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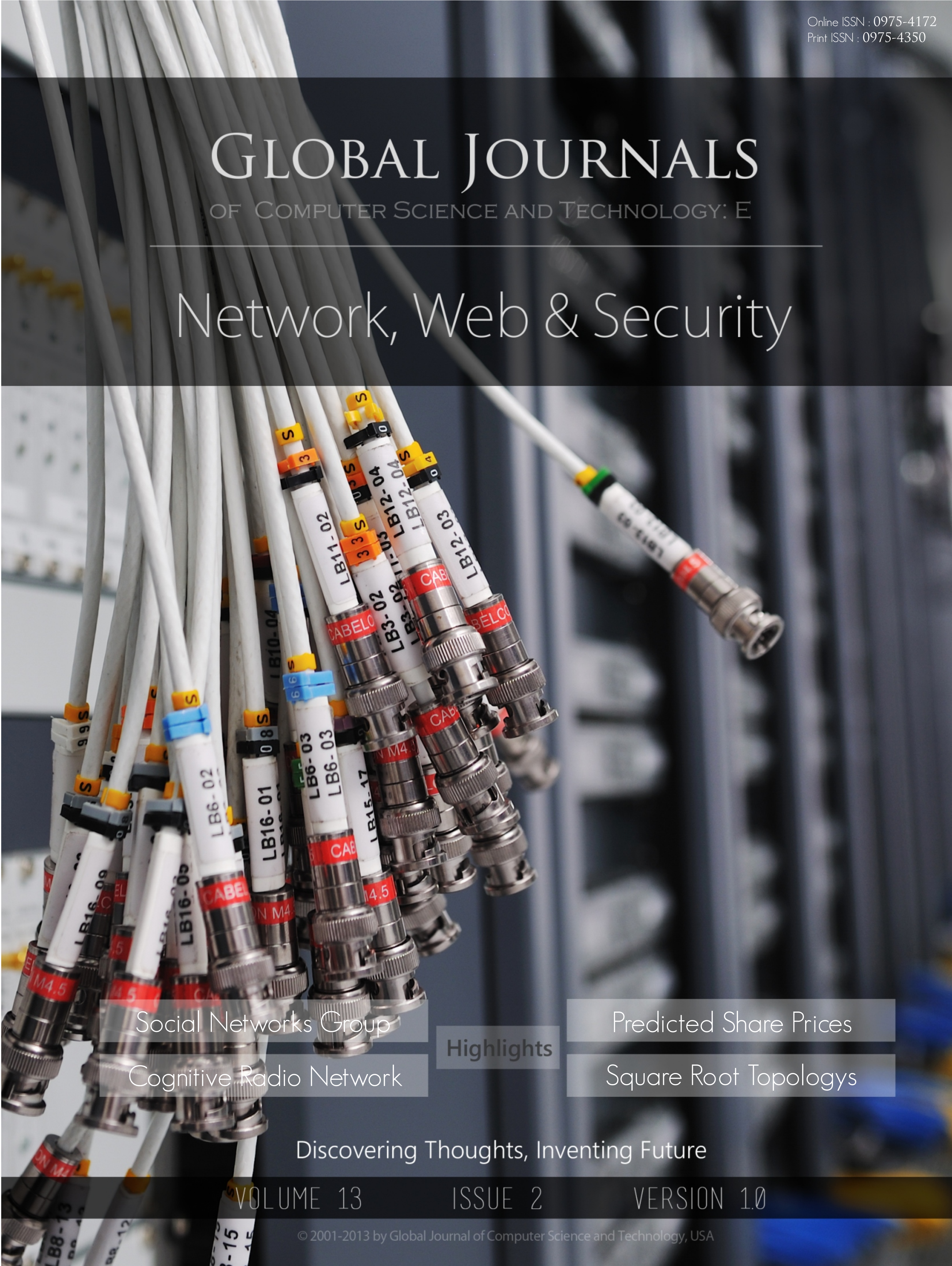

Highlights

- Social Networks Group
- Cognitive Radio Network
- Predicted Share Prices
- Square Root Topologys

Discovering Thoughts, Inventing Future

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The Intensity of Social Networks Group Use among the Students of Jordanian Universities

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Abstract - The paper investigates the intensity of (Social Networking Sites) SNSs use among the students of Jordanian universities. Four universities were involved in this study, while 727 undergraduate students respond to a questionnaire that measured their intensity of SNSs use. To answer research questions, the researchers used descriptive statistics, ANCOVA, Chi-Square, and T-test. The data analyses revealed significant differences among students' uses of SNSs. The variables consisted of university, faculty, gender, and year level. The study recommendation was the focus on integrating SNSs within learning management systems.

Keywords : social networks sites (SNSs), higher education, academic use, academic relations, university students, jordanian university.

GJCST-E Classification : J.4

THE INTENSITY OF SOCIAL NETWORKS GROUP USE AMONG THE STUDENTS OF JORDANIAN UNIVERSITIES

Strictly as per the compliance and regulations of:

The Intensity of Social Networks Group Use among the Students of Jordanian Universities

Mustafa Jwaifell [α], Hasan Al-Shalabi [σ], Swidan Andraws [ρ], Arafat Awajan [ω] & Adnan I. Alrabea [¥]

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I. Introduction

The Arab spring was influenced dramatically by the Social Networks Sites (SNS), while youths had played a great part in this spring. The population of Jordan is consisted of 65% of youth; most of them are enrolled in universities. Academics and policy makers are committed to make use of Social Networks for the benefits of teaching and learning and integrating SNSs within Learning management systems or even giving educators attention to exploit relative advantages of SNSs academically and implement new innovations of methodologies such as Mobile learning or interact with students through Internets' technologies.

II. Background of the Study

SNSs can be described as online community that gathers people with same interests. Kwon and Wen (2009) defined SNSs Sites as an individual web page which enables online, human-relationship building by collecting useful information and sharing it with specific or unspecific people. Boyed and Ellison (2007) defined SNSs Sites as web-based services that allow individuals to construct a public or semi-public within a bounded system. Facebook can be considered one of the most SNSs that influenced online communications between people, even this relationship shifted to a specific enrollment of relationship. Hewitt and Forte (2006) described the results from ongoing investigation of student/faculty relationships in the online community Facebook to understand how contact on Facebook was influencing student perceptions of faculty, where the result of this survey point to one third of the students they surveyed did not believe that faculty should be present on the Facebook at all. Those finding are very interesting while the Arab universities students insists to have faculty member e-mail to interact with him as we noticed all the time in our experience.

The students' experiences and uses of SNSs can differ according to their needs, which may differ from country to another. Pempek, Yermolayeva, and Calvert (2009) investigated experiences of 92 undergraduates students by completing a diary-like which measure each day for a week, reporting daily time use and responding to an activities checklist to assess their use of the popular Social Networking site, Facebool, where they concluded that they students spend approximately 30 minutes throughout the day as a part of their daily routine, beside this result, the use of Facebook in a style of one-to-many was a tool of communicating through Facebook.

The uses of SNSs can be one-to-one or one-to-many as a part of group uses. This study is trying to survey Jordanian Universities' students to gain a full picture about time and group uses among them, which can open the doors for Academics and Policy Makers to take advantages of the most common SNSs among the students of Jordanian universities as youths of the Arab world.

On the contrary Valenzuela, Park, and Kee (2008) they found that Social sites Networks; precisely Facebook; effect college students. They found positive relationships between intensity of Facebook use and students' life satisfaction, social trust, civic participants and political engagement.

With regard to intensity, Ellison, Steinfield and Lampe (2007) investigated the benefits of Facebook "Friends:" social capital and college students' use of online SNSs; they examined the relationship between use of Facebook and the formation and maintenance of social capital. The study surveyed 286 undergraduate students, the foundlings of their study showed a strong

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association between use of Facebook and the three types of social capital, with the strongest relationship being to bridging social capital.

SNSs are playing a great roll in the lives of university students as Leng, Likoh, Japang, Andrias, and Amoala (2010) pointed out. They reach this point of view through a descriptive study conducted to investigate SNS usage among university students in Labuan. The study concluded that the mass adoption of SNS points to evolution in human social interaction regardless age, culture background, occupations and general demographic profile includes university students. Thus it was obvious to them that university students will eventually use the SNS as a main medium of communication to maintain their relationships with friends and family members as well as expanding their niche community.

It is obvious that SNSs became as a demand of interaction between academics and their students whereas SNS are part of university student daily life all over the world. Ahmad (2011) studied the SNSs' usage and students' attitudes towards social behaviors and academic adjustment in Northern Nigerian Universities, the finding revealed that there were differences existed among ethnicity and religion in the extent of SNS usage, while there is a positive inter-relationships among the SNSs usages, students' social behavior and students' academic adjustment, beside the considerations of attitudes that can be a strong predictor and moderator of the relationship between SNSs and both the students' social behavior and students' academic adjustment. The use of SNSs still needed in the Arab world academically, while we encountered a huge number of users in a social usage behind the academic.

III. Problem Statement of the Study

Educators and policy makers can make use of SNSs and start to realize to reflect the intensity of using SNSs into their teaching and learning situation, the developing new acceptable technologies and innovations that students primarily involved in, while the traditional methodologies are the major approach that those educators are using. This study aimed at investigating the intensity of SNSs use among the students of Jordanian universities which can give motivational indicator to educators and policy makers to adopt those technologies.

IV. Questions of the Study

To explore intensity of SNSs group use among the students of Jordanian Universities, the research questions were:

Q1: what are the most popular SNSs Sites among the students of Jordanian Universities?

Q2: are there any differences between students' friends at SNSs related to university?

Q3: what is the intensity of SNSs use among the students of Jordanian Universities?

Q4: what is the intensity of SNSs group use among the students of Jordanian Universities related to some variables?

Q5: what are the natures of participation in the online SNSs groups among the students of Jordanian Universities?

V. Method and Measures

The study conducted as a part of a project of investigating the SNSs uses among students of Jordanian Universities, while the items of the questionnaire is part of the project conducted by the authors.

To answer the research questions, the researchers set a questionnaire consisted of 9 questions related to the study variables, while some of the questionnaire items derived out of Ellison, Steifield, and Lampe (2007) study. The questionnaire distributed to four universities with intensity of SNSs group use among the students of Jordanian Universities. Data collected and analyzed in a descriptive quantitative research.

VI. Sample of the Study

The sample of the study consisted of (727) out of (36350) students resembling (2%) of each university drawn randomly out of (4) Jordanian universities, resembling the study variables: 1) university, 2) faculty, 3) gender, and 4) year level, as shown below:

Table 1 : Brake down of sample

Variables		Frequency	Percent
University	University of Jordan	280	38.5
	Hussein	155	21.3
	Balqa	135	18.6
	Sumaya	157	21.6
Total		727	100
Faculty	Science	531	73
	Arts	196	27
Total		727	100
Gender	Male	319	43.9
	Female	408	56.1
Total		727	100
Level	First Year	163	22.4
	Second Year	154	21.2
	Third Year	177	24.3
	Fourth Year	233	32.0
Total		727	100

VII. Limitations of the Study

The study results and findings are limited to the sample of the study and tools are used.

VIII. Results

a) Social Networks Sites popularity

Students were asked to define the SNSs that they are participated in, out of 20 SNSs, the most popular SNSs Sites among the students of Jordanian Universities determined with a percentage above 10% of all the participants who indicated they use those sites as shown in Table 2:

Table 2 : The most popular SNSs

University	District	Sample	SNSs							
			FaceBook		Twitter		Yahoo!Buzz		WLP	
			Count	%	Count	%	Count	%	Count	%
Jordan	Capital	280	258	92.1	131	46.8	128	45.7	93	33.2
Hussein	South	155	134	86.5	48	31.0	57	36.8	16	10.3
Balqa	Middle	135	109	80.7	52	38.5	82	60.7	21	15.6
Sumaya	Capital	157	146	93.0	71	45.2	31	19.7	47	29.9
Total		727	647	89	302	41.5	298	41.5	177	24.3

* Windows live Profile (WLP)

It can be concluded out of the table, that Face Book, Twitter, and WLP had the highest percentage according to capital districted, while the middle district had the highest percentage of using Yahoo! Buzz among all universities. The nature of middle district population is between the civil urban and countryside, this nature of using small words to express feeling, attitudes, approval or disapproval, which was translated into Arabic by the word "Taghreedat" as a Buzz.

b) Social Networks Sites social usage

Students were asked to define how many SNSs friends they had. The means of friends in each university, faculty, gender, and year level were taken to examine the differences between students' friends at SNSs related to university. Table 3 presenting total means:

Table 3 : Students' Friends at SNSs

Variables		Mean	Total
University	University of Jordan	405.3	113476
	Hussein	227.9	35328
	Balqa	154.2	20818
	Sumaya	369.8	58055
Total		313.2	227677
Faculty	Science	366.4	194573
	Arts	168.9	33104
Total		313.2	227677
Gender	Male	330.2	105328
	Female	229.9	122349
Total		313.2	227677
Level	First Year	318.8	51957
	Second Year	232.6	35818
	Third Year	438.6	77635
	Fourth Year	267.2	62267
Total		313.2	227677

ANOVA used to define the differences between friends amount among the students of Jordanian Universities according to university and year level. Table 4 shows the ANOVA summary:

Table 4 : ANOVA summary of students' friends at SNSs

Source	Sum of Squares	df	Mean Square	F	Sig
Between Universities	7415966	3	2471988.77	1.325	.265
Within Universities	1.3E+009	723	1865219.748		
Total	1.4E+009	726			
Between Year Level	4282074	3	1327358.053	.763	.515
Within Year Level	1.4E+009	723	1869554.315		
Total	1.4E+009				

ANCOVA revealed no significant differences at $\alpha \leq 0.05$ between students' friends amount at SNSs according to university and year level.

Independent Sample T-test used to define the differences between friends amount among the students of Jordanian Universities according to faculty and gender. T-test revealed no significant differences $\alpha \leq 0.05$ between friends amount for both faculty and gender (Faculty, T=1.732, Sig=.084. Gender, T=.297, Sig=.767).

c) Social Networks Sites intensity use

Students were asked to define on a typical day, about how much time do they spend on SNSs at the scale of: No time at all, Less than 1 hr, More than 1 hr up to 2 hrs, and more than 2 hrs. Table 5 presenting their responses:

Table 5 : Respondents actual use of SNSs. N=727

Variables		No time at all	Less than 1 hr	More than 1 hr up to 2 hrs	more than 2 hrs
University	University of Jordan	8	82	88	102
	Hussein	13	57	50	35
	Balqa	17	43	42	33
	Sumaya	8	44	50	55
Total		66	226	230	225
Faculty	Science	24	163	171	173
	Arts	22	63	59	52
Total		46	226	230	225
Gender	Male	22	113	86	98
	Female	24	113	144	127
Total		46	226	230	225
Level	First Year	14	50	53	46
	Second Year	10	45	55	44
	Third Year	8	49	60	60
	Fourth Year	14	82	62	75
Total		**46**	**226**	**230**	**225**

Chi square calculated to determine the count distribution among the students' responses according to scale and study variables. Table 6 summarized Chi square results:

Table 6 : Chi square summary of students' SNSs intensity use

Variables	Chi	df	EC	Sig
University	26.48	9	8.54	.002
Faculty	12.16	3	12.40	.007
Gender	7.67	3	20.18	.053
Year Level	8.66	9	9.74	.469

* EC: Expected Count

Chi-Square revealed no significant differences at $\alpha \leq 0.05$ among students' SNSs intensity of use according to both gender and year level, while there are significant differences according to university and faculty.

d) Social Networks Sites intensity of group use

Students were asked to define on a typical day, about how much time they spend reading and posting on the groups' walls at the SNSs they have joined at a scale of: No time at all, Less than 1 hr, More than 1 hr up to 2 hrs, and more than 2 hrs. Table 7 presenting their responses:

Table 7 : Respondents actual groups' use of SNSs. N=727

Variables		No time at all	Less than 1 hr	More than 1 hr up to 2 hrs	more than 2 hrs
University	University of Jordan	10	138	129	3
	Hussein	19	80	43	13
	Balqa	20	59	51	5
	Sumaya	12	81	62	2
Total		61	358	285	23
Faculty	Science	36	271	206	18
	Arts	25	87	79	5
Total		61	358	285	23
Gender	Male	29	160	115	15
	Female	32	198	170	8
Total		61	358	285	23
Level	First Year	21	76	59	7
	Second Year	9	87	58	0
	Third Year	14	81	75	7
	Fourth Year	17	114	93	9
Total		**61**	**358**	**285**	**23**

Chi square calculated to determine whether the differences in frequency count among the students' responses were statistically significant. Table 8 summarized Chi square results:

Table 8 : Chi square summary of students' SNSs intensity group use

Variables	Chi	df	EC	Sig
University	46.227	9	4.27	.000
Faculty	7.779	3	6.2	.051
Gender	6.122	3	10.09	.106
Year Level	14.997	9	4.87	.091

* EC: Expected Count

Chi-Square revealed no significant differences at α≤0.05 among students' SNSs intensity group use according to faculty, gender, and year level, while there are significant differences according to university.

e) Nature of Students' participations in the online SNSs groups

Students were asked to define the nature of their participations in the online SNSs groups. This question consisted of the following sub questions:

1) In the past week, how many did you: read profiles on the online groups you have joined on the SNSs?
2) In the past week, how many did you: send messages on the groups' walls you have joined?
3) In the past week, how many did you: read or write a new topics on the groups' walls you have joined?
4) Which one of the followings best describe your participation in the online groups you have joined on SNSs?:
    1. Rarely visit profiles
    2. Reads wall/ discussion board
    3. Mostly reads, sometimes write on wall/ discussion board
    4. Reads and writes on wall/ discussion boards
    5. Reads, writes and starts new topics on wall/ discussion board.

The participants' responses for questions 1 to 3 were calculated in means as shown in table 9:

Table 9 : Nature of Students' participation at SNSs

Variables		Reading profiles	Sending messages	R/W New topics
University	University of Jordan	7.7	15.3	1.8
	Hussein	9.9	12.3	4.3
	Balqa	7.9	6.8	3.1
	Sumaya	6.9	5.7	2.2
Total		8.0	11.0	2.6
Faculty	Science	7.4	8.0	2.5
	Arts	9.7	19.1	3.1
Total		8.0	11.0	2.6
Gender	Male	8.2	11.6	3.1
	Female	7.9	10.6	2.3
Total		8.0	11.0	2.6
Level	First Year	9.9	10.2	3.2
	Second Year	8.1	9.1	2.6
	Third Year	8.0	9.8	2.7
	Fourth Year	6.7	13.8	2.2
Total		8.0	11.0	2.6

ANOVA used to define the differences between students' participations according to university and year level. Table 10 shows the ANOVA summary:

Table 10 : ANOVA summary of students' participations at SNSs

	Source	Sum of Squares	df	Mean Square	F	Sig
Reading profiles	Between Universities	809.179	3	269.726	.709	.547
	Within Universities	274861.0	723	380.167		
	Total	275670.1	726			
Sending messages	Between Universities	12108.809	3	4036.270	1.035	.376
	Within Universities	2818574	723	3898.442		
	Total	2830683	726			
R/W New topics	Between Universities	703.756	3	234.756	5.063	002
	Within Universities	33496.684	723	46.330		
	Total	34200.440	726			
Reading profiles	Between Year Level	979.027	3	326.342	.859	.462
	Within Year Level	274691.1	723	379.932		
	Total	275670.1	726			
Sending messages	Between Year Level	2640.835	3	913.612	.234	.873
	Within Year Level	2827942	723	3911.400		
	Total	2830683	726			
R/W New topics	Between Year Level	95.359	3	31.876	.674	.568
	Within Year Level	34105.082	723	47.172		
	Total	**34200.440**	**726**			

ANCOVA revealed no significant differences at α≤0.05 between students' participations at SNSs according to university and year level except reading, writing and starting new topics according to university. Post Hoc Tests (Scheffe, 1959) revealed that only significant difference exist between University of Jordan and Al-Hussein University for the benefit of Al-Hussein University as shown in Table 11.

Table 11 : Summary of Scheffe Test

	Al- Hussein	Balqa	Sumaya
University of Jordan	2.51959 *	1.38386	0.46132
α	.004	.289	.950
Al- Hussein	-	1.13572	2.11827
α	-	.671	.057
Balqa	-	-	0.98254
α	-	-	.680

Independent Sample T-test used to define the differences between students' participations according to faculty and gender. Table 12 shows the T-test summary:

Table 12 : T-test summary of students' participations

Variable	Participation	t	df	Sig
Faculty	Reading profiles	1.413	725	.158
	Sending messages	2.137		.033
	R/W New topics	1.054		.292
Gender	Reading profiles	0.146		.889
	Sending messages	0,222		.825
	R/W New topics	1.452		.147

Results of t-test revealed no significant differences between students' participations at $\alpha \leq 0.05$ except sending messages according to faculty, where students of Faculties of Arts mean (19.1) is more than sciences faculties (8.0). This result revealed how much the students of sciences are engaged in studying more than using SNSs to communicate with groups by sending messages.

Overall, to gain a precise picture about students' participations, they have been asked to answer the question: which one of the followings best describe your participation in the online groups you have joined on SNSs?:

1. Rarely Visit Profiles (RVP)
2. Reads Wall/ Discussion Board (RWDB)
3. Mostly Reads, Sometimes Write on wall/ discussion board (MRS)
4. Reads and Writes on Wall/ Discussion Boards (RWWDB)
5. Reads, writes and starts new topics on wall/ discussion board (Topics)

The following Table, showing students' responses:

Table 13 : Respondents actual groups' participations of SNSs. N=727

Variables		RVP	RWDB	MRS	RWWDB	Topics
University	University of Jordan	39	99	27	54	61
	Hussein	42	41	34	20	18
	Balqa	33	42	00	20	40
	Sumaya	28	60	2	25	42
Total		142	242	63	119	161
Faculty	Science	94	186	43	95	113
	Arts	48	56	20	24	48
Total		142	242	63	119	161
Gender	Male	77	104	22	50	66
	Female	65	138	41	69	95
Total		142	242	63	119	161
Level	First Year	42	49	18	21	33
	Second Year	27	52	13	21	41
	Third Year	29	64	14	31	39
	Fourth Year	44	77	18	46	48
Total		**142**	**242**	**63**	**119**	**161**

Chi square calculated to determine the count distribution among the students' responses according to scale and study variables. Table 14 summarized Chi square results:

Table 14 : Chi square summary, of students' participations at SNSs

Variables	Chi	df	EC	Sig
University	83.728	12	11.70	.000
Faculty	9.356	4	16.98	.053
Gender	9.018	4	27.64	.061
Year Level	12.482	12	13.35	.408

* EC: Expected Count

Chi-Square revealed no significant differences at $\alpha \leq 0.05$ among students' participations at SNSs according to faculty, gender, and year level, while there are significant differences according to university, where Balqa University had no any participation in: Mostly Reads, Sometimes Write on wall/ discussion board.

IX. Discussion

The finding of how many friends that students gain on SNSs, reflected the social usage concerning relationships among youths in Jordanian Universities, which does not affected by the nature of universities as a community. This finding can lead all the Academics and Policy Makers to a fact that Students of Jordanian Universities are in the same cultural manner according to seeking friends to establish a SNSs community, so they can use this fact to take advantages of SNSs in universities community as a tool of interaction between the educators and their students. While the results of friends amount according to students ethnographic variables also can be considered as indicators of judging the harmony among students of Jordanian Universities according to social relationships.

The SNSs intensity of use according to both gender and year level can be related to the shortage of personal computers in both Al-Hussein and Balqa universities, while both of the University of Jordan and Sumaya University are in the capital district are having more intensity than other universities. The Jordan and Sumaya universities' reputation of hard work students made them less users of SNSs, and what can confirm this is the highest achievements of those students if they want to be accepted to study in those universities.

There is a great participations in equal manner among Jordanian students, while University of Jordan (1963) considered as the most favorable university beside its' rank (1) among Jordanian universities, so when you compare it with a southern district university that considered as a new one (1999) and far of the capital city Amman in about 220Km, this distance and desert environment are made it unfavorable to students, this can lead to a gap between districts, so students try to read more than writing or starting new topics in order to "see what goes around", It appears that students of Jordanian Universities have great groups participations at SNSs.

X. Conclusion

The study revealed how students of Jordanian Universities use SNSs. These findings have implications for efforts to use SNSs an academic tool for communication and interacting with/between educators and students alike. The results from this descriptive study help to clarify the role of SNSs in the lives of university students according to universities districts, faculties, gender, and year level. The students interact with each other individually and by groups, where most of the students are engaged in SNSs group walls and discussions. Academics and policy makers can take advantages of SNSs and integrating them into learning management systems.

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Convergence of Actual and Predicted Share Prices – An ADALINE Neural Network Approach

By Ravindran Ramasamy & Tan Chee Siang
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GJCST-E Classification : I.2.6

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Strictly as per the compliance and regulations of:

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Ravindran Ramasamy [α] & Tan Chee Siang [σ]

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I. Introduction

Forecasting is an important task the fund managers perform for decision making and controlling especially very important for those who are managing other people's money like fund managers. With the uncertain future, the manager needs to have a set of guidelines and tools in assisting him to predict the future movement of financial time series like share prices (Yoon and Swales, 1991; Thomaidis and Dounias, 2007).

Investments are made with the objective of maximizing the return and simultaneously reducing the risk (Banz, 1981; Hirt and Block, 1996). The Sharpe ratio gives the investors how much they earn for every unit of risk they face (Jones, 2007). The mutual fund managers' objective is to maximize the return, minimize the risk and in addition they have to guarantee the safety of the funds invested by hedging. Several hedging tools are available for a fund manager presently and he has to select the best tool with minimum cost and fewer complexities to manage. All these require a well balanced efficiently forecasted share prices. The forecasted prices not only serve the purpose of hedging but also they help in controlling and decision making (Mitchell and Pavur, 2002) whether to buy or hold or sell.

The objective of this paper is to apply ADALINE neural network technique to forecast the share prices. Though several traditional techniques are available like moving averages, Bollinger bands, and chartist approach (Janssen, Langager and Murphy, 2011) they depend too much on the past data and they predict the future prices for a long period ahead with the same base data. The traditional linear regression technique (Grønholdt and Martensen, 2005) takes fundamental economic variables as independent and share price as dependent variable, fail to achieve good convergence because the independent variables are macro economic variables which slowly change but the share prices are dynamic and changes daily. This mismatch results in poor forecasting.

There are several plus points in applying neural networks to forecast the share prices. The first major merit is that it does not consider fundamental assumptions like normality of data (Aleksander and Morton, 1995), extreme data etc. All traditional statistical assumptions are absent here. In addition the neural nets always go for iterations which update the weights several times repeatedly with a learning rate which controls the weights of the neurons (Hecht-Nielsen 1989; Govindarajan and Chandrasekaran, 2007). Yet another advantage of neural net is the data memory issue. The old data becomes obsolete as the data has life cycle. The recent data is more useful than the oldest data. To capture this moving window technique is adopted in networks which ignore the oldest data and adds the new data for training and forecasting. This gives the required efficiency in forecasting.

II. Adaline Neural Network

Adaptive Linear Neuron known as ADALINE is a single layer neural network which is useful in predicting time series like share prices (Lin and Yeh 2009; Matilla-Garcia, and Arguello, 2005; Remus and O'Connor, 2001; Rude 2010). ADALINE is adopted with the assumption that the relationship between historical daily returns and the forecasted daily returns are linear and each of it carried different weight. The weight is not constant but ever changing when a new data arrives (Kaastra and Boyd, 1996).

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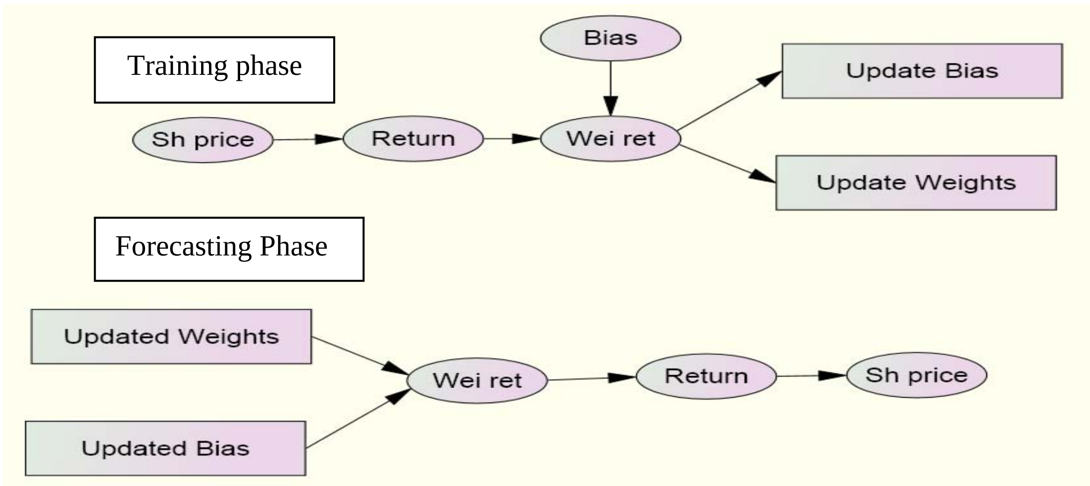
ADALINE Architecture



Wei ret = weighted return

Figure 1 : Training and forecasting flow algorithm

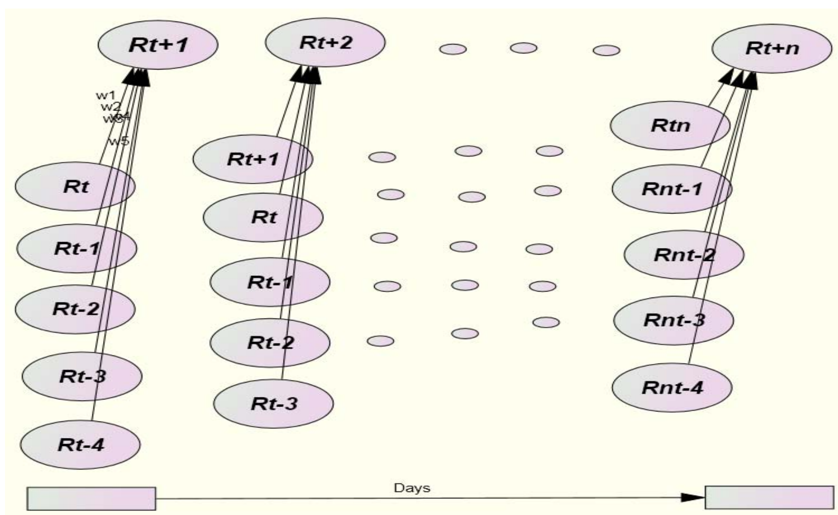


Figure 2 : Neuron and synapse connection in forecasting

ADALINE ALGORITHM

Given: *Share prices*

Initialise: *Small random weight for each neuron, a bias and a learning rate*

Convert: *Share prices to returns* $r = p_t / p_{t-1}$

Where r = *daily return*

p_t = *price today*

p_{t-1} = *previous day's price*

Iterate: *Until a condition is satisfied (say, 100 times)*

Compute the net input and keep it in y_i $\quad y = \sum_{i=1}^{n} w_i * x_i + b$

where y = *forecasted daily return*

b = *bias*

w = *weight*

x = *historical daily return*

n = *number of synapse*

Update weights $w_{i(new)} = w_{i(old)} + alpha * (t-y)$

where *alpha* = *Learning rate*

t = *target return* (6^{th} *day return)*

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Update bias $b_{(new)} = b_{(old)} + alpha * (t-y)$

End iteration after 100 times

Forecasting: *Take the above updated weights and bias*

Iterate: *for 252 days (∵ stock market works for 252 days approximately)*

Compute the return $y = \sum_{i=1}^{n} w_i * x_i + b$

Convert: *Returns to Share price* $P = r * p_{t-1}$

The main reason to convert the daily share price to daily return is to avoid non-stationary nature of share price. Moreover the daily share price does not indicate whether the price is moving up or down. The positive sign or negative sign of the daily return will be useful in finding the hit rate. There are three stages in this study, i.e., initialisation phase, training phase and forecasting phase.

III. Initialisation Phase

At this phase the learning rate, number of neurons. Synapses, weights and bias are decided and given to the net for starting the computation process. The random weights and bias will change at every time we start the program. To avoid this we have set the random state as 10. This will make sure the random numbers are identical whenever or wherever the program is executed.

IV. Training Phase

The training of the network is performed through a windowing technique (Sapena, Botti, and Argente, 2003). The window will move as time progresses. The net will compute the activation value by multiplying the random weights and window of five returns and the result will be added to bias. This will be treated as the forecasted return. This value will be compared with the target the sixth day return to find variance. It is stored as error. This error with learning rate and the original sixth day's return and old weight all determine the new weight. This process will be repeated by dropping the oldest data and taking the newest data in updating weights till the end of the training set. Similar approach has been used by Buscema & Sacco (2000) in attempting to predict the stock market index returns. The same procedure is adopted by Refenes and Francis (1993) in predicting the currency exchange rate and (De Faria *et al*, 2009) in predicting the Brazilian stock market index.

V. Testing or Forecasting Phase

The training process will be carried out in forecasting phase also. First five returns will be taken from the December 2010 data and January 2011 first return will be computed and stored. Then as in training the error will be computed comparing final return with the predicted return. Then this error, final return of 2010 and the updated weight in the training phase all will decide the first new weight and bias for 2011. This procedure will be repeated for 252 days. Later all 252 returns will be converted to predicted share prices.

VI. Measurement of Effectiveness

The difference in actual and predicted prices is recorded for the purpose of performance evaluation. The root mean squared error (RMSE), mean absolute error (MAE), mean absolute percentage error (MAPE) and hit rate are computed and recorded as follows.

The RMSE is computed based on following formula

$$\varepsilon = \sqrt{\frac{\sum_{t=1}^{n} (x_t - y_t)^2}{n}}$$

Where ε = root mean squared error

n = total number of days

t = days

x_t = t[th] actual share price

y_t = t[th] forecasted share price

The MAE is computed based on the following formula

$$MAE = \frac{\sum_{t=1}^{n} | x_t - y_t |}{n}$$

The MAPE is computed based on the following formula

$$MAPE = \frac{MAE}{\left(\frac{\sum_{t=1}^{n} x_t}{n}\right)} \times 100\%$$

VII. Hit Rate

The hit rate is one if the actual and predicted returns have the same sign. This shows the direction of prediction.

$$hr = \begin{cases} 1, & x \text{ and } y; \text{ same sign} \\ 0, & x \text{ and } y; \text{ opposite sign} \end{cases}$$

Average hit rate is computed as follows

$$hr = \frac{1}{n} \sum_{t=1}^{n} hr\,(x_t, y_t)$$

VIII. Sample, Analysis and Interpretation

With the above ADALINE architecture and methodology a MATLAB program was written to test the efficiency of neural networks forecasting time series, the share prices. Share prices of four companies listed in Malaysian stock exchange was selected for two years from yahoo finance and the star newspaper websites for 2010 an 2011. The share price of 2010 was considered as training sample and 2011 was retained for validation. To overcome the non-stationary problem, 2010 share prices were converted to returns. The returns forecasted for 2011 were reconverted to share prices and graphs were prepared to visually observe the convergence or divergence of price lines.

IX. AMMB

AMMB is a listed company in Malaysian stock exchange. The share price prediction results are given in the following table. The actual mean price for 2011 is RM 6.28. The average predicted prices at various learning rates are very close to the actual mean price except at the learning rate of 15%. At this level the forecasted mean price deviates more showing RM 7.02. The standard deviation gives the volatility or variation of share prices. The actual standard deviation is 0.34 and the forecasted volatilities are around 0.40 except at 15% learning rate, which is 0.43. The median price and range also move in tandem with mean price.

Table 1 : Descriptive statistics of actual and forecasted share prices of AMMB, 2011

	Actual Share price		Learning Rates Predicted share prices		
Parameters		0.15	0.35	0.55	0.75
Mean	6.28	7.02	6.59	6.53	6.56
Std Deviation	0.34	0.43	0.40	0.40	0.40
Median	6.36	7.05	6.64	6.57	6.60
Range	1.77	2.45	2.19	2.09	2.22
Maximum	7.15	8.28	7.63	7.55	7.59
Minimum	5.38	5.83	5.44	5.46	5.37
Correlation coefficients	--	0.55	0.73	0.77	0.78

The correlation coefficients show the relationship between the actual price and predicted prices at various learning rates. A high correlation indicates that the actual and predicted prices move in tandem and vice versa. At the learning rate of 75% the correlation is 78%. The correlation coefficients increase continuously as the learning rate increases. This implies at lower learning rates the actual prices and forecasted prices do not converge and more gaps is existing between them.

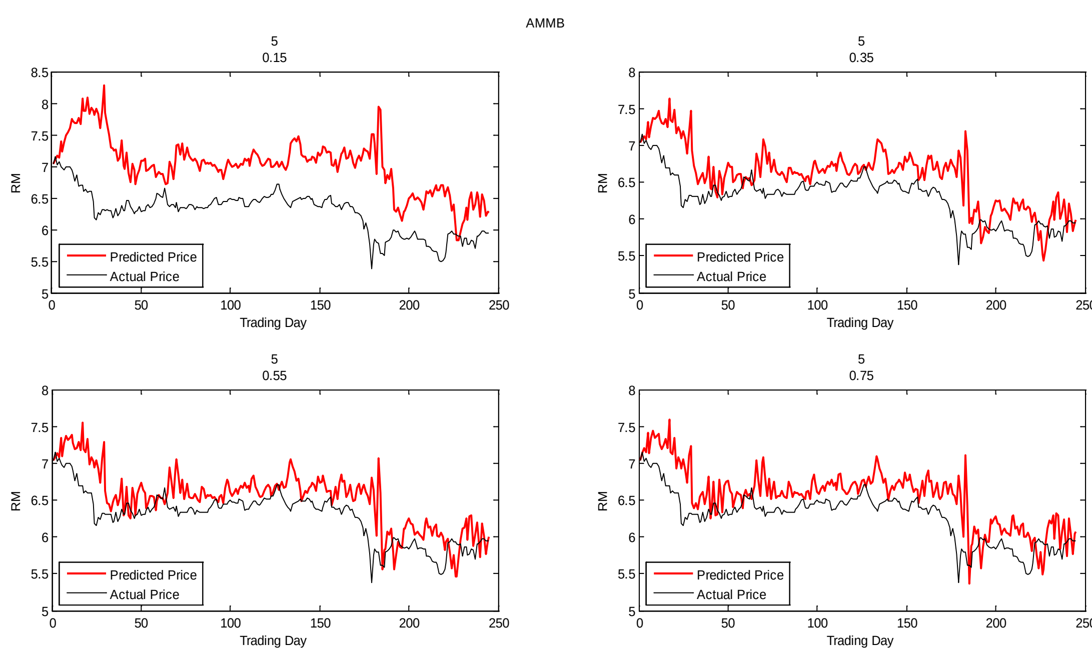

Figure 1 : Convergence of actual and forecasted share prices of AMMB

A close observation of the figures reveal at 75% of learning rate the forecasting is efficient because the forecasted price and the actual price converge almost perfectly. In January and February the forecasted line and the actual lines show a larger gap and later predicted line follows the actual price line closely. At lower levels of learning there is an appreciable gap between the lines which results in larger error.

Table 2 : Different types of errors produced at various learning rates - AMMB

Learning rates	RMSE	MAE	MAPE (%)	Hit Rate (%)
0.15	0.83	0.74	11.82	42.39
0.35	0.42	0.34	5.44	39.09
0.55	0.36	0.28	4.53	37.45
0.75	0.37	0.31	4.89	35.80

When the learning rate increases the error levels fall steeply. At 15% learning level the RMSE was 0.83 but in 75% learning level it decreased to 37%. The same trend is visible in MAE and MAPE. Hit rate also reduces but not as steep as other error measures. These results imply at higher learning rates the ADALINE neural net predicts the share prices more precisely.

X. Axiata

Axiata share prices are forecasted at different learning rates ranging from 15% to 75% for 2011 and the results are as follows.

Table 3 : Descriptive statistics of actual and forecasted share prices of Axiata, 2011

	Actual share price		Learning Rates Predicted share prices		
Parameters		0.15	0.35	0.55	0.75
Mean	4.89	4.95	4.91	4.89	4.88
Std Deviation	0.13	0.18	0.17	0.16	0.17
Median	4.89	4.95	4.92	4.90	4.88
Range	0.57	1.04	0.94	0.92	0.90
Maximum	5.14	5.54	5.37	5.36	5.35
Minimum	4.57	4.50	4.44	4.44	4.45
Correlation coefficients	--	0.05	0.25	0.30	0.33

The actual mean price for 2011 is RM 4.89 and the forecasted mean prices are very close to this price except at the learning rate of 15% which is RM 4.95. When the learning rate increases the mean prices are decreasing and come closer to actual mean price which implies at the higher learning rates the net learns better and forecasts better. The volatility is 0.13 for actual prices but for forecasted prices the volatility is slightly more. Median prices show similar trends as mean prices. The range also decreases when the learning rate increases. The correlation coefficients increase from 5% to 33% when the learning rates increase from 15% to 75%. These results imply that the net forecasts well in higher learning rates and the movements are also closer to actual prices.

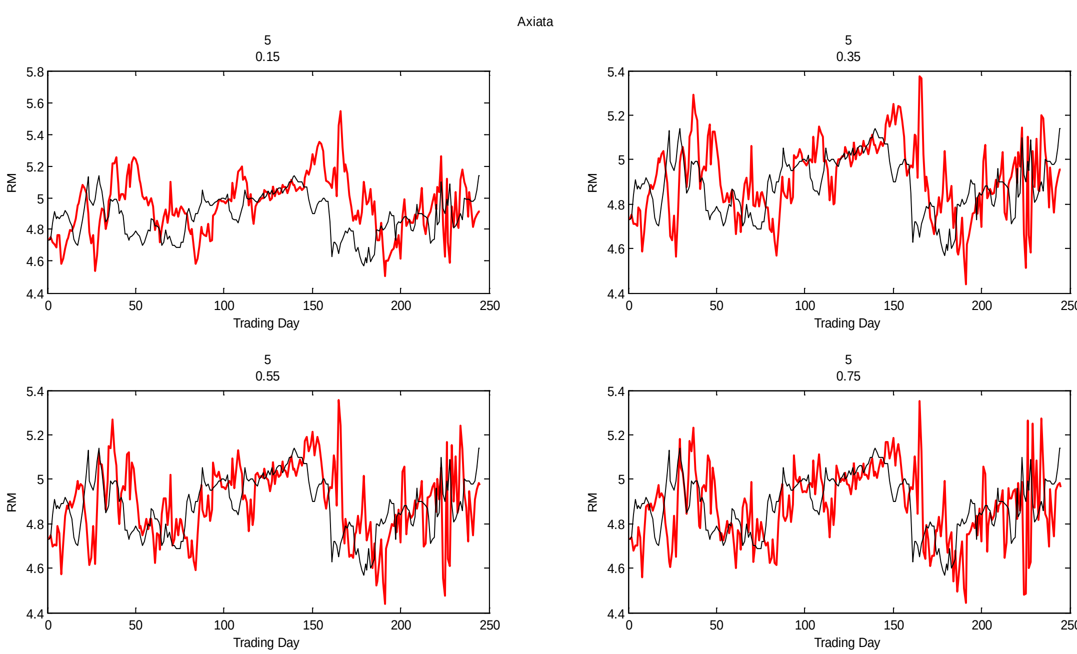

Figure 2 : Convergence of actual and forecasted share prices of Axiata

The thin black line shows the actual price and the thick line shows the predicted prices. It could be observed that both lines are moving in tandem capturing the same trend. However the thick line is more volatile and oscillates up and down more compared to the actual line. At 15% learning rate the lines diverge more than at 75% learning rate where the convergence is better.

Table 4 : Different types of errors produced at various learning rates - Axiata

Learning rates	RMSE	MAE	MAPE (%)	Hit Rate (%)
0.15	0.22	0.17	3.52	50.21
0.35	0.19	0.14	2.93	45.27
0.55	0.18	0.13	2.75	43.21
0.75	0.17	0.13	2.70	43.21

At the learning rate of 15% all errors are very high including the hit rate. When the learning rate increases the errors decline gradually but the hit rate falls steeply. The results indicate the net performs well in higher learning rates.

XI. HLB

HLB is another listed company in the Malaysian stock exchange. By applying the same procedure the share prices are predicted by the ADALINE net after training by the 2010 return data. The actual mean price is RM 11.07 for HLB in 2011 and at various levels of learning rates the forecasted mean prices are very close in the range of RM 11.03 to 11.09. The average price predicted at the learning rate of 15% is very low at RM 10.88. The standard deviation is also very high for this company price when compared to all other companies' standard devotions. Like mean prices the median prices also increase when the learning rate increases. The range is higher for the predicted prices than the actual price. The correlation coefficients between the actual and forecasted prices are strong around 85% to 89% except at 15% learning rate which indicates the actual and the forecasted prices move very closely in tandem. All these reveal that the net is producing robust results at higher learning rates.

Table 5 : Descriptive statistics of actual and forecasted share prices of HLB, 2011

	Actual Share price		Learning Rates Predicted share prices		
Parameters		0.15	0.35	0.55	0.75
Mean	11.07	10.88	11.03	11.08	11.09
Std Deviation	1.45	1.63	1.56	1.55	1.54
Median	10.58	10.46	10.58	10.64	10.68
Range	4.55	6.29	5.45	5.27	5.18
Maximum	13.76	14.81	14.35	14.31	14.23
Minimum	9.21	8.52	8.91	9.05	9.05
Correlation coefficients	--	0.71	0.89	0.88	0.85

The following figure shows the convergence of actual and predicted share prices for HLB. The first graph which is predicted at 15% learning rate shows wider gap between the actual and predicted prices. This gap reduces gradually with the same trend when the learning rate increases progressively. The convergence is excellent at 75% learning rate.

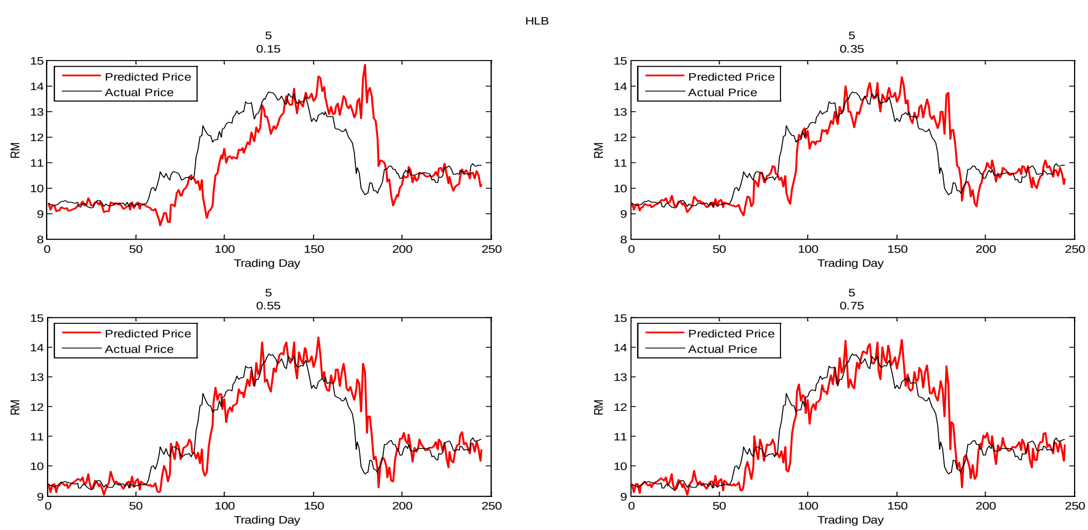

Figure 3 : Convergence of actual and forecasted share prices of HLB

Table 6 : Different types of errors produced at various learning rates - HLB

Learning rates	RMSE	MAE	MAPE (%)	Hit Rate (%)
0.15	1.19	0.79	7.17	41.56
0.35	0.84	0.54	4.88	45.27
0.55	0.74	0.49	4.39	45.68
0.75	0.69	0.46	4.18	45.27

The RMSE, MAE and MAPE all decease steeply when the learning rate increase from 15% to 75%. The RMSE declines from 1.19 to 0.69 almost a drop of 42%. The MAE and MAPE also fall by the same percentage. The hit rate behaves in an opposite way. When learning rate increases from 15% to 75% the hit rate also increases by 8% approximately. It seems at higher learning rates the net forecasts well.

XII. KLK

KLK is another listed company in Malaysian stock market. The mean actual price for this company in 2011 is RM 21.45 and the median price is RM 21.34, with a volatility of 0.67. The predicted mean prices are not very close to the actual mean price they differ substantially. At the learning rate of 15% the mean and median prices go up to RM 24.05 and RM 23.92 respectively. The range values are also higher. The correlation coefficient is 44% at the learning rate of 75% but registered a poor correlation coefficient of 9% at the learning rate of 15%.

Table 7 : Descriptive statistics of actual and forecasted share prices of KLK, 2011

	Actual Share price		Learning Rates Predicted share prices		
Parameters		0.15	0.35	0.55	0.75
Mean	21.45	24.05	23.42	23.01	22.78
Std Deviation	0.67	0.95	0.89	0.88	0.89
Median	21.34	23.92	23.31	22.91	22.66
Range	3.54	5.56	4.70	4.59	5.68
Maximum	23.10	27.27	26.26	25.41	25.56
Minimum	19.56	21.70	21.56	20.81	19.88
Correlation coefficients	--	0.09	0.35	0.42	0.44

The following figures also reveal the poor convergence of actual and predicted prices of KLK for 2011. The gap is substantial in 15% learning rate. When the learning rate goes up the gap between the actual and predicted price reduces a bit but not to the expected levels as in the other companies. The volatility is also very steep in the predicted lines.

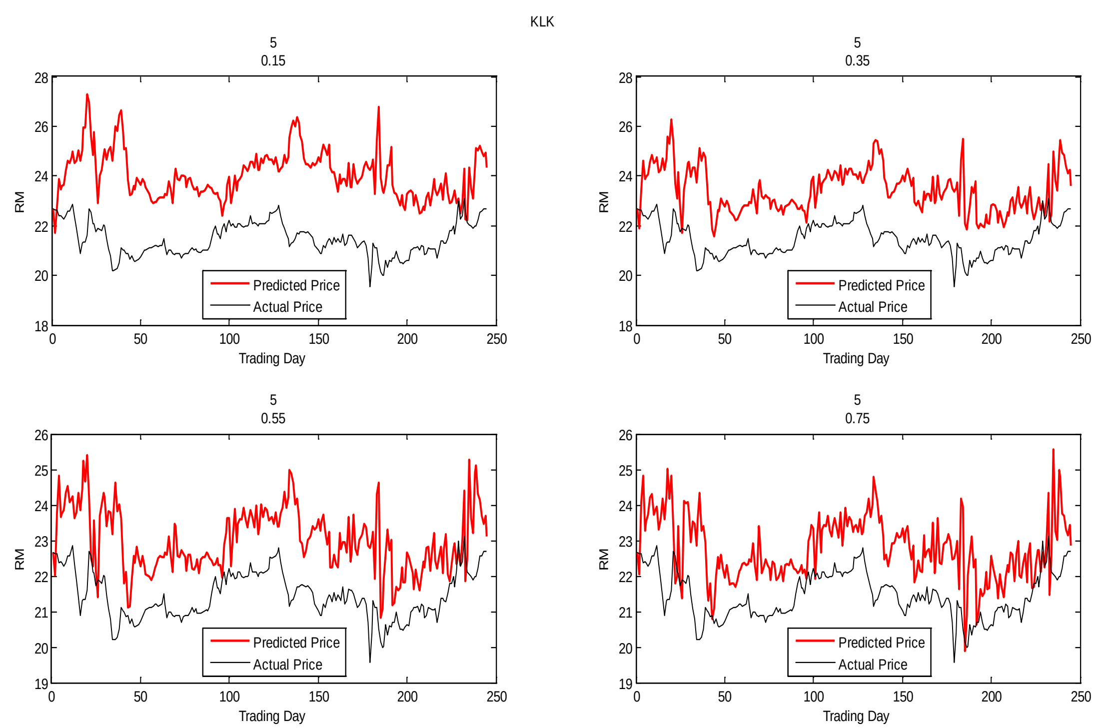

Figure 4 : Convergence of actual and forecasted share prices of KLK

Table 8 : Different types of errors produced at various learning rates - KLK

Learning rates	RMSE	MAE	MAPE (%)	Hit Rate (%)
0.15	2.82	2.60	12.14	48.97
0.35	2.16	1.98	9.21	48.15
0.55	1.78	1.58	7.35	46.50
0.75	1.57	1.36	6.32	47.74

The RMSE declines when the learning rate increases from 15% to 75% by 44% approximately. Similarly the MAE and MAPE decline by 47.69% and 47.94% respectively. The hit rate declines when the learning rate increases by 2.51%. In absolute terms it declines from 48.97% to 47.74%. These higher error levels reveal the poor convergence of actual and predicted share prices of KLK.

XIII. Conclusion

In this article we applied ADALINE neural network to predict the selected share prices of companies listed in Malaysian stock market. The ADALINE neural network predicts the trends well for all the four companies. The convergence of actual and predicted prices is excellent at higher learning rates in three companies. KLK company's graph shows poor fitting. The predicted prices closely converge with the actual prices with negligible gap at the higher learning rates. At lower learning rates the convergence is poor for all four companies. Our finding will be useful for fund managers to predict the share prices which will facilitate not only in decision making, controlling, and hedging but also in selection of shares for constructing share portfolios.

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MATLAB Program

```
close all
clear all
clc

load data4                     %  Load data
for m = 1:4                    %  Data from 1 to 4
   p=5;                        % Number of neurons
   alp=[.15 .35 .55 .75];      % Learning Rates

   for kk=1:4
      x=data(22-p:end,m);          % Take the share price
      xr=price2ret(x);             % Convert share price to geometric returns
      xr10=xr(1:ceil(length(xr)/2),:);        % Take returns of 2010
      xr11=xr(ceil(length(xr)/2)+1:end,:);    % Take returns of 2011
      t1=xr10(1:end);                         % 2010 target returns
      t2=xr11;                                % 2011 target returns
      X=convmtx(xr,p);                        % Convolution matrix for taking a few returns
      X=X(p:(end-p+1),:);                     % Take only the rows with full data
      rand('state',10)                        % Fix the random numbers
      w=2*(rand(1,p)-0.5);                    % Generate 5 random numbers for weights
      b=rand(1,1);                            % Generate a random number for bias

   %% Training algorithm

   for i= 1:length(t1);
      y(i) = b+w*X(i,:)';                 % Find the weighted total
      err(i) = t1(i) -y(i);               % Find deviation from the target
      w=w+alp(kk)*err(i)*X(i,:);          % Update the old weight
      b=b+alp(kk)*err(i);                 % Update the bias
      ww(i,:) = w;                        % Store the new weights
   end

    %% Testing or prediction
   k=1;                                % Counter initialisation
   nn=length(xr10);                    % 2010 Number of days
   spa=x(nn+1);                        % Take share prices of 2010
   spaa=x(nn+1+p);                     % Take share prices of 2010 plus another 5 prices

   for j=nn+1:length(X)
      y1=b+w*X(j,:)';                  % Compute a predicted return
      yy(k)=y1;                        % Store it in yy
      err=t2(k)-y1;                    % Find the deviation the predicted and actual price
      w=w+alp(kk)*err*X(j,:);          % Update the weight
      b=b+alp (kk)*err;                % Update the bias
      k=k+1;
   end
   sp=ret2price(yy,spaa);              % Predicted share price

   p11=x(length(t1)+1+p:end);          % Actual share price
   e=p11;
   f=sp(1:end-1)';
   p12=(sp(:,end-1))';
   err1=(mean((p12-p11).^2)^0.5);
   q=(e - f);                          % Errors
   qq=(e - f).^2 ;                     % Squared Error
   qqq=mean((e - f).^2)  ;             % Mean Squared Error
   rmse = sqrt(mean((e - f).^2));      % Root Mean Squared Error
```

```
%% Graph codes

        subplot(2,2,kk);
        bh=plot(sp,'r', 'linewidth', 1.5);
        hold on
        bg=plot(p11,'k');
        tt=num2str(alp(kk));
        title([textdata(m), 'Learning Rate',tt]);
        xlabel ('Trading Day')
        ylabel ('RM')
        legend('Predicted Price','Actual Price',3)
        axis([0 250 -inf inf])
    end
    figure
end
```

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Enhancing Transmission Capacity of a Cognitive Radio Network by Joint Spatial-Temporal Sensing with Cooperative Communication Strategy

By Muntasir Ahmed, Md. Anwar Hossain, A F M Zainul Abadin & Purno Mohon Ghosh

Pabna Science and Technology University, Bangladesh

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Keywords : cognitive radio network; cooperative communication; joint spatial-temporal sensing; spectrum sensing; spectrum sharing.

GJCST-E Classification : C.2.1

ENHANCING TRANSMISSION CAPACITY OF A COGNITIVE RADIO NETWORK BY JOINT SPATIAL-TEMPORAL SENSING WITH COOPERATIVE COMMUNICATION STRATEGY

Strictly as per the compliance and regulations of:

Enhancing Transmission Capacity of a Cognitive Radio Network by Joint Spatial-Temporal Sensing with Cooperative Communication Strategy

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I. Introduction

The radio spectrum is among the most heavily regulated and expensive natural resources around the world. In Europe, the 3G spectrum auction yielded 35 billion dollars in England and 46 billion in Germany. The question is whether spectrum is really this scarce. Although almost all spectrums suitable for wireless communications has been allocated, preliminary studies and general observations indicate that much of the radio spectrum is not in use for a significant amount of time, and at a large number of locations.

According to the statistics of the Federal Communications Commission (FCC), temporal and geographical variations in the utilization of the assigned spectrum range from 15% to 85% [1].

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The limited available radio spectrum and the inefficiency in spectrum usage necessitate a new communication paradigm to exploit the existing spectrum dynamically. The FCC has realized that overcrowding of unlicensed bands is only going to worsen and is considering opening up licensed bands for opportunistic use by secondary radios/users. One of the most efficient paradigms is the cognitive radio network (CRN), first introduced by J. Mitola [2], which is built upon software-defined radio (SDR) technology. S. Haykin defines a cognitive radio (CR) as "an intelligent wireless communication system that is aware of its environment and uses the methodology of understanding-by-building to learn from the environment and adapt to statistical variations in the input stimuli" [3,4] with the overarching aim of providing reliable communication whenever and wherever needed while efficiently using the resources available to it.

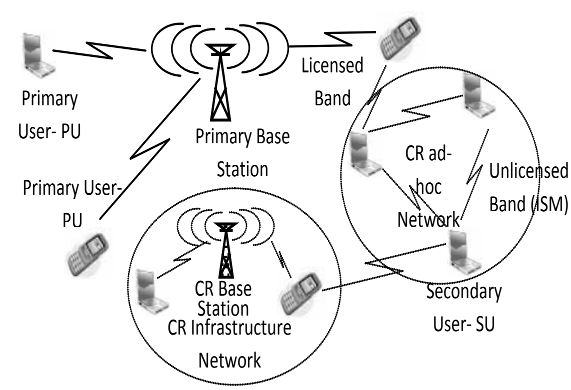


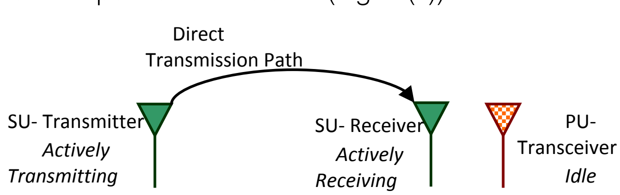
Figure 1 : CRN architecture. The CR users coexist with the primary users. The CR users can use both unlicensed bands and licensed bands that are free from primary users' activities

A CRN is built on the following principle: a network of secondary users (SU) (users without license) continuously senses the use of a spectrum band by primary users (PU) and opportunistically utilizes the band when PUs are absent. Any SU in a CRN performs two main functions: (1) sensing spectrum usage to identify absence or presence of a PU, and (2) transmitting at appropriate power if the PU is absent. Thus, the design principle for CRN regards the CR users as visitors in the spectrum they occupy (Fig. 1). The successful operation of these principles relies on the CRN users' ability to be aware of their surroundings, which is accomplished through spectrum sensing solutions.

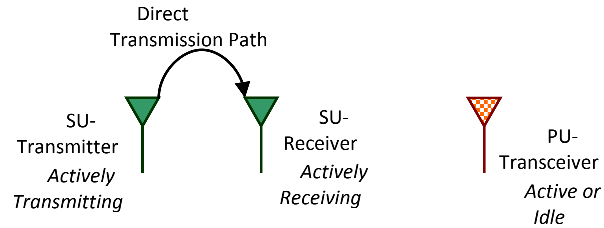
Spectrum sensing (the optimization of sensing parameters in a single spectrum band, spectrum selection and scheduling, and an adaptive and cooperative sensing method) enables CR users to adapt to the radio environment by determining currently unused spectrum portions, so-called spectrum holes or spectrum white spaces, without causing interference to the primary network. Generally, spectrum sensing techniques can be classified into four groups: (1) primary transmitter detection (matched filter detection, energy detection, and feature detection), (2) cooperative detection, (3) primary receiver detection, and (4) interference temperature management [1]. The SUs periodically sense the spectrum in order to identify and use the spectrum holes. When a SU senses that the PU is accessing the spectrum or determines that the PU is going to access the spectrum, it then vacates the spectrum and moves to the another spectrum or lowers its transmitting power. If there is another SU instead of the PU, then the first SU shares the spectrum with the new SU.

Spectrum holes exist both in time and in space. A spectrum hole in time may arise when a PU of the spectrum is idle, i.e., not transmitting. In this case, temporal spectrum hole is the duration for which the primary user-transmitter (PU_t) is in the idle state (Fig. 2 (a)). A spectrum hole in space with respect to a given frequency channel may occur if a given SU is sufficiently far from a PU that is actively transmitting (Fig. 2 (b)). In this case, the SU may transmit up to a certain level, which we called the maximum interference-free transmit power (MIFTP), without causing harmful interference to PUs who are receiving the transmissions. This results a useful spectrum sharing.

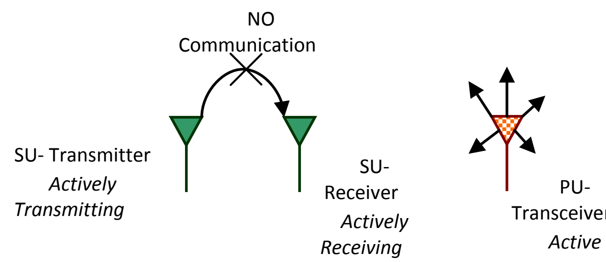
However, in the typical scenarios of static CRN where SU observe the activity of the PU in a fixed spectrum band and access the entire spectrum band if a spectrum opportunity is detected (based on IEEE 802.11 and IEEE 802.15.3 technologies), a SU transmitter communicates directly with SU receiver only when the PU is idle. A SU has to stop its transmission when no spectrum holes exist (Fig. 2 (c)).



(a)



(b)



(c)

Figure 2 : Typical spectrum sharing scenarios in CNR: The SU transmitter communicates directly with the SU receiver, due to the existence of a (a) temporal spectrum hole or a (b) spatial spectrum hole with respect to PU_t. Typical CRN transmission limitation due to lack of spectral holes in shown in (c)

To improve the transmission capacity of CRN, here we approach to combine CRN with cooperative communication strategy employing joint spatial-temporal sensing to maximize the transmission capacity of SUs in a CRN. In these scenarios, when PU transmitter is active, SU transmits to another SU receiver via a relay channel. By enabling the use of both the direct and relay channels, the transmission performance of the secondary system (CRN) can be improved significantly. Our proposed approach is depicted in Fig. 3.

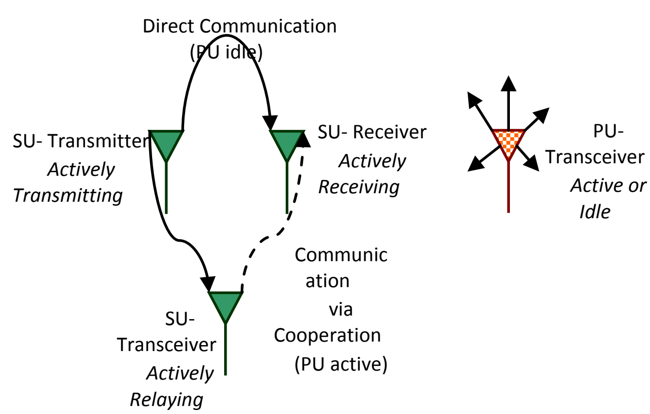


Figure 3 : Joint spatial-temporal spectrum sensing in a typical CRN for improving the transmission limitation due to lack of spectral holes by utilizing cooperative communication

Cooperative communications is a new paradigm that draws from the ideas of using the broadcast nature of the wireless channel to make communicating nodes help each other, of implementing the communication process in a distribution fashion and of gaining the same advantages as those found in MIMO systems [5]. The end result is a set of new tools that improve communication capacity, speed, and performance; reduce battery consumption and extend network lifetime; increase the throughput and stability region for multiple access schemes; expand the transmission coverage area; and provide cooperation tradeoff beyond source–channel coding for multimedia communications. This idea is true for wide varieties of wireless networks such as mobile ad hoc networks, sensor networks, or cellular networks. In this paper, we consider the decode-and-forward (DF) cooperative strategy focusing on the case of a single-hop relay channel.

II. System Model

a) Transmission frames and PU_t behavior

Time on the wireless channel is divided into frames consisting of N_s symbols. We shall assume perfect symbol level timing synchronization between the nodes of the secondary system. The primary user-transmitter (PU_t) alternates between active and idle states on a per-frame basis according to the active-idle Markov model of Fig. 4.

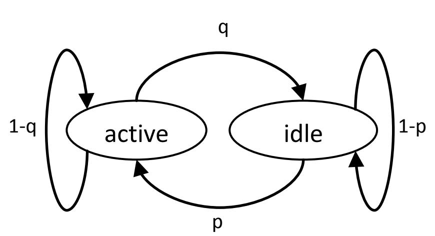


Figure 4 : 2-state Markov chain model for PU_t active/idle process

The active and idle durations can be modeled by geometric random variables with parameters q and p, respectively [6]. We focus on scenarios in which $q > p$; i.e., on average, PU_t is more often in the active state than the idle state (which is more practical to assume). Let us suppose that $q = kp$, where k is an integer with $k > 1$. Hence, if PU_t is idle for one time frame on average, it will be active for K time frames, on average. A similar approach can be used when $p > q$.

b) Cooperative transmission protocol

Suppose a secondary user-transmitter (SU_t) desires to transmit N_S symbols; i.e., it requires one full frame in which PU_t is idle. The cooperative protocol works as follows (Fig. 3): When PU_t is active, SU_t sends information to secondary user-receiver SU_r via the relay nodes SU_{relay}. When PU_t is idle, SU_t sends information directly to SU_r. In order to achieve this, the secondary nodes (SU_t, SU_{relay} and SU_r) perform joint spatial-temporal sensing [7]. In particular, all secondary users estimate their MIFTPs based on signal strength measurements, which they exchange with one another. They also decide whether the PU_t is active or idle, by transmitting their local decisions to a fusion center, which then makes the final decision.

We shall assume that there exists a communications path from SUt to SUr through SUrelay. This path would be established by a routing protocol. A repetition code [8] is used to repeat the transmission of the signal over K_0 and K_1 frames, where $K_0 + K_1 = K$. At each relay, the transmitted signal is amplified and forwarded to the next relay node until it reaches the destination. When PUt is idle, SUt can communicate N_S symbols over one time frame directly to SUr. Due to broadcast wireless channel, SUrelay also received a copy of signal from SUt but ignores it. When SUr receives a signal from the relay path, it stores the received signal and waits until it receives the same signal directly from SUt and vice versa. The received signals at SUr are then combined using MRC. Finally, maximum likelihood (ML) detection is used to detect the signals.

c) Cooperative Relaying

The received signal of a simple wireless channel model with flat fading and no shadowing is given by [9]

$$y = \delta\sqrt{\left(d_r/d\right)^{\alpha}}\, h\sqrt{\varepsilon}s + n = \sqrt{P}hs + n \qquad (1)$$

Where δ^2 is the free space signal-power attenuation factor between the source and a reference distance d_r, d is the distance between the source and destination, α is the propagation exponent, $h \sim CN\left(0,\sigma_h^2\right)$ is a complex Gaussian random variable with variance σ_h^2, $n \sim CN\left(0,N_0\right)$, and s is the transmitted signal. In Eq. (1), $P = \delta^2\left(d_r/d\right)^{\alpha}\varepsilon$ denotes the equivalent transmitted power after taking into account the effect of path loss. We also define $P_0 = \delta^2\left(d_r/d_0\right)^{\alpha}\varepsilon_0$, $P_1 = \delta^2\left(d_r/d_1\right)^{\alpha}\varepsilon_1$ and $P_t = \delta^2\left(d_r/d_t\right)^{\alpha}\varepsilon_t$ as the equivalent transmitted powers from SU_t to SU_{relay}, from SU_{relay} to SU_r, and from SU_t to SU_r, respectively. Here, d_0, d_1 and d_t denote the distances between the node pairs (SU_t, SU_{relay}), (SU_{relay}, SU_r), and (SU_t, SU_r), respectively. Also ε_0 and ε_1 denote the MIFTPs of SU_t and SU_{relay}, respectively when PU_t is active and ε_t denotes the maximum transmit power of SU$_t$. When $\varepsilon_0 << \varepsilon_t$, SU$_t$ may not communicate directly with SU$_r$ when PU$_t$ is active because the power level P_0 is too low. Hence, when PU$_t$ is active, SU$_t$ communicates with SU$_r$ through relay node SU$_{relay}$, which is closer to SU$_t$. The received signal at a relay is the MRC sum of a repetition code over K_0 time frames [8] as

$$y_1 = \sum_{i=1}^{K_0} g_i^*\left(g_i\sqrt{P_0}s + n_i\right) = \tilde{g}\sqrt{P_0}s + \tilde{n}\,, \qquad (2)$$

Where $\tilde{g} = \sum_{i=1}^{K_0}|g_i|^2$ and $\tilde{n} = \sum_{i=1}^{K_0} g_i^* n_i$, s is the transmitted symbol, $|s|^2 = 1$ and g_i is the channel gain between SU$_t$ and SU$_{relay}$ during time frame i. The received signal at SU$_r$ due to relay SU$_{relay}$ is

$$y_R = \sum_{j=1}^{K_1} h_j^*\left(\sqrt{P_1}h_j A\left(\tilde{g}\sqrt{P_0}s + \tilde{n}\right) + n_j\right) = \sqrt{P_0P_1}\tilde{h}A\tilde{g}s + n_R\,, \qquad (3)$$

Where $h = \sum_{j=1}^{K_1}|h_j|^2$, $n_R = \sum_{j=1}^{K_1}\left(|h_j|^2 A\sqrt{P_1}\tilde{n} + h_j^* n_j\right)$, h_j is the channel gain between SU$_{relay}$ and SU$_r$ during time frame j. Here, A is the amplification factor which is chosen to maintain average constant power output at SU$_{relay}$, $A^2 = 1/\left(P_0\tilde{g}^2 + N_0\tilde{g}\right)$. The noise variance of y_R is $\sigma_R^2 = A^2 P_1\tilde{g}\tilde{h}^2 N_0 + \tilde{h}N_0$ where $\tilde{h} = \sum_{j=1}^{K_1}|h_j|^2$. The direct transmission (SU$_t$ → SU$_r$) channel model is

$$y_T = f\sqrt{P_t}s + n_T\,, \qquad (4)$$

Where f is the channel gain between SU$_t$ and SU$_r$. f, h_j and g_i are constant over one time frame duration and independently identical distributed from one frame to another. At SU$_r$, MRC is used to combine y_R and y_T. The noise variables n_R and n_T have different powers because n_R includes a noise contribution at the relay. For this reason, noise normalization is necessary for MRC of y_T and y_R as in [10]. The resulting SNR is

$$\gamma_w = |f|^2\left(P_t/N_0\right) + |A\tilde{g}\tilde{h}|^2\left(P_0P_1/\sigma_R^2\right) = \gamma_t + \gamma_r\,, \qquad (5)$$

Where $\gamma_t = |f|^2\left(P_t/N_0\right)$ and

$$\gamma_r = |A\tilde{g}\tilde{h}|^2\left(P_0P_1/\sigma_R^2\right) = \left(\gamma_0\gamma_1/\left(\gamma_0 + \gamma_1 + 1\right)\right), \qquad (6)$$

with $\gamma_0 = \tilde{g}\left(P_0/N_0\right)$ and $\gamma_1 = \tilde{h}\left(P_1/N_0\right)$. We assume that f, g_i, h_j are known at receiving end. The symbol error probability (SEP) conditioned on the instantaneous SNR γ_w is given by $P_e = Q\left(\sqrt{k\gamma_w}\right)$ [10] where k is a constant that depends on the type of modulation and $Q(x) = \left(1/\sqrt{2\pi}\right)\int_x^\infty e^{-t^2/2}dt$ is the standard Q-function.

III. Performance Analysis

In this section, we derive a lower bound on the average SEP. We show that the SEP lower bound is minimized when $K_0 = K_1$ for K even and $K_0 = K_1 + 1$ for K odd. From Eq. (6), we can upper-bound γ_r as follows:

$$\gamma_r \le \left(\gamma_0\gamma_1/\left(\gamma_0 + \gamma_1\right)\right) \le \sqrt{\gamma_0\gamma_1}/2 = \left(\sqrt{P_0P_1}/2N_0\right)\sqrt{\tilde{g}\tilde{h}}\,, \qquad (7)$$

Taking expectations on both sides, we have

$$E[\gamma_r] \le \left(\sqrt{P_0P_1}/2N_0\right)E\left[\sqrt{\tilde{g}\tilde{h}}\right], \qquad (8)$$

Note that $g_i, h_j \sim CN(0,1)$ then $2\tilde{g}$ and $2\tilde{h}$ are independent χ^2-distributed random variables with $2K_0$ and $2K_1$ degrees of freedom, respectively. Applying Jensen's inequality,

$$E\left[\sqrt{\tilde{g}\tilde{h}}\right] \le \sqrt{E\left[\tilde{g}\tilde{h}\right]} = \frac{1}{2}\sqrt{E[2\tilde{g}]E\left[2\tilde{h}\right]} = \sqrt{K_0K_1}\,, \qquad (9)$$

From Eq. (8) and Eq. (9), we have

$$E[\gamma_r] \le \left(\sqrt{P_0P_1}/2N_0\right)\sqrt{K_0K_1}\,, \qquad (10)$$

Assuming M-PSK modulation, the average SEP can be expressed as follows [11]:

$$SEP = \frac{1}{\pi}\int_0^{\frac{(M-1)\pi}{M}} M_{\gamma_t}(-\kappa)M_{\gamma_r}(-\kappa)d\theta\,, \qquad (11)$$

Where $M_{\gamma_t}(u) \cong E\left[e^{u\gamma_t}\right]$ and $M_{\gamma_r}(u) \cong E\left[e^{u\gamma_r}\right]$ are the moment generating functions of γ_t and γ_r, respectively, and $\kappa \cong \left(k/\sin^2\theta\right) \ge 0$. Applying Jensen's inequality and Eq. (10), we have

$$M_{\gamma_r}(-\kappa) = E\left[e^{-\kappa\gamma_r}\right] = e^{-\kappa E[\gamma_r]} \geq e^{-\beta\sqrt{K_0 K_1}}, \quad (12)$$

Where $\beta \cong \kappa\sqrt{P_0 P_1}/(2N_0) \geq 0$. The lower bound for the SEP is then obtained by substituting the right hand side of Eq. (12) into Eq. (11). If K is even, i.e., $K = 2m$ where m is an integer, $2\sqrt{K_0 K_1} \leq K_0 + K_1 = 2m$, with equality holding when $K_0 = K_1 = m$. In this case, Eq. (12) implies that the choice of $K_0 = K_1$ maximizes the performance of our proposed scheme. If K is odd, i.e., $K = 2m+1$, information-theoretic results in [12] suggest the choice $K_0 > K_1$, in order to maximize the SNR at the first hop. Let $K_0 = K_1 + n$, where $n \geq 1$ is an integer. We have $2K_1 = 2m + 1\text{-}n$,

$$4K_0 K_1 = 4m^2 + 4m + 1\text{-}n^2 \leq 4m^2 + 4m \quad (13)$$

The equality in (13) holds for $K_0 = K_1 + 1$, which also suggests that choosing $K_0 = K_1 + 1$ minimizes $M_{\gamma_r}(-\kappa)$ and hence the SEP. Our analysis is confirmed by the simulation results presented in Section 4.

IV. Numerical Results

In this section, we present the simulated result of our proposed scheme in CRN. In the performance curves, the 95% confidence intervals are omitted for clarity. BPSK modulation is used and $f, g_i, h_j \sim CN(0,1)$ The frame length is 100 symbols. MRC and ML detection are used at the receiver.

In the first phase, we have assumed that the three channels have equal average SNRs, i.e. the distances between source, relay and destination are assumed to be equal. So it is logical to think the same MIFTPs for this case.

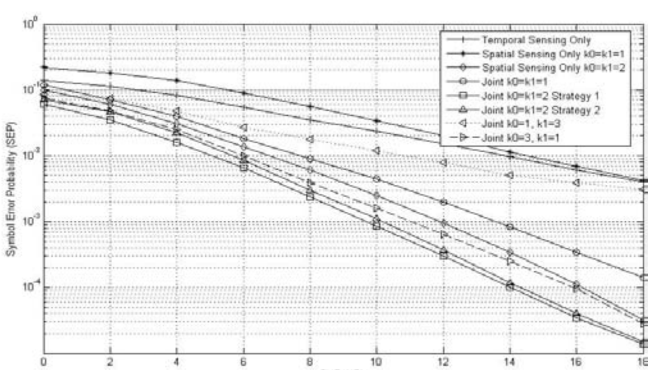


Figure 5 : Decode-and-Forward (DF) with one relay and K = 4

When $K = 2m$, the transmission strategy follows the scheme described in Section 2, which we call (strategy 1). The traditional cooperative communication scheme, which we call strategy 2, transmits m times on the path SU_t → SU_{relay} → SU_r over m branches.

Fig. 5 shows the SEP performance of our scheme with one relay and $K = 4$ in comparison to pure temporal sensing, pure spatial sensing, and traditional cooperative communications with $K_0 = K_1 = 1$. The pure temporal sensing scheme corresponds to direct communication from SU_t to SU_r, whereas the pure spatial sensing scheme corresponds to communication over the relay path. The simulation results confirm our analytical conclusion that the best performance is achieved with our proposed scheme with $K_0 = K_1 = 2$. Similar performance trends can be seen in Fig. 6, for which $K = 5$, $K_0 = 3$ and $K_1 = 2$.

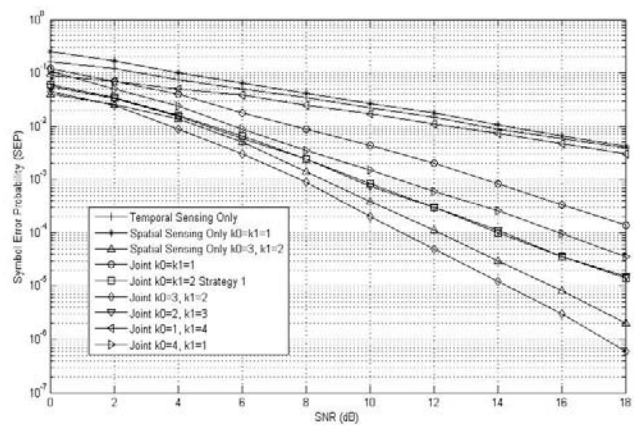


Figure 6 : DF with one relay and K = 5

In practice, the situation in the CRN becomes so much complex that it leads us to think different distances among the SU_t, SU_{relay} and SU_r (instead of assuming equal distances among them having the same average SNRs) which results different fading characteristics of these three channels. Hence these three channels will have different average SNRs. The simulated result of this condition is presented in Fig. 7 when the MIFTPs and the average SNRs (P_t/N_0), (P_0/N_0) and (P_1/N_0) are different. We found that a higher SNR at the link from SU_t to SU_{relay} results the best performance. The valuable insight from this is that we should choose the relay node that maximizes the average SNR (P_0/N_0) from the subset of relay nodes having the same total average SNR $((P_0 + P_1)/N_0)$. This also confirms the results in [12] in which the maximum transmission capacity is achieved when the relay is situated slightly near the source terminal or in the middle between the source and the destination.

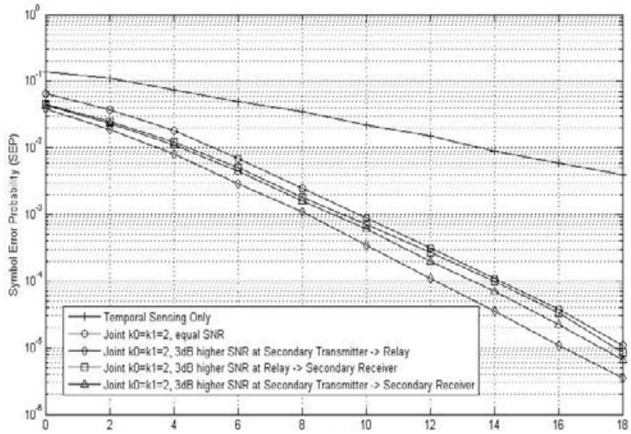


Figure 7 : DF with one relay, asymmetric SNR, and K = 4

V. Conclusion

We proposed a scheme works with the cooperative communication strategy in cognitive radio networks so that the secondary users can get all time transmission connectivity by using both spatial spectrum white space sensing and temporal spectrum white space sensing. This results maximum possible spectrum utilization. The proposed scheme improves the transmission capacity of static cognitive radio network to a great extent.

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A Square Root Topologys to Find Unstructured Peer-To-Peer Networks

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Abstract - Unstructured peer-to-peer file sharing networks are very popular in the market. Which they introduce Large network traffic. The resultant networks may not perform search efficiently and effectively because used overlay topology formation algorithms are creating unstructured P2P networks are not performs guarantees. In this paper, we choosen the square-root topology, and show that this topology. Which improves routing performance compared to power-law networks. In the square-root topology shows that this topology is optimal for random walk searches. A power-law topology for other types of search techniques besides random walks. Then we interoduced a decentralized algorithm for forming a square-root topology, its effectiveness in constructing efficient networks using both simulations and experiments with our prototype. Results show that the square-root topology can provide a good and the best performance and improvement over power-law topologies and other topology types.

Keywords : peer to peer connections, unstructured overlay networks, search, random walks.

GJCST-E Classification : C.2.4

A SQUARE ROOT TOPOLOGYS TO FIND UNSTRUCTURED PEER-TO-PEER NETWORKS

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A Square Root Topologys to Find Unstructured Peer-To-Peer Networks

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Abstract - Unstructured peer-to-peer file sharing networks are very popular in the market. Which they introduce Large network traffic. The resultant networks may not perform search efficiently and effectively because used overlay topology formation algorithms are creating unstructured P2P networks are not performs guarantees. In this paper, we choosen the square-root topology, and show that this topology. Which improves routing performance compared to power-law networks. In the square-root topology shows that this topology is optimal for random walk searches. A power-law topology for other types of search techniques besides random walks. Then we interoduced a decentralized algorithm for forming a square-root topology, its effectiveness in constructing efficient networks using both simulations and experiments with our prototype. Results show that the square-root topology can provide a good and the best performance and improvement over power-law topologies and other topology types.

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I. Introduction

PEER-TO-PEER networks have been widely used in the internet, and they provide more services like file sharing, information gathering, media streaming. P2P applications are more popular because they firstly gives low entry barriers and self-scaling. P2P applications are dominating 20 percent of Internet traffic. Object search is the big task in P2P applications. Gnutella is a popular P2P search protocol in the market. Gnutella networks are unstructured, The peers participating in networks connect to one another randomly, peers search objects in the networks By using message flooding. To flood a message, peer broadcasts the message to its neighbouring peer. The broadcast message is associated with a positive integer time-to-live value. By receiving a message, the peer decreases the TTL value with the message by 1 and then stops the message with the updated TTL value to its neighbours, except the one sending the message to j, if the TTL value remains positive. Aside from forwarding the message to the neighbours, j searches its local store to see if it can provide the objects requested by peer i. if j has the requested objects and is ready to send them, then j directly sends i the objects or returns the objects to the overlay path where the query message moves from i to j. The Gnutella search performance is like unstructured P2P networks. used orthogonal techniques is for improving search performance in unstructured P2P networks. replications, super peer architectures and overlay topologies, among others. we use the square-root topology technique for unstructured P2P networks, to enhance search efficiency and effectiveness. The P2P network to minimize the overlay path length between any two peers to dicrease the query response time. The probability of peer j being the neighbor of peer i increasing if j shares more common interests with i. we first observe the existing P2P file sharing networks shows the power-law file sharing process. this proposal has the following unique features.

In a constant probability, the search hop count between any two nodes is OðlnC1 NÞ,where 1< c1<2 is a small constant, and N is the number of active peers participating in the network.

In a constant probability of approximately 100 percent, peers on the search path from the querying peer to the destination peer progressively and effectively exploit their similarity.

Whereas some solutions require centralized servers to help to set the system, our proposal needs no centralized servers to participate . our solution is mathematically provable and gives performance guarantees. we using a search protocol to take advantage of the peer similarity exhibited by overlay network. one extra finding in our performance analysis shows that P2P networks. the search path length is OðN c2 Þ (where 0 < c2 < 1) if any peer i on the path has to search another peer j, which is to be same as to the destination peer d than i, to receive and forward the query toward d. from having a best performance analysis, our theoretical analysis is existed in simulations. we compare our proposal with two representative distributed algorithms. With our similarity-aware search protocol, that the overlay networks that shows the similarity of participating peers can considerably dicrease the query traffic and the search protocol based on blind flooding.

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II. Our Proposal: The Square-Root Topology

A peer-to-peer network with N peers. Each peer k in the network has degree dk. The total degree in the network is *D,* where

D = _Nk=1 dk.

Equivalently, the total number of connections in the network is D/2. We used the square-root topology as a topology where the degree of each peer is proportional to the square root of the popularity of the peer's content. if we define gk as the proportion of searches submitted to the system that are satisfied by content at peer k, then a square-root topology has dk ∝ √ gk for all k. consider a user submits a search *s* that is existed by the by content at a particular peer k. Until the search is processed by the network, we do not know which peer k is. How many hops will the search message take before it arrives at k. The expected length of the random walk depends on the degree of k:

Lemma 1. If the network is connected and non-bipartite, then the expected number of hops for search s to reach peer k is D/dk.

Where the probability of transition from state i to state j depends only on i and j, and not on any other history about the process. The states of the Markov chain are the peers in the system, and 1 ≤ i, j ≤ N. Associated with a Markov chain is a transition matrix T that shows the probability that a transition occurs from a state i to another state j. this transition probability is the probability that a search message that is at peer i is next sends to peer j. With random walks, the transition probability from peer i to peer *j* is 1/di if i and j are neighbors, and zero. it depends only on the node degrees, and not on the structure. the expected length of a walk does not depend on which peers are connected to which other peers. This property exicutes from the fact that the Markov chain converges to the same stationary distribution of which vertices are connected.

Thismodel shows peers forward search messages to a randomly chosen peers, even if that search message has just come from that neighbor or has already visited this neighbor. This process simplifies the Markov chain analysis. Already used process for random walks have noted that avoiding previously visited peers can improve the efficiency of walks, and we state this possibility in simulation results in the next section. Using the transition matrix, we can calculate the probability that a search message is at a given peer at a given point in time. First, we define an N element vector V0, called the initial distribution vector, the kth entry in V represents the probability that a random walk search starts at peer k. The entries of V sum to 1. Given *T* and V0, we can calculate V1, where the kth entry represents the probability of the search being at peer k after one hop, as V1 = TV0. In general, the vector Vm, representing the probabilities that a search is at a given peer after m hops, is recursively defined as Vm = TVm−1. Under the conditions of the lemma, Vm converges to distribution vector Vs, representing the probability that a random walk search visits a given peer at a particular point in time. It shown that the kth entry of Vs is dk/D. In the steady state, the probability that a search message is at a given peer k is dk/D.

The search routing as a series of experiments, by choosing a random peer k from the population of N peers with probability dk/D. The successful experiment occurs when a search chooses a peer with matching content. The expected number of experiments before the search message successfully reaches a particular peer *k* is a geometric random variable with expected value 1 dk/D = D dk. This is the result comes by Lemma 1.

If a given search requires D/dk hops to reach peer k, we assume that a search will be satisfied by a single peer. We define Gk to be the probability that peer k is the goal peer, gk ≥ 0 and _N k=1 gk = 1. The gk vary from peer to peer. The proportion of searches seeking peer *k* is *gk*, The expected number of hops that will be taken by peers seeking peer k is D/dk, The expected number of hops taken by searches is:

H = _N k=1 gk · D dk (1)

It turns out that *H* is minimized when the degree of a peer is proportional to the square root of the popularity of the documents at that peer. This is the square-root topology.

Theorem 1:
H is minimized when dk = D √ gk _N i=1 √ gi (2)

Proof:

We use the method of Lagrange multipliers to minimize equation (1). Recall the constraint that all degrees dk sum to D, the constraint for our optimization problem is

f = (_N k=1 dk) − D = 0.

We must find a Lagrange multiplier λ that satisfies ∇H = λ∇f (where ∇ is the gradient operator). First, treating the *gk* values as constants,

∇H =_N k=1−D • gk • d −2 K • uˆk (3)

Where uˆk is a unit vector. Next,

λ∇ f = λ _N k=1 uˆk = _N k=1 λuˆk (4)

Because ∇H = λ∇f, we can set each term in the summation of equation (3) equal to the corresponding term of the summation of equation (4), so that

−D • gk • d−2k • uˆk =λuˆk.

Solving *dk* gives

$$dk = \sqrt{}\sqrt{D} \cdot gk - \lambda \quad (5)$$

Now we will eliminate λ, the Lagrange multiplier. Substituting equation (5) into *f* gives

$$\_N\ k=1\ (\sqrt{}\ \sqrt{D} \cdot gk - \lambda) = D \quad (6)$$

and solving gives

$$1 \sqrt{} -\lambda = \sqrt{} D\ D\ \_N\ k=1 \sqrt{} gk \quad (7)$$

If we change the dummy variable of the summation in equation (7) from *k* to *i*, and substitute back into equation(1), we get equation (2). Theorem 1 shows that the square-root topology is the optimal topology over a large network, does not impact performance substituting equation (2) into equation (1) eliminates *D*. any value of *D* that ensures the network is connected is sufficient. Result shows more of which peers are connected to which other peers, because of the properties of the stationary distribution of Markov chains. Peer degrees must be integer values, Therefore, the optimal peer degrees must be calculated by rounding the value calculated in equation (2).

III. Experimental Results on the Square-Root Topology

In analysis of the square-root topology is based on an idealized model of searches and content. peer-to-peer systems are less idealized, searches may match content at multiple peers. In this we present simulation results to get the performance of a square-root topology. We use simulation because we wish to exbit the performance of large networks and it is difficult to deploy that many live peers for research on the Internet. Our first metric is to count the total number of messages sent under each search method. Searches terminate when enough results are found, where enough is defined as a user specified goal number of results *G*.

The results show:

- Random walks perform best on the square-root topology, requiring up to 45 percent fewer messages than in a power-law topology. The square-root topology also results in up to 50 percent less search latency than power-law networks, even when multiple random walks are started in parallel.
- The square-root topology is the best topology when replication is used, and the combination of square-root topology and replication provides higher efficiency than technique alone.
- Other search techniques based on random walks, such as biased high-degree, biased towards results or fewest result hop neighbors, and random walks with state keeping performed best on the square-root topology, decreasing the number of messages sent by as much as 52 percent compared to a power-law topology.
- The square-root topology shown better than other topology structures, including a constant degree network, and a topology with peer degrees directly proportional to peer popularity. In super-peer networks the square-root was the best topology for connecting the super-peers. we first sets our experimental setup, and then present our results.

a) *Experimental Setup*

Our results were exhibited by using a discrete-event peer-to-peer simulator. In this simulator models individual peers, documents and queries, also the topology of the peer-to-peer overlay. Searches are send to individual peers, and then walk around the network according to the routing algorithm.

Parameter	Value
Number of peers	20,000
Documents	631,320
Queries submitted	100,000
Goal number of results	10
Average links per peer	4
Minimum links per peer	1

Table 1 : Experimental Parameters

Simulations used networks with 20,000 peers. Simulation parameters are listed in Table 1.

Square-root topology is based on the popularity of documents stored at different peers, it is important to accurately model the number of queries that match each document, and the peers at which each document is stored. It is difficult to gather complete query, document and location data for tens of thousands of real peers. Therefore, we used the content model described in, which is based on a trace of real queries and documents, and more accurately describes real systems than simple uniform or Zipfian distributions. We downloaded text web pages from 1,000 real web sites, and evaluated keyword queries against the web pages. Then we generated 20,000 synthetic queries matching 631,320 synthetic documents, stored at 20,000 peers, such that the statistical properties of our synthetic content model matched those of the real trace. The resulting content model allowed us to simulate a network of 20,000 peers. In this simulation, we submitted random queries chosen from the set of 20,000 to produce a total of 100,000 query submissions. we describe the details of this method of generating synthetic documents and queries, and provide experimental evidence that the content model, though synthetic, results in highly accurate simulation results. The synthetic model retains an accurate distribution of the popularity of peer content, which is critical for the construction of the square-root topology.

b) Random Walks

We conducted an experiment to examine the performance of random walk searches in different topologies. This queries matched documents stored at different peers, and had a goal G = 10 results. We compared three different topologies.

- A square-root topology, generated by assigning a degree to each peer based on equation (2), and then creating links between randomly chosen pairs of peers based on the assigned degrees.
- A low-skew power-law topology, generated using the PLOD algorithm. In this network, $\alpha = 0.58$.
- A high-skew power-law topology, generated using the PLOD algorithm, with $\alpha = 0.74$.

Random walks in the square-root topology require 8,940 messages per search, 26 percent less. than random walks in the low-skew power-law topology and 45 percent less than random walks in the high-skew power-law topology. In the power-law topologies, searches tend toward high degree peers, even if the walk is truly random and not explicitly directed to high degree peers. These high degree peers also have the most popular content, Result is that searches have a low probability of going to the peer with matching content, and the number of hops and thus messages increases. If the power-law distribution is more skewed, then the probability that searches will congregate at the wrong peers is higher and the total number of messages are necessary to get to the right peers increases. Even though random walks perform best in the square-root topology, a large number of messages need to be sent. the result is a significant improvement over traditional Gnutella style search, flooding in a high-skew power-law network, with a TTL of five in order to find at least ten results on average, requires 17,700 messages per search. The above results are for simple, unoptimized random walks. Adding optimizations such as proactive replication or neighbor indexing reduces the cost of a random walk search, and results for these techniques show that the square-root topology is still best. Another issue with random walks is that the search latency is high, as queries may have to walk many hops before finding content. To deal with this, Lv et al propose creating multiple, parallel random walks for each search. Since the network processes these walks in parallel, the result is reduced search latency. We ran experiments where we created 2,10, 15, 20, 30, and 100 parallel random walks for each search, and measured search latency.

Walks	Square root Power-law	Power law low-skew	high-skew
1	8930	12090	16350
2	4500	6210	8970
5	1800	2490	3740
10	904	1250	1880
20	454	630	947
100	96	130	194

Table 2 : Parallel random walks: search latency (ticks)

These results are shown in Table 2.The square-root topology provided the lowest search latency, regardless of the number of parallel walks that were generated. The improvement for the square-root topology was consistently 27 percent compared to the low-skew power-law topology, and 50 percent compared to the high-skew power-law topology. Even when searches are walking in parallel, the square root topology helps those search walks quickly arrive at the peers with the right content.

c) Proactive Replication

The square-root topology is complementary to the square-root replication. It is feasible to proactively replicate content, the square-root replication specifies that the number of copies made of content should be proportional to the square root of the popularity of the content. The square-root topology can be used whether or not proactive replication is used, the combination of the two techniques can provide significant performance benefits. We conducted an experiment where Replicated content according to the square-root replication. Then we connected peers in the square-root, high-skew power-law, and low-skew power-law topologies, and states the performance of random walk searches. Again, *G*= 10. As expected, proactive replication provided better performance than no replication. Proactive replication performs best with the square-root topology, requiring only 2,830 messages per search, 42 percent less than in the low-skew power-law network and 56 percent less than in the high-skew power-law network. replication makes more copies of the documents that a search will match, while the square-root topology makes it easier for the search to get to the peers where the documents are stored. The combination of the two techniques provides more efficiency than either technique alone. For example, the square root topology with proactive replication required 68 percent fewer messages than the square root topology without replication.

d) Other search walk techniques

We examined the performance of other walk-based techniques on different topologies. We compared three other techniques based on random walks:

- Biased high degree messages are preferentially forwarded to neighbors that have the highest degree.
- Most results messages are forwarded preferentially to neighbors that have returned the most results for the past 10 queries.
- Fewest result hops messages are forwarded preferentially to neighbors that returned results for the past 10 queries who have traveled the fewest average hops.

In each case, ties are broken randomly. For the biased high degree technique, we examined both neighbour indexing and no neighbour indexing. Although describes several ways to route searches in addition to most results and fewest result hops, these two techniques represent the best that the result hops requires the least bandwidth, while most results has the best chance of finding the requested number of matching documents. The square-root topology is best. The most improvement is seen with the biased high degree technique, where the improvement on going from the high-skew power-law topology to the square-root topology is 52 percent. Large improvements are achieved with the fewest result hops technique and most results. The smallest improvement observed was for the biased high degree technique with neighbor indexing. square-root topology offers a 16 percent decrease in messages compared to the lowskew power-law topology. The square-root topology provides the best performance, even with the extremely efficient biased high degree/neighbor indexing combination. The square-root topology can be used even when neighbor indexing is not feasible. The combination of square-root topology, square-root replication and biased high degree walking with neighbor indexing provides even better performance. Our results indicate that this approach is extremely efficient, requiring only 248 messages per search on average. The square root topology is better than the power law topology when square-root replication and neighbor indexing are used. Using all three techniques together results in a searching mechanism that contacts less than 2 percent of the systems peers on average while still finding sufficient results. The results so far assume state-keeping, where peers keep state about where the search has been. peers can avoid forwarding searches to neighbours that the search has already visited. The results demonstrate that the square-root topology is better than power-law top logies, whether or not statekeeping is used.

e) Other Topologies

We also tested the square-root topology in comparison to several other network structures. We compared against two simple structures.

- Constant-degree topology: every peer has the same number of neighbors. In our simulations, each peer had five neighbors.
- Proportional topology: every peer had a degree proportional to their popularity *gk*.

Our results show that the square-root topology is best, requiring 10 percent fewer messages than the constant degree network, and 7 percent fewer messages than the proportional topology. Although the improvement is smaller than when comparing the square-root topology to power-law topologies, these results again demonstrate that the square-root topology is best. The cost of maintaining the square-root topology is low, as we discuss in Section 4, requiring easily obtainable local information. It clearly makes sense to use the square-root topology instead of constant degree or proportional topologies. A widely used topology in many systems is the super-peer topology. In this topology, a fraction of the peers serve as super-peers, aggregating content information from several leaf pears. Then, searches only need to be sent to super-peers. They are connected using a normal unstructured topology. We ran simulations using a standard superpeer topology, in which searches are flooded to super peers. We compared this standard topology to a super peer topology that used the square-root topology and random walks between super peers. The results indicate a significant improvement using our techniques the square root super peer network required 54 percent fewer messages than a standard super-peer network.

IV. Conclusions

We have presented the square-root topology, and shown that implementing a protocol that causes the network to converge to the square root topology, rather than a power-law topology, can provide significant performance improveents for peer-to-peer searches. In the square-root topology, the degree of each peer is proportional to the square root of the popularity of the content at the peer. Our analysis shows that the square-root topology is optimal in the number of hops required for simple random walk searches. We also present simulation results which demonstrate that the square-root topology is better than power-law topologies for other peer-to-peer search techniques. we presented an algorithm for constructing the square-root topology using purely local information. Each peer estimates its ideal degree by tracking how many queries match its content, and then adds or drops connections to achieve its estimated ideal degree. Results from simulations and our prototype show that this locally adaptive algorithm quickly converges to a globally efficient square-root topology. Our results show that the combination of an optimized topology and efficient search mechanisms provides high performance in unstructured peer-to-peer networks.

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The recommended size of original research paper is less than seven thousand words, review papers fewer than seven thousands words also.Preparation of research paper or how to write research paper, are major hurdle, while writing manuscript. The research articles and research letters should be fewer than three thousand words, the structure original research paper; sometime review paper should be as follows:

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27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

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33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

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Key points to remember:

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A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

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· Use present tense to report well accepted

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· Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives

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The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

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- Fundamental goal
- To the point depiction of the research
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- Significant conclusions or questions that track from the research(es)

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- Report the method (not particulars of each process that engaged the same methodology)
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What to keep away from

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The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.
- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

Discussion:

The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a argument should be. Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implication of the study. The purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly described. Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved with prospect, and let it drop at that.

- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

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Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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