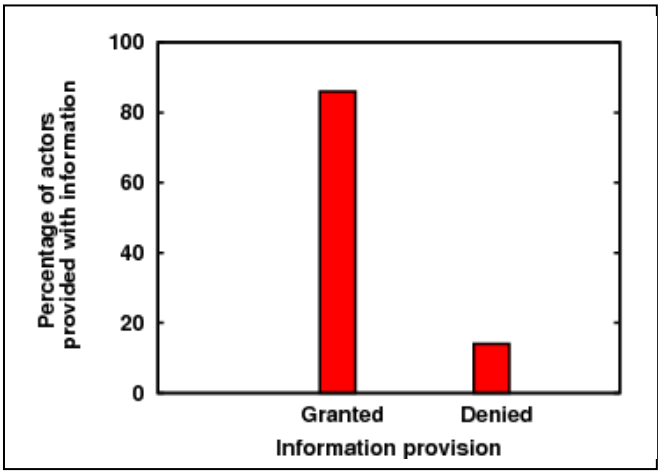

Figure 6. Percentage of actors provided with information.

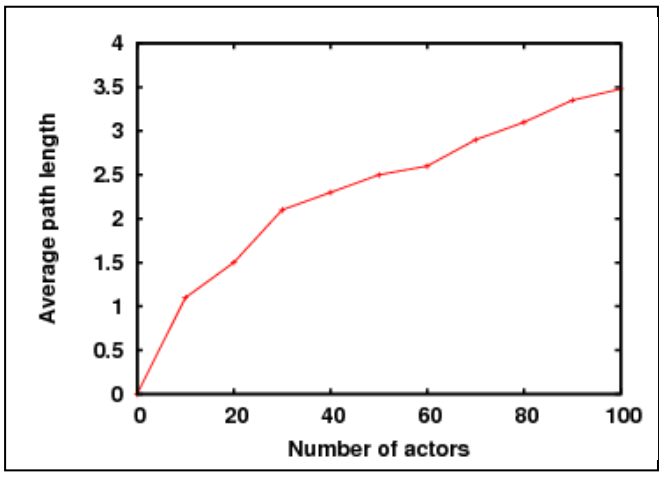

Figure 7. Average path length vs Number of actors.

VI. Conclusion

An Intelligent Method of Information Provisioning for an Academic Social Network (IMIPASON) was discussed, which facilitated information provisioning to the members of an academic social network based on relations and levels. The model had three key features. Firstly, it categorized the actors into different levels based on personal information, professional information, etc. Secondly, relations among actors were formed leading to the formation of the academic social network. Finally, using relation among actors and their level, appropriate information was provided to the actors. Graphs obtained were consistent with the generalized formulation and the application. The proposed model can be easily deployed for information provisioning for the actors of any academic social network.

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About Authors:

Swapnil S. Ninawe received his BE in Electronics Engineering from Shri Ramdeobaba Kamla Nehru Engineering College, Nagpur, India, and ME Degree in Electrical Communication Engineering from Indian Institute of Science, Bangalore, India, in 2008 and 2011 respectively. Currently he is pursuing his Ph.D degree on Social Networks under the guidance of Prof. Pallapa Venkataram in the Department of Electrical Communication Engineering at Indian Institute of Science, Bangalore, India. His research interests are in the areas of Ubiquitous Computing, Social Networks and Social Computing. He has published papers in national conference and international journals. He is a student member of IEEE.

Prof. Pallapa Venkataram received his Ph.D. Degree in Information Sciences from the University of Sheffield, England, in 1986. He is currently the chairman for center for continuing education, and also a Professor in the Department of Electrical Communication Engineering, Indian Institute of Science, Bangalore, India. Dr. Pallapa's research interests are in the areas of Wireless Ubiquitous Networks, Social Networks, Communication Protocols, Computation Intelligence applications in Communication Networks and Multimedia Systems.

He is the holder of a Distinguished Visitor Diploma from the Orrego University, Trujillo, PERU. He has published over 200 papers in International/national Journals/conferences. Written three books: Mobile and wireless application security, Tata McGraw-Hill, Communication Protocol Engineering, Prentice-Hall of India (PHI), New Delhi, 2004 (Co-author: Sunil Manvi), and Multimedia: Concepts & Communication, Darling Kinderley(India) Pvt. Ltd., licensees of Pearson Education in South Asia, 2006. Edited two books: Wireless Communications for Next Millennium, McGraw-Hill, 1998, and Mobile Wireless Networks & Integrated Services, John Wiley & Sons(Asia) Pvt. Ltd., 2006(Co-editors: L.M.Patnaik & Sajal K. Das). Written chapters for two different books, and a guest editor to the IISc Journal for a special issue on Multimedia Wireless Networks. He has received best paper awards at GLOBECOM'93 and INM'95 and also CDIL (Communication Devices India Ltd) for a paper published in IETE Journal. He is a Fellow of IEE (England), Fellow of IETE(India) and a Senior member of IEEE Computer Society.