A Comparative Study of the Perceptions of End Users in the Eastern, Western, Central, Southern and Northern Regions of Saudi Arabia about Email SPAM and Dealing with it

Hasan Alkahtani[*], Robert Goodwin[**], and Paul Gardner-Stephen[**]

[*] Computer Science Department, College of Computer Science and Information Technology, King Faisal University,
P.O. Box: 400 Al-Hassa 31982, Kingdom of Saudi Arabia
hsalkahtani@kfu.edu.sa

[**] School of Computer Science, Engineering and Mathematics, Faculty of Science and Engineering, Flinders University,
GPO Box 2100, Adelaide SA 5001, Australia
robert.goodwin@flinders.edu.au, paul.gardner-stephen@flinders.edu.au

ABSTRACT

This paper presents the results of a survey of email users in different regions of Saudi Arabia about email SPAM. The survey investigated the nature of email SPAM, how email users in the eastern, western, central, southern and northern dealt with it, and the efforts made to combat it. It also investigated the effectiveness of existing Anti-SPAM filters in detecting Arabic and English email SPAM.

1,500 participants located in the eastern, western, central, southern and northern regions of Saudi Arabia were surveyed and completed surveys were collected from 1,020 of the participants.

The results showed that there were different definitions for email SPAM based on different users' opinions in Saudi Arabia. The results showed that the participants in the central and western regions were more aware of SPAM than the participants in other regions.

The results revealed that the volume of email SPAM was different from region to another and the volume of SPAM received by the participants in the northern and central regions was larger than that received in other regions. The results indicated that the majority of email SPAM received by the participants in different regions was written in English. The results showed that the most common type of email SPAM received in Arabic was emails related to forums and in English was phishing and fraud, and business advertisements.

The results also showed that a few participants in all regions responded to SPAM and the average of the participants who responded to SPAM was larger in the southern region than other regions.

The results showed that most of the participants were not aware of Anti-SPAM programs and the participants in the central region were more aware of Anti-SPAM programs than the participants in other regions. The results showed that the participants in all regions estimated that the existing Anti-SPAM programs were more effective in detecting English SPAM than Arabic SPAM.

The results showed that most of the participants in all regions were not aware of the government efforts to combat SPAM and the participants in the central region were more aware of the government efforts than the participants in other regions.

The results also showed that most of the participants in all regions were not aware of the ISPs efforts to combat SPAM and the participants in the central and western regions were more aware of the ISPs efforts than the participants in other regions.

KEYWORDS: SPAM, email, Arabic, users, English, Saudi.

1. INTRODUCTION

Email is an important tool for many people and they consider email as a necessary part of their daily lives. Email enables people to communicate with each other in a short time at low cost. Although email gives benefits for people who use it, some people, called spammers, have exploited email for their personal purposes. They send so-called SPAM to a large number of recipients. They can use programs known as spam-bots to catch email addresses on the internet or they can buy email addresses from individuals and organizations to send email SPAM to these addresses [11]. They

also use many methods to bypass SPAM filters such as tokenization and obfuscation [27].

Email SPAM is defined as "Unsolicited, unwanted email that is sent indiscriminately, directly or indirectly, by a sender having no current relationship with the recipient" [12], [13]. It is also defined as Unsolicited Bulk Email (UBE) that is sent to a large number of recipients who were not asked if they wanted to receive it [4], [14], [18]. Some studies [6], [7], [25] defined email SPAM as Unsolicited Commercial Email (UCE) that contains business advertisements sent to a large number of recipients.

There are legal and technical methods [2] to combat SPAM. Legally, some countries enacted laws against SPAM. Examples of these countries include the United States of America [26], European Union countries and Australia [5]. However, there are no laws in Saudi Arabia to combat SPAM although research and projects were conducted to assess the problem of SPAM in the country.

Technically, there exist many filters to combat SPAM. Examples of these filters include content based filters such as Bayesian [24], keywords [11] and genetic algorithms [15], and origin based filters like black lists [11], white lists [22], origin diversity analysis [16] and challenge response systems [21]. However, some of these techniques need to be updated to detect new types of email SPAM due to spammers developing ways to bypass these techniques.

This study aimed to gain an understanding about:

a. The nature of email SPAM, its definition based on email users' opinions, its volume and its types in different regions of Saudi Arabia.
b. Differences between Arabic SPAM and English SPAM received by the participants in different regions of Saudi Arabia.
c. The effects of email SPAM on email users in different regions of Saudi Arabia.
d. How email users in the eastern, western, central, southern and northern deal with email SPAM.
e. The efforts of government to combat email SPAM.
f. The efforts of ISPs to combat email SPAM.
g. Evaluation of email users' perception in different regions of Saudi Arabia for the effectiveness of Anti-SPAM filters in detecting Arabic and English email SPAM.

2. METHODOLOGY

2.1. Measures

It was decided that the best way to answer the research questions was through a questionnaire. Therefore, a questionnaire was distributed to the participants in different region of Saudi Arabia and the responses were analyzed.

Initially a pilot questionnaire was prepared and distributed to a few participants to get their comments about the questions. Then all the participants completed the 10 page questionnaire which included both yes/no answers and open ended answers. The questionnaire consisted of three main parts as follows.

2.1.1. General information questions

In this part, the participants were asked for the following information: gender, age, nationality, speaking language, highest level of education, major area of study, work status and the nature of the work. These questions helped in understanding and comparing the level of awareness of users about email SPAM. Examples for the first part of questions of the survey can be seen in Figure 1.

```
1. Gender:
O Male
O Female

2. What is your age?

3. Nationality:
O Saudi
O Other

4. What is your current work status?
O Student
O Employed
O Self employed
```

Figure 1: Examples of questions of the first part of the survey

2.1.2. Email SPAM questions

At the beginning of this part, the participants were asked for a definition of email SPAM in their own words in order to understand the definition of email SPAM based on their opinions.

Then the study defined email SPAM as "*an unsolicited, unwanted, commercial or non-commercial email that is sent indiscriminately, directly or indirectly, to a large number of recipients without their permission and there is no relationship between the recipients and sender*". This definition was in the survey and used to provide a reference point for the remainder of the questions. Care was taken to ensure that the respondents did not see the study

supplied definition until after they had supplied their own definition of email SPAM to prevent introducing a strong bias. The variety of responses to the question of what is SPAM is evidence that this approach was successful. Some examples of email SPAM, keywords and phrases used in email SPAM were given in the survey.

The participants were asked if they knew about email SPAM prior to reading the survey, and what were the sources of their knowledge. The participants were also asked if they received email SPAM and how many email SPAMs they received on average weekly. They were also asked about the languages they received in email and types of Arabic and English email SPAM. The study focused on English and Arabic email SPAM because English is the main language in the world and Arabic is the native language in Saudi Arabia.

The participants were asked about what they did when they receive email SPAM (i.e. the actions of email users in dealing with SPAM). The actions of emails users in dealing with SPAM described in the survey were as follows: reading the entire email SPAM, deleting the email SPAM without reading it, and contacting the ISP and notifying it about email SPAM. The participants were asked to choose one option from the following options to answer their action in dealing with SPAM. These options were as follows: never, sometimes and always. Figure 2 shows an example for questions of email users in Saudi Arabia about their actions in dealing with email SPAM.

Note: the following question will ask you to choose the appropriate option for your dealing with email SPAM.

For example, when I am not reading the SPAM email at all, I will circle the option "**Never**" in the scale in the following table. If I sometimes read SPAM, I will circle the option "**Sometimes**".

Read the entire email	**Never**	**Sometimes**	**Always**

Figure 2: An example for questions of email users in Saudi Arabia about their actions in dealing with email SPAM

The participants were asked if they purposely responded to an offer made by a SPAM email and what benefits they derived from email SPAM. They were also asked if they were affected by email SPAM and what were the effects of email SPAM on them.

The participants were asked if they were aware of Anti-SPAM filters to block email SPAM, what were the sources of their knowledge about these filters, and how effective these filters were in detecting Arabic and English email SPAM. Examples for the second part of questions of the survey can be seen in Figure 3.

1. Everyone defines SPAM differently, in your own words, how would you define email SPAM?	
2. Did you know about SPAM emails prior to reading this survey? O Yes O No	
3. Have you received SPAM emails? O Yes O No	
2. What is the language of SPAM email you receive on average weekly? The percentages should add up to **100 %**.	**Percentage %**
O English	
O Arabic	
O Other language	
O Languages I do not recognize	
5. Are you aware of Anti-SPAM programs? O Yes O No	
6. If you have used Anti-SPAM programs, please rate their effectiveness in detecting English and Arabic email SPAM?	

Current Programs\Percentage	0%	25%	50%	75%	100%
The effectiveness of current programs in detecting Arabic email SPAM					
The effectiveness of current programs in detecting English email SPAM					

Figure 3: Examples of questions of the second part of the survey

2.1.3. Questions about the efforts of government and ISPs to combat email SPAM

In this part, the participants were asked if they were aware of government efforts to combat SPAM and which efforts they were aware of. The participants were also asked if they were aware of ISPs efforts to combat SPAM and which efforts they were aware of. Examples for the third part of questions of the survey can be seen in Figure 4.

| 1. Are you aware of efforts by the government in Saudi Arabia to combat email SPAM? |
| O Yes |
| O No |
| 2. Are you aware of efforts by ISPs in Saudi Arabia to combat email SPAM? |
| O Yes |
| O No |

Figure 4: Examples of questions of the third part of the survey

2.2. Participants

The questionnaire was designed and distributed to 1,500 participants in the central, eastern, western, southern and northern regions of Saudi Arabia. Completed questionnaires were received from 1,020 participants in Saudi Arabia.

34% of the participants were from the central region, 20% were from the eastern region, 20% were from the western region, 13% were from the southern region and 13% were from the northern region. Table 1 shows general information about the participants who were located in the Eastern, Western, Central, Southern and Northern regions in Saudi Arabia.

Table 1: General information about the participants in the Eastern, Western, Central, Southern and Northern regions of Saudi Arabia

Question		Region				
		E	W	C	S	N
Part 1: General Information						
Gender:	Male	62%	59%	57%	64%	61%
	Female	38%	41%	43%	36%	39%
Age:	15-25	58%	63%	35%	37%	35%
	26-35	25%	26%	41%	38%	47%
	36-45	14%	10%	17%	21%	12%
	46-55	2%	1%	6%	2%	6%
	56 and more	1%	0%	1%	2%	0%
Nationality:	Saudi	90%	88%	81%	75%	86%
	Other	10%	12%	19%	25%	14%
Language of speaking:	Arabic	99%	100%	99%	99%	99%
	English	62%	81%	63%	73%	75%
	Other	2%	2%	3%	3%	1%
Highest level of education:	High school	17%	17%	11%	15%	12%
	Diploma	2%	2%	7%	5%	8%
	Bachelor	61%	70%	54%	49%	52%
	Master	12%	7%	16%	17%	19%
	PhD	8%	4%	12%	14%	9%
Major area of study for the participants who had diploma, bachelor, master or PhD:	Education and teaching	17%	13%	20%	16%	26%
	Computer science and information technology	31%	40%	34%	31%	26%
	Social sciences	4%	5%	12%	20%	15%
	Physical and biological sciences	21%	7%	11%	5%	6%
	Health sciences and medicine	16%	7%	8%	12%	10%
	Other	11%	28%	15%	16%	17%
Work status:	Student	58%	61%	29%	41%	45%
	Employed	42%	37%	70%	59%	51%
	Self-employed	0%	2%	1%	0%	4%
Nature of work for the employed participants:	Educational	44%	55%	48%	47%	58%
	Medical	17%	8%	8%	8%	16%
	Technical	14%	20%	18%	16%	9%
	Management	21%	16%	19%	24%	3%
	Other	4%	1%	7%	5%	14%

3. RESULTS

This section described the responses of the participants in the eastern, western, central, southern and northern regions of Saudi Arabia for the email users' survey.

3.1. Respondents Definition and Awareness of Email SPAM

Email users were asked for a definition of email SPAM based on their opinions. The responses showed that only 428 of 1,020 participants in different regions of Saudi Arabia answered this question.

42% of the participants who answered this question defined email SPAM as an email that was sent randomly to numerous recipients and contained Spyware, files, links, images or text that aims to hack the computer or steal confidential information such as email passwords, credit card numbers and bank account numbers.

39% defined email SPAM as an email that did not contain an email address or that was sent randomly, directly or indirectly by unknown senders or sources to a large number of recipients without their permission to receive it.

33% said that email SPAM was an email that was sent randomly and contained malicious programs such as Viruses, Trojans, Worms, or contained hidden links, strange contents and untrusted attachments that aimed to damage computer, software and hardware, or aimed to delete important information in a computer.

29% defined email SPAM as Unsolicited Commercial Email (UCE) or email that was sent to a large number of recipients and aimed to promote commercial advertisements which contained attractive words that were used to encourage the recipient to buy medical, technical and sexual products.

9% said that email SPAM was annoying and unimportant email that was sent from friends, but it was not sent in person and contained jokes, greetings, invitations to subscribe to forums, invitations for friendship by social networks such as Facebook, competition, puzzles, political and religious reviews, news, and scandals of famous people in the world.

7% defined email SPAM as junk email or as Unwanted, Unsolicited Bulk Email (UBE) that was sent randomly to a large number of recipients.

1% defined email SPAM as an email that was not related to recipients' work or was not related to their interests.

From the definitions described above, it can be clearly seen that there was no a specific definition for email SPAM by email users and that the most common definition for email SPAM was that "*an email that was sent randomly to numerous recipients and contained Spyware, files, links, images or text that aims to hack the computer or steal confidential information such as email passwords, credit card numbers and bank account numbers*". The definitions described above indicated that some definitions of users in Saudi Arabia for email SPAM agreed with the international definitions for email SPAM by defining email SPAM as Unsolicited Commercial Email (UCE) and as Unsolicited Bulk Email (UBE).

The differences in definition of email SPAM could cause problems in enacting laws to combat SPAM in Saudi Arabia and developing Anti-SPAM filters for different languages such as Arabic. This suggests that there is a scope to specify an agreed definition for email SPAM which could be used for enacting laws to combat SPAM and developing Anti-SPAM techniques in Saudi Arabia.

When the participants were asked if they knew about email SPAM prior to reading the survey, the results revealed that approximately third of email users in Saudi Arabia did not know about email SPAM and this is a significant and a risk for Saudi society. The results of the survey revealed that most of the participants indicated prior awareness of SPAM, suggesting that the survey itself has acted as a means of educating the participants about SPAM and its impact. This suggests that a broader survey or information campaign about SPAM would have a further positive impact in different regions of Saudi Arabia. Also, this suggests that conducting research related to SPAM and funding researchers who work in the field of SPAM could help in increasing the awareness of email users in all regions about email SPAM and hence reducing the impact of email SPAM in Saudi Arabia.

As seen in Table 2, the results revealed that the participants in the central and western regions were more aware of SPAM than the participants in other regions of Saudi Arabia. This could be because of the major area of study where the results indicated that the percentages of the participants who studied computer science and information technology in the western and central regions were higher than the percentages of the participants who studied the same area of study in the other regions. Also, it could be because of the work nature where the results indicated that the participants who worked in technical positions in the central and western regions were more than the participants who worked in the same positions in the other regions. The results suggest that there should be a focus on awareness programs about SPAM for users in different regions of Saudi Arabia, especially in the eastern, southern and northern regions. These awareness programs could be executed by the government sectors or private sectors.

The results, as shown in Table 2, revealed that most of the participants in all regions knew about SPAM by self-education through the internet and forums, and friends and relatives. The results showed that there were prominent efforts by school and university education in informing users about SPAM in all regions compared to other public and private sectors, and the educational sectors in the southern region have the highest percentage in the awareness of users about SPAM.

The results also revealed that there was a deficiency in the government efforts in awareness of email users about SPAM in all regions, and the efforts of the government in informing users about SPAM was better in the northern region than other regions. Also, the results revealed that there were no government efforts in informing users about SPAM in the western region. The results also revealed that there was a deficiency in the ISPs efforts in awareness of users about SPAM although they are one of the sectors who are responsible to control internet service in Saudi Arabia.

This suggests that the government should focus on the awareness of users about SPAM in all regions, especially in the western region. The awareness programs could be executed by educational sectors such as universities, broadcast media such as magazines and newspapers, and sectors who are responsible to provide and control internet services in Saudi Arabia.

Table 2: Responses of the participants in the Eastern, Western, Central, Southern and Northern regions about their knowledge about email SPAM

Question		Region				
		E	W	C	S	N
Part 2: Email SPAM						
Did you know about SPAM emails prior to reading the survey?	Yes	57%	70%	72%	56%	37%
	No	43%	30%	28%	44%	63%
How do you know about SPAM emails?	Internet Service Providers (ISPs)	9%	7%	6%	13%	13%
	The internet and forums	67%	76%	59%	51%	50%
	Broadcast media such as radio, TV, newspapers and magazines	10%	21%	13%	11%	8%
	Friends and relatives	45%	56%	39%	48%	44%
	Government ministries and commissions	6%	0%	4%	4%	8%
	Through my school or university education	38%	29%	41%	44%	40%
	Other	4%	3%	5%	7%	6%

3.2. Volume and Nature of Email SPAM in Saudi Arabia

When the participants were asked if they received email SPAM, the results showed that most of the participants in Saudi Arabia received email SPAM. Email users estimated they received an average of 108 SPAM emails per week.

Another study, conducted by [17], showed that the participants received an average of 94.5 emails SPAM per week. By comparing the volume of SPAM received in Saudi Arabia to the volume of SPAM in that study [17], it can be clearly seen that the volume of SPAM in Saudi Arabia was broadly similar to the volume in that study.

The results shown in Table 3 revealed that the highest percentage of the participants who received SPAM was in the southern region. The results indicated that the average of the number of email SPAM received weekly by the participants was different from region to another. The results revealed that the average of SPAM received weekly was 77 emails SPAM in the eastern region, 104 emails SPAM in the western region, 126 emails SPAM in the central region, 95 emails SPAM in the southern region and 129 in the northern region. This indicated that the number of SPAM received was larger in the northern and central regions than other regions.

When the participants were asked about the language of email SPAM that they received, the results showed that the most email SPAM received (59%) was in English, 34% was in Arabic, 4% was not recognized and 3% was in other languages.

A study conducted in Bahrain indicated that 64% of the respondents said that they received English SPAM, 18% said that they received Arabic SPAM and 18% said that they received both Arabic and English SPAM [1]. The results of this study indicated that the volume of English SPAM received in Bahrain was similar to the volume of English SPAM that received in Saudi Arabia. The results of the study also revealed that the volume of Arabic SPAM received in Bahrain was less than that received in Saudi Arabia.

As seen in Table 3, the results revealed that the volume of English SPAM received was larger in the northern region than other regions. Also, the results showed that the volume of Arabic SPAM was larger in the western region than other regions. The number of unrecognized SPAM was larger in the southern and northern regions than other regions. The results showed that the participants in the southern region received SPAM in other languages such as Chinese, Japanese, Russian, Turkish, French, Brazilian, Spanish, Persian, German, Italian, Hindi, Urdu and Hebrew more than other regions.

Table 3: Responses of the participants in the Eastern, Western, Central, Southern and Northern regions about the languages of email SPAM

Question		Region				
		E	W	C	S	N
Part 2: Email SPAM						
Have you received SPAM emails?	Yes	70%	75%	73%	83%	65%
	No	30%	25%	27%	17%	35%
What is the language of SPAM email you receive on average weekly?	English	60%	51%	61%	61%	65%
	Arabic	33%	43%	33%	30%	29%
	Not recognized	4%	3%	4%	5%	5%
	Other language	3%	3%	2%	4%	1%

When the participants were asked about the types of Arabic and English emails SPAM that they received, the results showed that there were many types for both Arabic and English SPAM and these types were different from Arabic to English SPAM. Types of Arabic and English SPAM and the differences between them can be seen in Table 4.

Table 4: The differences between Arabic and English email SPAM received by end users in Saudi Arabia

Types of email SPAM	AR (%)	EN (%)
Business	31	30
Religious and Political Party	5	2
Pornographic	10	24
Forums	36	3
Products and services	11	12
Phishing and Fraud	6	28
Other	1	1
Total	**100**	**100**

As described in Table 4, it can be clearly seen that the volume of business advertisements, emails from religious and political parties, and emails related to forums was larger in Arabic SPAM than English SPAM. The percentages indicated that there was a significant difference in composition between Arabic and English SPAM, for example in the volume of forum emails where this volume was much more in Arabic SPAM than English SPAM.

Also, the results showed that the volume of pornographic emails, products and services emails, and phishing and fraud emails was larger in English SPAM than Arabic SPAM. The percentages indicated that there was a significant difference between Arabic and English email SPAM in the volume of pornographic and phishing and fraud emails where this volume was much more in English SPAM than Arabic SPAM (See Table 4).

The results revealed other types of Arabic SPAM that did not exist in English SPAM. These types included news, training consultation, jokes, scandals of famous people, puzzles, greetings, competition, and invitations by social networks websites such as Facebook.

A study conducted by the Communication and Information Technology Commission (CITC) in Saudi Arabia in 2007 showed that 64% of email SPAM received in Saudi Arabia were direct marketing, 25% were sexual emails, 5% were religious emails, and 5% was other types [20]. However, this study did not specify if the email SPAM received was written in Arabic or English. The results of the CITC study indicated that the volume of religious emails, pornographic emails and other types of email SPAM was similar to the volume of the same types in this study.

The results, seen in Table 4, showed that the volume of pornographic emails for both Arabic and English email SPAM was lower compared to the same type in other countries such as Bahrain. The results of a study conducted in Bahrain by [1] revealed that 76% of the participants received pornographic emails while 24% did not receive pornographic emails. The results of this study did not specify if the volume of pornographic emails was larger in English or Arabic. Therefore, the results of this study indicated that the volume of pornographic emails in Saudi Arabia was lower and this could be because the access to pornographic websites is not allowed for public in Saudi Arabia and this could be contributed in reducing the volume of SPAM email that sent from pornographic websites.

Table 5 shows the different averages of Arabic email SPAM received by the participants in the eastern, western, central, southern and northern regions of Saudi Arabia. The results revealed that the participants in the southern region received business advertisements more than the participants in other regions. The volume of religious and political emails received by the participants in the eastern region was higher compared to the same type received by the participants in other regions. The results indicated that the volume of pornographic emails received in the western and central regions was larger than the same type received in other regions.

In addition, the results revealed that the participants in the northern region received more forums emails than the participants in other regions. The volume of products and services emails was larger in the eastern and western regions than other regions. The results showed that the volume of phishing and fraud was larger in the western region than other regions. The percentages also showed that the volume of other types of Arabic SPAM was larger in the eastern, central and southern regions than other regions (See Table 5).

Table 5 shows the different averages of English email SPAM received by the participants in the eastern, western, central, southern and northern regions of Saudi Arabia. The results showed that the volume of business advertisements was larger in the northern region than other regions. The volume of religious and political emails received in the western and southern regions was larger compared to the same type in other regions. The results revealed that the participants in the eastern region received pornographic emails more than other regions. The volume of forums, products and services, and other types of English SPAM was larger in the western region than other regions.

The results also showed that the volume of phishing and fraud emails was larger in the southern region than other regions.

Table 5: Averages of Arabic and English email SPAM received by the participants in the Eastern, Western, Central, Southern and Northern regions of Saudi Arabia

Types of email SPAM	E		W		C		S		N	
	AR %	EN %	AR %	EN %	AR %	EN %	AR %	EN %	AR %	EN %
Business	31	27	29	28	32	31	34	30	31	32
Religious and Political Parties	6	2	5	3	5	2	4	3	5	2
Pornographic	9	27	11	22	11	24	6	23	9	26
Forums	35	3	30	6	36	2	39	3	42	2
Products and Services	13	9	13	17	10	13	11	9	8	10
Phishing and Fraud	5	31	12	22	5	28	5	32	5	27
Other	1	1	0	2	1	0	1	0	0	1

A study conducted by [3] described some keywords and phrases used in Arabic and English email SPAM in Saudi Arabia. These keywords and phrases were collected from different ISPs in Saudi Arabia.

Examples of Arabic SPAM keywords and phrases are as follows: "فياقرا", "ألعاب", "أدوية", "ريجيم", "فرصة للربح", "مبروك لقد ربحت", "مسابقة", "انضم إلينا", "تعليم", "اربح مليون ريال سعودي", "بطاقة", "خضراء للسفر إلى أمريكا", "موضة", "حصرياً", "زواج", "شريك العمر", "جنس", "فمافوق 18+", "رومانسية", "فضيحة", "مفاجآت", "البرامج", "تدريب", "تبرعات", "اشترك في المنتدى", "شارك واربح", "جائزة", "عرض", "خاص", "هدية", "إباحية", "أقل الأسعار", "ثورة", "أسهم", "بشرى", "أموال", "دورة", "أزياء", "مقاطع", "مضحكة", "اعمل من المنزل", and "للرجال فقط".

Examples for English SPAM keywords and phrases are as follows: "sex", "Cialis", "gift", "Dollar", "discount", "bonus", "girls", "Viagra", "Loto winner", "Investment", "Forex", "Green", "Visa and Master", "reactivate your email account", "Incomplete personal information", "Verify your account", "Account not updated", "Financial Information Missing", "$USD", "You have won", "fund", "money", "winning promotion", "transferring", "Training", "South Africa", "Partnership", "Bank loans", and "work and live in USA".

3.3. Actions of Email Users in Dealing with SPAM

The participants were asked about the appropriate action for dealing with email SPAM. In the survey, the participants were given three actions for their dealing with SPAM. These actions were as follows. The first action was that reading the entire email SPAM. The second action was that deleting the email SPAM without reading it. The third action was that contacting with the ISP and notifying it about email SPAM. To answer this question, the participants were asked to evaluate their actions in dealing with SPAM by choosing one of the following options for each action. The options for each action were as follows: never, sometimes and always.

Firstly, when the participants were asked if they read the entire email SPAM, the results revealed that the most of the participants said that they sometimes read the entire SPAM. The results showed that participants in the eastern and central regions were better than the participants in other regions where the results showed that the average of the participants who said that they never read the entire email SPAM was larger in the eastern and central regions than other regions (See Table 6).

Secondly, when the participants were asked if they delete the email SPAM without reading it, the results showed that the most of the participants said that they sometimes delete the email SPAM without reading it. The results, as shown in Table 6, revealed that the participants in the central and eastern regions were better than the participants in other regions where the results indicated that the average of the participants who said that they always delete the email SPAM without reading it was larger in the central and eastern regions than other regions.

Thirdly, when the participants were asked if they contact with ISP and notify it about email SPAM, the results revealed that the most of the participants said that they never contact with ISP and notify it about SPAM (See Table 6). The results indicated that the participants in the southern and northern regions were better than the participants in other regions where the results revealed that the average of the participants who said that they always contact with ISP and notify it about SPAM was larger in the southern and northern regions than other regions.

The results of a study conducted by [17] showed that 11.7% of the participants said that they contacted their ISPs when they received email SPAM. By comparing the results of two studies, it can be clearly seen that most of email users in the two studies did not contact with ISPs regarding SPAM problems.

From the results shown above regarding the actions of users in dealing with email SPAM, it can be clearly suggest that the ISPs in Saudi Arabia should inform users about email SPAM, its impacts, technical and legal efforts of the ISPs to combat SPAM, and what are the

necessary procedures that users do when they receive SPAM.

When the participants were asked if they responded to an offer made by a SPAM email, the results showed that the most of the participants in all regions did not respond to an offer made by a SPAM email (See Table 6). The results revealed that the participants in the southern region responded to offers made by SPAM email more than the participants in other regions of Saudi Arabia.

The results indicated that the participants in the western and southern regions were enjoyed fun emails involved in SPAM more than the participants in other regions. The results also showed that the participants in the eastern and northern regions used purchasing and selling offers involved in SPAM email more than the participants in other regions. Also, the results revealed that the participants in the central and southern and northern regions used SPAM as a learning tool more than the participants in other regions. The participants in the northern region derived other benefits from SPAM such as friendship requests more than the participants in other regions (See Table 6).

The results indicated that as long as some users responded to some offers of SPAM, email SPAM could be increased and caused problems for other users unless those users combat it. This suggests that laws against SPAM in Saudi Arabia could reduce the incidence of SPAM by greatly reducing the ability of spammers to make sales without fear of penalties.

Table 6: Actions of users in the Eastern, Western, Central, Southern and Northern regions of Saudi Arabia in dealing with email SPAM

Question			Region				
			E	W	C	S	N
Part 2: Email SPAM							
What do you do when you receive SPAM email?	1- Read the entire email	Never	40%	33%	37%	28%	29%
		Sometimes	48%	62%	53%	62%	65%
		Always	12%	5%	10%	10%	6%
	2- Delete the email without reading it	Never	11%	6%	7%	13%	5%
		Sometimes	49%	59%	50%	52%	62%
		Always	40%	35%	43%	35%	33%
	3- Contact with ISP and notify it about email SPAM	Never	77%	87%	83%	73%	86%
		Sometimes	19%	12%	14%	15%	6%
		Always	4%	1%	3%	12%	8%
Have you ever purposely responded to an offer made by a SPAM email?		Yes	19%	15%	20%	34%	20%
		No	81%	85%	80%	66%	80%
What benefits did you derive from SPAM emails?		Purchasing and selling	23%	10%	18%	16%	23%
		Learning	33%	39%	47%	47%	46%
		Fun	56%	71%	54%	71%	50%
		Other	3%	3%	0%	0%	4%

3.4. Effects of Email SPAM on End Users

When the participants were asked if they affected negatively by email SPAM, the results revealed that approximately half of the participants in all regions affected by email SPAM (See Table 7).

The results showed that the participants in the southern and northern regions were affected by email SPAM more than the other participants in other regions. This could be because of the most of the participants in the southern and northern regions were not aware of SPAM and the effective ways in dealing with it. Also, this could be because of dealing of the participants in the southern and northern regions with offers made by a SPAM email where the results revealed that the participants in the southern and northern regions responded to emails SPAM more than the participants in other regions (See Table 7).

The results revealed that the main impact of SPAM on users was that filling inboxes with SPAM. The results showed that the participants in the southern region were more affected by this impact than the participants in other regions. The results also showed that the second main impact of SPAM on users was that the infection of computers by a Virus, Worm or other malicious program. The results revealed that the participants in the northern and central regions were more affected by this impact than the participants in other regions (See Table 7).

The results showed that the participants in the western region were affected by SPAM through losing time and reducing productivity more than the participants in other regions. The results revealed that the participants in the eastern, southern and western regions were affected by SPAM through stealing personal information such as user name, password and credit card numbers more than the participants in other regions. The results also revealed that the participants in the eastern, western and central regions felt less confidence in using the email more than the participants in other regions. Also, the results showed that the participants in the central region were affected by email SPAM through other effects such as annoying and bothering more than the participants in other regions (See Table 7).

Table 7: Effects of email SPAM on of users in the Eastern, Western, Central, Southern and Northern regions of Saudi Arabia

Question		Region				
		E	W	C	S	N
Part 2: Email SPAM						
Have you been affected negatively by email SPAM?	Yes	43%	37%	46%	51%	52%
	No	57%	63%	54%	49%	48%
What was the impact of email SPAM?	Stealing personal information such as user name, password and credit card numbers	23%	22%	18%	23%	16%
	Losing time and reducing productivity	45%	51%	44%	36%	35%
	Less confidence in using the email	25%	23%	22%	7%	15%
	Filling email inbox	52%	66%	65%	71%	56%
	Computer was infected by a Virus, Worm or other malicious program	55%	51%	58%	43%	59%
	Other impacts	2%	3%	4%	3%	3%

3.5. Awareness of Anti-SPAM Filters and the Effectiveness of Anti-SPAM Filters in Detecting Arabic and English SPAM

When the participants were asked if they aware of Anti-SPAM programs, the results revealed that the most of the participants in all regions were not aware of Anti-SPAM programs. The results indicated that the participants in the central region were more aware of Anti- SPAM programs than the participants in other regions (See Table 8).

A study conducted in Bahrain [1] revealed that 26% of the participants knew about Anti-SPAM programs while 74% did not know about Anti-SPAM programs. By comparing the results of Bahraini study to the results of this study, it can be clearly seen that Saudi society was more aware of Anti-SPAM programs than Bahraini society, but still most Saudi society were not aware.

When the participants were asked about how they knew about Anti-SPAM programs, the results showed that the majority of the participants in all regions knew about Anti-SPAM programs through the internet and forums and through school and university education. The results also revealed that there was a deficiency in the government and ISPs efforts in informing users about Anti-SPAM programs and how they work. As seen in Table 8, there were no government efforts to inform users about Anti-SPAM programs in the western and southern regions. This suggests that there should be a coordinating between the government and the sectors of providing the internet service in Saudi Arabia in informing users in all regions, especially in the western and southern regions,

about Anti-SPAM programs and how they work to detect SPAM. This also suggests that distributing free Anti-SPAM programs by the government or by sectors of providing the internet service for email users could reduce the effects of SPAM in Saudi Arabia.

Table 8: Responses of the participants in the Eastern, Western, Central, Southern and Northern regions of Saudi Arabia about their knowledge about Anti-SPAM programs

Question		Region				
		E	W	C	S	N
Part 2: Email SPAM						
Are you aware of Anti-SPAM programs?	Yes	38%	38%	44%	31%	28%
	No	62%	62%	56%	69%	72%
How did you know about Anti-SPAM programs?	Internet Service Providers (ISPs)	4%	8%	6%	10%	8%
	The internet and forums	67%	79%	62%	52%	67%
	Broadcast media such as radio, TV, newspapers and magazines	6%	3%	8%	5%	3%
	Friends and relatives	32%	25%	28%	48%	14%
	Government ministries and commissions	6%	0%	3%	0%	11%
	Through my school or university education	33%	27%	47%	52%	36%
	Other	1%	5%	5%	5%	6%

When the participants were asked to rate the effectiveness of Anti-SPAM programs in detecting Arabic and English SPAM, the results revealed that the existing Anti-SPAM programs were not completely effective in detecting Arabic and English SPAM. This suggests that the existing Anti-SPAM filters need to be developed to detect SPAM in different languages such as Arabic and English.

The results showed that the participants in all regions estimated that the existing Anti-SPAM programs were effective in detecting English SPAM more than Arabic SPAM. This suggests that there should be a focus on producing and developing techniques to detect email SPAM in Arabic language.

The evaluation of the participants in all regions for the effectiveness of Anti-SPAM programs in detecting Arabic and English SPAM can be seen in Figure 5 and Figure 6.
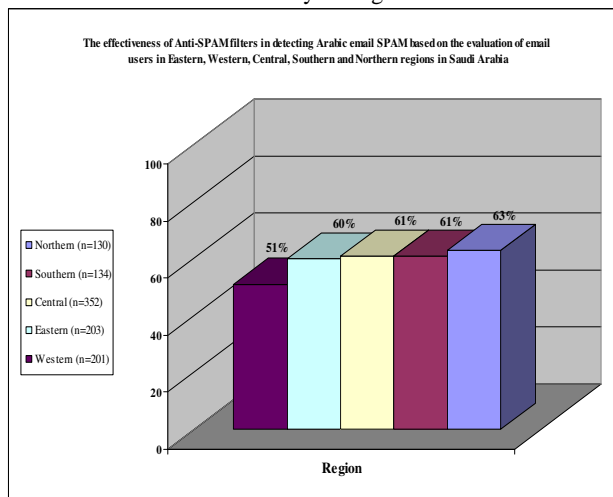
Figure 5: The effectiveness of Anti-SPAM filters in detecting Arabic email SPAM based on the evaluation of the participants in the Eastern, Western, Central, Southern and Northern regions of Saudi Arabia
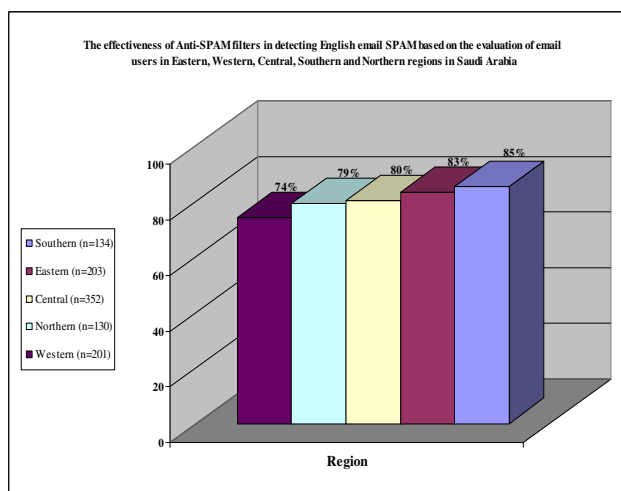

Figure 6: The effectiveness of Anti-SPAM filters in detecting English email SPAM based on the evaluation of the participants in the Eastern, Western, Central, Southern and Northern regions of Saudi Arabia

3.6. Efforts of Government and ISPs to combat SPAM

When the participants were asked if they aware of the government efforts to combat SPAM, the results showed that only a few participants were aware of the government efforts to combat SPAM. The results revealed that users in the central regions were more aware of the government efforts to combat SPAM than other regions (See Table 9). This suggest that the government should inform users about their efforts to combat SPAM and should provide awareness programs about SPAM, its impacts and methods of combating it for users in all regions of Saudi Arabia. This could help in reducing the effects of SPAM on email users in Saudi Arabia.

Table 9: The awareness of the participants in the Eastern, Western, Central, Southern and Northern regions of Saudi Arabia about the government and ISPs efforts

Question		Region				
		E	W	C	S	N
Part 3: Efforts of combating of Email SPAM in Saudi Arabia						
Are you aware of efforts by the government in Saudi Arabia to combat email SPAM?	Yes	20%	22%	30%	20%	23%
	No	80%	78%	70%	80%	77%
Are you aware of efforts by ISPs in Saudi Arabia to combat email SPAM?	Yes	11%	15%	16%	13%	10%
	No	89%	85%	84%	87%	90%

The participants who were aware of government efforts to combat SPAM were asked about these efforts that they were aware of. Most of the participants (62%) said that the government efforts could be observed by King Abdulaziz City for Science and Technology (KACST). They said that KACST blocks unsecured websites and websites that send SPAM, informs people about dangerous security attacks and their impacts, and conducts and fund researches related to information technology [19].

24% of the participants said that the government recommended that each government sector and private sector in Saudi Arabia should apply security policy in the organization. The policy should include: providing the organization with software and hardware that are necessary to avoid security attacks such as Viruses and SPAM, awareness of employees and customers about security attacks and methods of combating them, conducting researches related to security attacks and countermeasures for these attacks, conducting training and workshops related to security issues for employees, employment of qualified people in the field of networks security in the organization to deal with security attacks, providing financial budget to develop the work of security policy and reviewing the security policy regularly to find out the strengths and weaknesses of the work of security policy.

22% said that the government established and funded centres to deal with information security issues. Examples for these centres are Centre of Excellence in Information Assurance (COEIA) [8], Computer Emergency Response Team (CERT) [10] and Prince Muqrin Chair for Information Security Technologies (PMC IT SECURITY) [23]. They said the aims of these centres were to inform people about security attacks such as Viruses and SPAM and their

impacts, conducting and funding researches related to security issues and conducting conferences and workshops regarding security attacks.

19% of the participants said that the government efforts could be observed by Communication and Information Technology Commission (CITC). They said that CITC funded Saudi National Anti-SPAM Program project and created a website for this project that includes information about SPAM, methods of combating it and published it for public on the internet. They also said that this project informed people about SPAM by publishing brochures or by subscription of people in mailing list of CITC to make people look for the new development in SPAM. The participants also said that the project conducted some researches regarding SPAM problems and publish the results of researches for public. They also said that CITC received complaints of people regarding SPAM problems and it processed these problems with the other responsible government sectors [9].

18% said that some universities in Saudi Arabia established centres for information security which provide the following services for people. First of all, information security centres provide awareness of people about security attacks. Second, these centres conducted workshops, conferences and ongoing training in the field of security issues and methods of combating it for people. Third, centres published valued researches in the field of security issues for people and different libraries in Saudi Arabia.

18% of the participants said that the government enacted law for combating electronic crimes in Saudi Arabia and there were no specific laws for SPAM. They said that the government sectors that are responsible to execute the electronic crime law are Communication and Information Technology Commission (CITC) with coordination with other legal sectors.

When the participants were asked if they aware of the ISPs efforts to combat SPAM, the results revealed that only a few participants were aware of ISPs efforts to combat SPAM. The results indicated that users in the central and western regions were more aware of ISPs efforts to combat SPAM than other regions (See Table 9). This suggests that the ISPs should provide awareness programs about SPAM and its impact, and their efforts to combat it for users in all regions of Saudi Arabia which could help in reducing the effects of SPAM on email users.

The participants who were aware of the ISPs efforts to combat SPAM were asked about these efforts that they were aware of. 42% of the participants said that the ISPs used advanced Anti-SPAM filters to block email SPAM before it reaches end users inboxes.

26% said that the ISPs blocked websites or forums that send email SPAM for recipients and put them in black lists.

13% of the participants said that the ISPs informed people about email SPAM and methods of combating it by email, brochures, and Short Message Service (SMS).

13% said that the ISPs warned customers not to send SPAM, they received customers' complaints regarding SPAM and they executed some legal actions against people who sent email SPAM such as disconnecting the internet service and cancellation of the contract.

4. CONCLUSION AND FUTURE WORK

This paper presented the results of a survey of email users in the eastern, western, central, southern and northern regions of Saudi Arabia about email SPAM and how they deal with it.

The results showed that there was no a specific definition for email SPAM and the most common definition for email SPAM was that "*an email that was sent randomly to numerous recipients and contained Spyware, files, links, images or text that aimed to hack the computer or steal confidential information such as email passwords, credit card numbers and bank account numbers*".

The results revealed that approximately third of users in Saudi Arabia did not know about email SPAM and this is a significant and a risk for Saudi society. The results showed that the level of the awareness of the participants about SPAM was different from region to another and the participants in the central and western regions were more aware of SPAM more than the participants in other regions.

The results showed that the volume of email SPAM was high in Saudi Arabia compared to other countries. The results revealed that the volume of email SPAM was different from region to another and the volume of SPAM received by the participants was larger in the northern and central regions than other regions. The results showed that most of the email SPAM received in all regions was written in English

and the volume of English SPAM was different from region to another.

The results also showed that there were many types of Arabic and English SPAM received by the participants in all regions. The results showed that the most common type of Arabic SPAM was forums emails and for English was business advertisements, and phishing and fraud emails and the volume of these types for both Arabic and English were different from region to another.

The results showed that a few participants in all regions responded to SPAM and the average of the participants who responded to SPAM was larger in the southern region than other regions.

The results revealed that approximately half of the participants in all regions were affected negatively by email SPAM and the average of the participants who affected negatively by SPAM was larger in the southern and northern regions than other regions.

The results showed that most of the participants in all regions were not aware of Anti-SPAM programs and the participants in the central region were more aware of Anti-SPAM programs than the participants in other regions. The results showed that the participants in all regions estimated that the existing Anti-SPAM programs were more effective in detecting English than Arabic SPAM.

The results showed that most of the participants in all regions were not aware of the government efforts to combat SPAM and the participants in the central region were more aware of the government efforts than the participants in other regions.

Finally, the results showed that most of the participants in all regions were not aware of the ISPs efforts to combat SPAM and the participants in the central and western regions were more aware of the ISPs efforts than the participants in other regions.

Future work could include investigating government efforts to combat SPAM to find more effective methods to combat SPAM.

Laws to combat SPAM in Saudi Arabia could be investigated. This could be achieved by taking the experiences of developed countries to combat SPAM. This could help in enacting a new clear law to combat SPAM in Saudi Arabia.

The legal and technical efforts of ISPs in Saudi Arabia to combat email SPAM, and ways to encourage ISPs to collaborate with each other ISPs, private sectors, government sectors and customers could be investigated.

Effective awareness programs to inform users in all regions of Saudi Arabia, private sectors and government sectors about SPAM, its effects and methods of combating it could be investigated.

Improving the performance of existing Anti-SPAM filters in detecting Arabic and English email SPAM could be investigated. This could be achieved by testing the effectiveness of existing Anti-SPAM filters in detecting Arabic and English SPAM email and this could help in creating and developing effective filters to detect new types of Arabic and English SPAM.

A listing of keywords and phrases used in Arabic email SPAM were involved in this research and this could help in designing and producing special Anti-SPAM filters for Arabic SPAM.

5. REFERENCES

1. Al-A'ali, M.: A Study of Email Spam and How to Effectively Combat It. http://www.webology.org/2007/v4n1/a37.html , Webology (2007).
2. Alkahtani, H. S., Gardner-Stephen, P., Goodwin, R.: A taxonomy of email SPAM filters. In: Proc. The 12th International Arab Conference on Information Technology (ACIT), pp. 351--356, Riyadh, Saudi Arabia (2011).
3. Alkahtani, H. S., Goodwin, R., Gardner-Stephen, P.: Email SPAM related issues and methods of controlling used by ISPs in Saudi Arabia. In: Proc. The 12th International Arab Conference on Information Technology (ACIT), pp. 344--351, Riyadh, Saudi Arabia (2011).
4. Androutsopoulos, I., Koutsias, J., Chandrinos, K. V., Spyropoulos, C. D.: An experimental comparison of naive Bayesian and keyword-based anti-spam filtering with personal e-mail messages. In: Proc of the 23rd annual international ACM SIGIR conference on Research and development in information retrieval, pp. 160--167, Athens, Greece (2000).
5. Australian Communications & Media Authority (ACMA), http://www.efa.org.au/Issues/Privacy/spam.html#acts
6. Boykin, O., Roychowdhury, V.: Personal Email networks: an effective anti-spam tool. Condensed Matter cond-mat 0402143, pp. 1--10 (2004).
7. Carreras, X., Marquez, L.: Boosting Trees for Anti-Spam Email Filtering. In: Proc. of RANLP, 4th International Conference on Recent Advances in Natural Language Processing, pp. 1--7, Tzigov Chark, BG (2001).
8. Centre of Excellence in Information Assurance (COEIA), http://coeia.edu.sa/index.php/en/about-coeia/strategic-plan.html
9. Communication and Information Technology Commission (CITC) , http://www.spam.gov.sa/eng_main.htm

10. Computer Emergency Response Team (CERT), http://www.cert.gov.sa/index.php?option=com_content&task=view&id=69&Itemid=116

11. Cook, D., Hartnett, J., Manderson, K., Scanlan, J.: Catching spam before it arrives: domain specific dynamic blacklists. In: Proc. of the 2006 Australasian workshops on Grid computing and e-research, pp. 193--202, Hobart, Tasmania, Australia (2006).

12. Cormack, G., Lynam, T.: Spam corpus creation for TREC. In: Proc. of Second Conference on Email and Anti-Spam (CEAS), pp. 1--2 (2005).

13. Cormack, G. V., Kolcz, A.: Spam filter evaluation with imprecise ground truth. In: Proce. of the 32nd international ACM SIGIR conference on Research and development in information retrieval, pp. 604--611, Boston, MA, USA (2009).

14. Damiani, E., Vimercati, S. D. C. d., Paraboschi, S., Samarati, P.: An Open Digest-based Technique for Spam Detection. pp. 1--6, San Francisco, CA, USA (2004).

15. Garcia, F. D., Hoepman, J.-H., Nieuwenhuizen, J. V.: SPAM FILTER ANALYSIS. SEC, pp. 395--410 (2004).

16. Gardner-Stephen, P.: A Biologically Inspired Method of SPAM Detection. 20th International Workshop, pp. 53--56, DEXA (2009).

17. Grimes, G. A., Hough, M. G., Signorella, M. L.: Email end users and spam: relations of gender and age group to attitudes and actions. Computers in Human Behavior 23, 1, 318--332 (2007).

18. Hovold, J.: Naive Bayes Spam Filtering Using Word-Position-Based Attributes. In: Proc. Of Conference on Email and Anti-Spam, pp. 1--8 (2005).

19. King Abdulaziz City for Science and Technology, http://www.kacst.edu.sa/en/about/Pages/default.aspx

20. National Saudi Anti-SPAM Program, http://www.spam.gov.sa/eng_stat2.htm

21. O'Brien, C., Vogel, C.: Spam filters: bayes vs. chi-squared; letters vs. words. In: Proc. of the 1st international symposium on Information and communication technologies, pp. 291--296, Dublin, Ireland (2003).

22. Pfleeger, S. L., Bloom, G.: Canning Spam: Proposed Solutions to Unwanted Email. IEEE Security and Privacy 3, 2, pp. 40--47 (2005).

23. [23] Prince Muqrin Chair for Information Security Technologies (PMC IT SECURITY), http://pmc.ksu.edu.sa/AboutPMC.aspx

24. Sahami, M., Dumais, S., Heckerman, D., Horvitz, E.: A Bayesian Approach to Filtering Junk E-Mail: Learning for Text Categorization. Papers from the 1998 Workshop, pp. 1--8, Madison, Wisconsin (1998).

25. Sakkis, G., Androutsopoulos, I., Paliouras, G., Karkaletsis, V., Spyropoulos, C. D., Stamatopoulos, P.: A Memory-Based Approach to Anti-Spam Filtering for Mailing Lists. Information Retrieval 6, 1, 49--73 (2003).

26. Sorkin, D. E.: SPAM LAWS. The Center for Information Technology and Privacy Law, http://www.spamlaws.com/ (2009).

27. Wittel, G. L., Wu, S. F.: On Attacking Statistical Spam Filters. In: Proc. of the Conference on Email and Anti-Spam *(CEAS)*, pp. 1--7, Mountain View, CA, USA (2004).