TOPIC MODELLING OF ONLINE CHILD PORNOGRAPHY DOCUMENTS

Micheline A. Gotardo

Leyte Normal University, Philippines

ABSTRACT

To preserve the child's innocence, it is the responsibility of every parent, guardians, family, and the community as well, to protect and keep them away from harm. Still, there are cases where children are exposed to dangers, and one of this is pornography. The invention of the internet allowed not only the growth of communication but gave a new medium for child pornographer, giving them greater access virtually through social networking sites, file-sharing sites, and photo-sharing sites. This study is anchored on using Latent Dirichlet Allocation Algorithms technique for processing the content analysis of online documents relating to child pornography from which five latent themes were generated.

Keywords: child pornography, Latent Dirichlet Allocation Algorithm, cybercrime, unsupervised learning, web mining

INTRODUCTION

As the lyrics of the song of Air Supply goes, "In the eyes of a child, there is joy, there is laughter" (The Eyes of a Child Lyrics, n.d.). To preserve the child's innocence, it is the responsibility of every parent, guardians, family, and the community as well, to protect and keep them away from harm. Still, there are cases where children are exposed to dangers, and one of this is pornography. Wortley & Smallbone (2006) believes that the treatment of children as sexual objects has existed through the ages, however, pornography in the modern sense began with the invention of the camera in the early nineteenth century. The invention of the internet allowed not only the growth of communication but gave a new medium for child pornographer, giving them greater access virtually through social networking sites, file-sharing sites, and photo-sharing sites. The internet has exposed children to various risks such as cyberbullying and pornography (MomSecure, 2016). In Canada, Cybertip.ca is operated by the Canadian Centre for Child protection and is the country's tipline for reporting online sexual exploitation of children. The tipline has received a total number of reports of 151,762 from 2008 to 2015, in which 145, 522 reports are concerns on child pornography (Cybertip.ca, 2016). In the Philippines, the

number of criminal cases of live stream child abuse is rising from 57 to 2013 to 89 in 2014, and 167 in 2015 (UNICEF, 2016). Furthermore, as reported by Villafania (2016), the United Nations Children's Fund (UNICEF) said that the Philippines is ranked among the world's top sources of child pornography and is one of the worst affected countries in Asia-Pacific for online abuse. In this paper, the author examined the online documents and explored on the different issues and challenges on child pornography utilizing Unsupervised Machine Learning and content analysis of the documents was made using Latent Dirichlet Allocation (LDA) Algorithm.

RESEARCH QUESTIONS

This study examined the online documents and explored the different issues and challenges on child pornography. This study aims to answer the following questions:

1. What countries are talking actively about child pornography on the web?
2. What latent themes can be generated from the online documents?
3. What possible measures and strategies can be done to avoid child pornography?

THEORETICAL FRAMEWORK

This study uses Routine Activity Theory. Created by Marcus Felson and Lawrence E. Cohen, Routine Activity Theory is a sub-field of the Crime Opportunity Theory. This theory identifies three necessary conditions for most crime, (1) a likely offender, (2) a suitable target, and (3) the absence of a capable guardian, coming together in time and space. The guardians referred to this theory is anything, a person or a thing, that discourages crimes to take place. These can be persons with authority (e.g., police, parents, guards) or things like fences, locks, etc. Furthermore, this theory points out that choices in lifestyle on the part of potential victims may create crime opportunities for the motivated offender. Additionally, the authors of this theory emphasize that crimes occur when there is a convergence of the normal everyday activities of both the offender and the victim without the presence of a guardian.

Figure 1: Routine Activity Theory

METHODOLOGY

Research Design

This study utilized Sequential Exploratory design using Content Analysis of Online Documents. According to Creswell (2013), this involves two phases. The first phase is characterized by the collection and analysis of quantitative data, while the second phase involves the collection and analysis of qualitative data that builds the results of the initial quantitative results. This allows the theoretical perspective of the researcher to guide the study and determine the order of data collection. Further, the results from both methods are combined during the interpretation phase.

Research Method

The methods and processes used in this study were anchored on the web mining: information and pattern discovery on the world wide web of Cooley, Mobasher, & Srivastava (1997).

Data mining was the main component in the data collection. Data mining involves the process of sorting through large data sets to identify patterns and establish relationships to solve problems through data analysis (Rouse, 2017). Data mining is also a step in the Knowledge Discovery Database (KDD). Norton (1999) defines KDD revolving on the investigation and creation of

knowledge, processes, algorithms, and the mechanisms for retrieving potential knowledge from data collections.

Topics related to Child Pornography for the last five years (2012-2016) were identified through the use of Google Trends. Data was gathered and downloaded from different internet sources: published journals, government websites, and news portals. Below are the countries where the documents were derived.

Table 1: Countries with Documents Published Related to Child Pornography from May 2012 to May 2016

Ranking	Country	# of Documents Published
1	Philippines	100
2	Canada	48
3	USA	48
4	South Africa	48
5	Australia	41
6	India	20
7	United Kingdom	17

Source: Google Trends

The documents were analyzed using the Latent Dirichlet Allocation Algorithm and Gibbs sampling.

Gibbs Sampling:

Gibbs sampling is one of the Monte Carlo Markov Chain (MCMC) technique suitable for the task. The idea in Gibbs sampling is to generate posterior samples by sweeping through each variable (or block of variables) to sample from its conditional distribution with the remaining variables fixed to their current values (Yildirim, 2012). The underlying logic of MCMC sampling is that we can estimate any desired expectation by ergodic averages.

Latent Dirichlet Allocation Algorithm

Latent Dirichlet allocation (LDA) is a generative probabilistic model of a corpus. The basic idea of LDA is that documents are represented as random mixtures over latent topics, wherein each topic is characterized by a distribution over words (Liu, Poshyvanyk, Ferenc, Gyimóthy, & Chrisochoides, 2009).
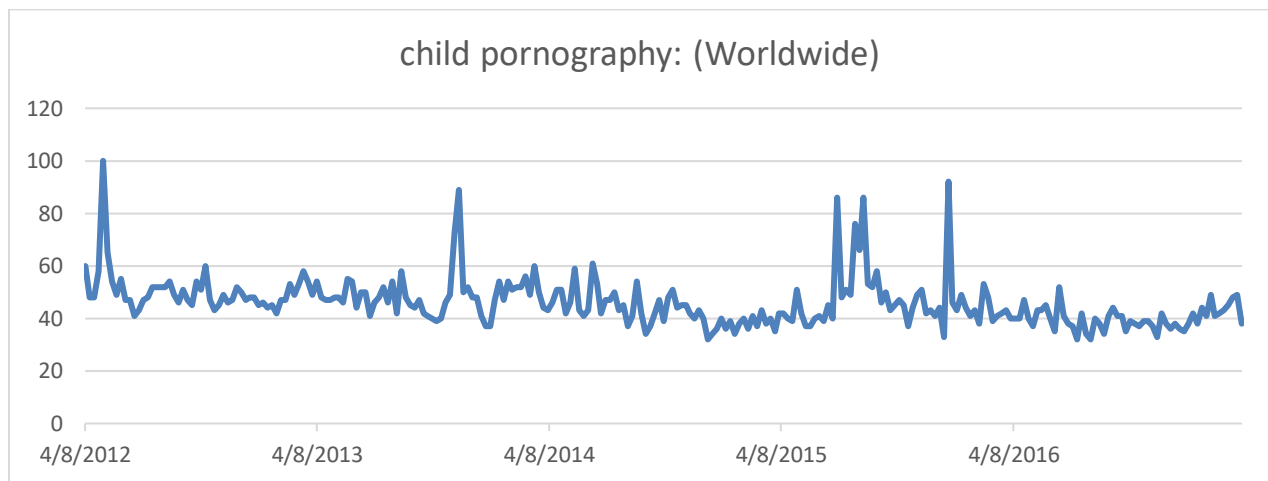
Finally, this paper uses software to generate the output of Latent Dirichlet Allocation Algorithm such as:

- Google Trend, for identifying the number of recent documents related to cyberbullying for the past six years.
- Rstudio and R-programming, for LDA algorithm application using Python programs like gibbs sampler and lda.

Ethical Consideration

The information utilized in this study were raw data coming from various published journals, government websites, and news portals from the seven (7) countries listed in Table 1. For the protection of the authors, their identity remains confidential. Furthermore, this study is based on the views of the researcher, and further validations and evaluations are needed.

RESULTS AND DISCUSSION

Figure 2: Worldwide Online Documents on Child Pornography

The figure above shows the trends and conversations on Child Pornography for the last five years (2012-2016). There has been a great deal of public and professional attention to child pornography offenders in recent years, particularly with the emergence of the Internet and the pornographic content that it has made available (Jenkins, 2001). It is observed that child pornography incidents are increasing. In 2016, the number and rate of child pornography incidents increased for the eighth consecutive year, up from 4,380 incidents in 2015 to 6, 245 incidents in 2016, as a result, the rate increased by 41% to 17 incidents per 100,000 population in 2016, 233% higher than the rate reported in 2006 (Mary Allen, 2016).

Table 2: Document to Topics

#	Document	Topic	#	Document	Topic
1	au_1.txt	1	18	phil_5.txt	2
2	au_2.txt	5	19	phil_6.txt	1
3	au_3.txt	1	20	phil_7.txt	1
4	au_4.txt	5	21	phil_8.txt	2
5	au_5.txt	5	22	phil_9.txt	2
6	can_1.txt	1	23	southA_1.txt	5
7	can_2.txt	1	24	southA_2.txt	2
8	can_3.txt	1	25	southA_3.txt	1
9	can_4.txt	1	26	southA_4.txt	2
10	can_5.txt	1	27	southA_5.txt	4
11	india_1.txt	1	28	uk_1.txt	1
12	india_2.txt	1	29	uk_2.txt	5
13	phil_1.txt	2	30	US_1.txt	3
14	phil_10.txt	4	31	US_2.txt	3
15	phil_2.txt	2	32	US_3.txt	2
16	phil_3.txt	2	33	US_4.txt	1
17	phil_4.txt	2	34	US_5.txt	1

Table 2 shows the 34 documents downloaded from different published journals, government websites, and news portals from the different countries indicated in Table 1. Most of the documents downloaded were from these countries: Philippines, Canada, USA and South Africa. These 34 documents were transcribed using LDA, from which five (5) underlying themes where identified.

Table 3: Word Frequency

Terms	Frequency	Terms	Frequency	Terms	Frequency
child	8198	young	671	fine	474
children	4828	data	664	victim	473
pornography	4566	including	640	youth	472
sexual	3531	rights	633	juvenile	470
the	3467	states	625	offender	465
law	2540	legislation	616	purposes	463
act	2295	offense	615	laws	455
internet	1961	department	611	republic	451

exploitation	1507	crime	609	acts	449
online	1379	used	594	human	449
sex	1373	this	582	united	443
years	1370	countries	581	for	441
article	1361	percent	567	justice	437
section	1333	imprisonment	557	tourism	435
images	1303	legal	556	committed	434
person	1291	persons	547	provide	432
criminal	1264	obscene	546	access	425
abuse	1252	provisions	546	criminalizes	425
information	1135	available	543	last	419
trafficking	1097	new	543	related	415
victims	1011	public	543	sexting	405
age	1006	however	540	country	404
protection	1004	reported	540	federal	404
national	964	sexually	533	agencies	394
code	953	computer	530	provided	393
offenders	928	number	530	south	393
use	895	social	526	case	392
state	843	services	523	local	387
offenses	843	material	518	violence	379
crimes	831	government	516	many	375
enforcement	821	people	513	media	374
prostitution	809	research	512	according	371
police	768	service	512	electronic	370
international	743	philippines	506	office	367
report	699	activities	498	purpose	365
cases	696	study	497	among	361
penal	679	term	485	addition	359
one	671	possession	476	means	356

Table 3 shows the word frequencies resulting from the extraction of the documents in Table 2 using LDA. A total of 20,253 words were extracted, of which the top 114 words are presented in Table 3. From these 114 words, the top 3 are child (8,198), children (4,828) and pornography (4,566). Additionally, words like internet (1,961), exploitation (1,507), images (1,303), young (671), and computer (530) are associated with child pornography.

Table 4: Topic to Terms

Document	Topic 1	Topic 2	Topic 3	Topic 4	Topic 5
1	child	children	child	child	young
2	pornography	child	the	pornography	sexting
3	the	the	children	act	people
4	children	sexual	sexual	law	sexual
5	internet	trafficking	pornography	article	law
6	sexual	exploitation	online	children	media
7	images	sex	internet	section	research
8	abuse	prostitution	percent	person	laws
9	police	protection	enforcement	years	male
10	offenders	international	law	code	legal
11	information	philippines	state	sexual	female
12	note	human	exploitation	criminal	south
13	age	rights	offenders	offenses	australia
14	material	victims	department	penal	new
15	see	tourism	reported	the	review
LATENT THEMES	Sexual Abuse and Offender	International Child Protection against trafficking	Law Enforcement on Sexual Child pornography and exploitation	Criminal offenses on child pornography	Studies on the effects of media on young people engaging sexual activities

Table 5: Topic Probabilities

Document	Topic 1	Topic 2	Topic 3	Topic 4	Topic 5
1	0.620578363	0.125742	0.140072	0.024141	0.089466
2	0.301145663	0.037643	0.05401	0.056816	0.550386
3	0.63174114	0.022342	0.09322	0.107473	0.145223
4	0.409335443	0.0125	0.047468	0.088924	0.441772
5	0.091572419	0.013742	0.036361	0.012039	0.846285
6	0.644641193	0.098322	0.171948	0.041845	0.043243
7	0.528744327	0.045638	0.320474	0.039839	0.065305
8	0.702512296	0.048119	0.121494	0.06952	0.058354
9	0.860663507	0.01485	0.093839	0.012322	0.018325
10	0.634178905	0.014686	0.17312	0.150423	0.027592
11	0.523182957	0.113409	0.168546	0.061404	0.133459
12	0.533678756	0.185233	0.091969	0.115285	0.073834
13	0.332479508	0.415984	0.026639	0.170082	0.054816
14	0.015083893	0.016073	0.003326	0.964443	0.001074
15	0.116203829	0.768671	0.030062	0.071448	0.013616
16	0.205175601	0.61315	0.079747	0.023237	0.07869
17	0.073233774	0.814857	0.039345	0.063565	0.008999
18	0.048133595	0.785855	0.064833	0.08055	0.020629
19	0.536601746	0.256044	0.02955	0.157656	0.020148
20	0.479213483	0.317978	0.047191	0.020225	0.135393
21	0.133667749	0.759516	0.057834	0.02213	0.026852
22	0.064581075	0.804243	0.027257	0.008828	0.095091
23	0.185034727	0.140611	0.053466	0.164461	0.456428
24	0.09123604	0.763581	0.04158	0.086062	0.017541
25	0.389873418	0.265823	0.149367	0.093671	0.101266
26	0.127219945	0.692281	0.033299	0.130977	0.016223
27	0.266783217	0.121329	0.034266	0.322727	0.254895
28	0.708609272	0.02649	0.089877	0.034059	0.140965
29	0.260105448	0.055185	0.07768	0.020035	0.586995
30	0.152840711	0.101603	0.715711	0.018706	0.011139
31	0.157049566	0.006852	0.792313	0.032438	0.011348
32	0.26285984	0.412931	0.198679	0.079991	0.04554
33	0.65107569	0.038498	0.222977	0.054699	0.03275
34	0.388274336	0.03208	0.340708	0.024336	0.214602

Table 4 shows the Latent Themes derived from the extraction of the 34 documents using LDA Algorithm. Each latent them consists of five (5) topics under which fifteen (15) words are identified. On the other hand, Table 5 shows the reliability of the topics using gibbs sampler per documents and topics. The reliability of the following documents to topic 1 are as follows: document 1 is 62.06%, document 3 is 63.17%, document 6 is 64.46%, document 7 is 52.87%, document 8 is 70.25%, document 9 is 86.07%, document 10 is 63.42%, document 11 is 52.32%, document 12 is 53.37%, document 33 is 65.11% and document 34 is 38.83%. This means that 15 out of the 34 downloaded documents conversations share a common topic on which falls on the *Topic 1: "Sexual Abuse and Offender."* On the other hand, documents 13 (41.60%), 15 (76.87%), 16 (61.32%), 17 (81.48%), 18 (78.58%), 21 (75.95%), 22 (80.42%), 24 (76.36%), 26 (69.23%), and 32 (41.29%) are talking on *Topic 2: "International Child Protection against trafficking*". While documents 30 and 31 are talking about *Topic 3: "Law Enforcement on Sexual Child pornography and exploitation,"* with a reliability of 71.57% and 79.23% respectively. Documents 14 and 27 on the other hand, speaks on the underlying theme of *Topic 4: "Criminal offenses on child pornography"* having a reliability of 96.44% and 32.37% respectively. Lastly, for the theme of *Topic 5: Studies on the effects of media on young people engaging sexual activities",* has the following reliability to these documents: document 2 (55.04%), document 4 (44.18%), document 5 (84.63%), document 23 (45.64%), and document 29 (58.70%).

The Anti-Child Pornography Law in the Philippines defines Child pornography as any representation, whether visual, audio or written combination thereof, by electronic, mechanical, digital, optical, magnetic or any other means, of a child engaged or involved in real or simulated explicit sexual activities (RA 9775, 2009). Taylor & Quayle (2003) as cited by Krone (2004) mentions that the Internet provides social, individual and technological circumstance in which an interest in child pornography flourishes.

- **Social.** The Internet has been used to create a self-justifying online community for child pornography users.
- **Individual**. Using the Internet, individuals can access material and communicate with others through a computer terminal providing an apparently private sphere for the expression of sexual fantasy.
- **Technological**. The Internet and Digital technology make it possible for child pornography consumers to become obsessive collectors so that the collection of images becomes an end in itself. The Internet also provides a ready means to access material supporting increasingly extreme sexual fantasies. It can then be used to act out those fantasies with children in online interactions or physical meetings arranged online.

Additionally, according to Wortley and Smallbone (2006), the problem of Internet child pornography can be divided into three components – the production, distribution, and downloading of images.

- **Production**. This pertains to the creation of pornographic images wherein collectors willingly place a premium on new materials on child pornography. Still, images taken from earlier magazines and film are circulating on the Internet. These may be professionally produced, and often documents the abuse of children in third-world countries.
- **Distribution**. This is done through uploading and dissemination of pornographic images, wherein these images may be stored in servers anywhere in the world. Organized crime groups that operate for profit or sophisticated pedophile rings may be involved in distribution. But, there are many cases that it is carried out by individuals seeking for no financial reward.
- **Downloading**. This is copying data, in these case child pornography materials via the Internet. The images do not need to be saved to the computer's hard drive or to a removable disk to constitute downloading. In some cases a person may receive spam advertising child pornography, a pop-up link may appear in unrelated websites, or he may inadvertently go to a child pornography website (e.g., by mistyping a keyword).

On the other hand, the Victims of Violence (n.d.) identified the different child pornography offenders: *the Producers, the Distributors, Coercers, and the User.*

- **The Producers.** These are the individuals who employ, uses, or advertise minors in any type of pornographic material. They are responsible for producing both homemade and commercially pornographic materials.
- **The Distributors.** These are the individuals who sell, mails, loan, gives, exports, advertise or transports any pornographic materials.
- **Coercers.** These are the individuals who encourage children through bribery and persuasion to be part of any pornographic material.
- **The User.** These are the people that use and take pleasure in pornographic materials; most commonly pedophiles.

With the increase of child pornography cases, governments have responded through reforms to strengthen existing laws further or through the creation of new laws. To improve the existing task force to fight Internet Crimes Against Children, "Providing Resources, Officers, and Technology to Eradicate Cyber Threats to our Children Act of 2008" or PROTECT our Children Act of 2008 was created in the US, to increase resources for regional computer forensic labs, and

to make improvements to increase the ability of law enforcement agencies to investigate and prosecute child predators. Additionally, under the US federal law, a person convicted of producing child pornography must be prisoned to at least five years, in the case of a first offense, or a minimum of fifteen years with either a qualifying conviction or hard-core child pornography (Smith, 2007).

Police: 3 elderly Seattle brothers arrested on child pornography charges. Seattle – Police found countless images and video of child pornography, toys and girls' clothing along with detailed notes about child-sex abuse and torture in a North Seattle home where three brothers lived for decades, according to police. As reported by the Seattle Times, "The defendants have no known conviction history, but are charged with collecting images depicting the misery of sexually abused children to satiate their deeply rooted deviant interests," the King County Prosecutor's Office said in court documents.

The following are more press releases from the United States Department of Justice (2017):

Melrose Man Sentenced to 60 months for Child Pornography Offenses: 32 old man named Jeremy Lillie from Melrose, New York was found guilty on the distribution, receiving, and possessing child pornography materials and was sentenced to 60 months period imprisonment. Additionally, Judge Sharpe ordered a restitution of $15,000 to be paid immediately.

North Hills Man Sentences to 18 Years in Prison for Producing Sexual Images of Minors. A former resident of Allegheny County, Pennsylvania, was sentenced 18 years of imprisonment for his conviction of producing materials showing sexual exploitation of a minor.

On the other hand, the Canadian criminal law under section 163.1 of the Criminal Code addresses on child pornography.

This is a press release from the Canada Border Services Agency (CBSA) (2017):

Child Pornography seizure at Emerson results in a 20-month jail sentence. Craig Eugene Leslie, 26, of Minnesota, pleaded guilty to smuggling digital images and videos of child pornography and was sentenced to 20 months imprisonment. Leslie was seeking entry into Canada when CBSA officers discovered suspected child pornography material in his electronic device.

The next article is a press release from the Royal Canadian Mounted Police:

Saint John man found guilty of accessing child pornography (October 18, 2017) Saint John, New Brunswick. A 36-year-old Saint John man has been found guilty of accessing child pornography. Kevin Stephen Logan was arrested in May 2016 following the execution of a search warrant at his Saint John home by the RCMP's Integrated Internet Child Exploitation Unit. At the time, police seized several electronic devices. In August 2016, Logan was charged with accessing child pornography. On October 17, 2017, he appeared in Saint John Provincial Court where he was found guilty. He was released under conditions pending a sentencing hearing on January 3, 2018. His conditions include restriction of his access to a computer and the Internet, as well as restrictions of not being around children under the age of 16 unless accompanied by an adult who is aware of his conditions ("Saint John Man Found Guilty", 2017).

In the Philippines, Republic Act No. 9775 or Anti-Child Pornography Act of 2009, an act defining the crime of child pornography, prescribing penalties therefore and for other purposes. This law covers sellers, users, producers, and transmitters of child pornography. The most significant penalty is reclusion perpetua and a fine of between two and five million pesos for any person found guilty of syndicated child pornography (Sections 5 and 15(a)) (Johnson, 2011).

The following are articles released by the International Justice Mission(IJM):

Two Young Teens Rescued as Visayas anti-Trafficking Police Lead Tenth Operation this year. (Cebu Philippines. September 14, 2017). IJM together with the Philippine authorities in Cebu rescued two young girls, 14 and 15 years old, from cybersex trafficking. The suspects were allegedly doing live-streaming sexual abuse of children via webcam from which foreigners pays to watch.

Two American Men Convicted of Exploiting Filipino Children. (Manila, Philippines. September 8, 2017). Two Americans were convicted of exploiting children in the Philippines. Two young survivors flew into California to give their testimonies during the trials.

A press release from the National Bureau of Investigation (NBI) of the Philippines:

September 28, 2017. Operatives of NBI-Anti-Human Trafficking Division (NBI-AHRTRAD) rescued two minors and a twenty-two-year-old woman who were victims of pornography in Batangas City. Information was provided by the

Australian Federal Police (AFP) that a specific Facebook user with an account username "Gyeong Aerum" believed to be Subject Angelical Camille Vilaruz y Custodio who is working in Malaysia was engaged in the distribution of child pornography materials. A surveillance operation was conducted confirming the information. Coordination with the Barangay Officials and the parents of the victims were made. Surrounding circumstances were explained to the parents and guardians of the victims. The victims were then peacefully turned over to the DSWD for custody.

An article from the Inquirer.Net by the reporter Marlon Ramps published on January 16, 2017.

Davao City – Presidential Communication Secretary Martin Andanar stated that President Duterte despised the proliferation of porn websites used by people to gain access to child pornography. Additionally, Andanar says that "These porn sites should be banned because they are being used by pedophiles and other people who subscribe to child pornography sites." The decision of the Department of Information and Communications Technology to bar access to two popular sex-themed Internet sites was warranted. Information and Communications Technology Secretary Rodolfo Salalima said an anti-child pornography council composed of social workers and police officers had been recommending to the National Telecommunications Center (NTC) to shut down websites violating Republic Act No. 9775 or the Anti-Child Pornography Law. "That committee is regularly monitoring websites, which violate the law on child pornography. Then recommends to the NTC to block those sites," Salalima told the INQUIRER. After the disclosure of pornhub.com that their top viewers were Filipinos, spending 12 minutes and 45 seconds on average in watching sex films, pornhub.com and xvideos.com were blocked.

Furthermore, a study conducted by Trinidad (2005) highlights the challenges in the fight against child pornography:

- Child pornography is little understood and hard to investigate practice;
- Identifying victims, perpetrators, and users of child pornography is difficult;
- Knowing the age of the child is difficult;
- Information technology's use is uncontrollable;
- Child pornography is linked with other forms of sexual exploitation;
- Official statistics on child pornography is incomplete;

- Credit card companies and ISPs are not cooperating;
- Gaps in the law and enforcement exist.

CONCLUSION

The internet has changed our way of life drastically, with just a click of a mouse, the world becomes closer, smaller, making our lives easier. As much as the Internet has given us a lot of advantages, it also comes with problems. Child pornography has been on-going for some time, but it showed some noticeable increase in the boom of the internet. The stark truth about the Internet is that it can expose children to vile and degrading materials in the sanctuary of their homes and open the door to dangerous child sexual predators (Arnagh, 1998). With this in mind, several countries have responded by coming up with new laws or improving their existing law(s) to address the increasing cases of child pornography. Protecting the child's welfare is important. As the result of the study by Trinidad (2005), the internet makes it difficult for officials to monitor and investigate the criminal practice. Furthermore, it is increasingly clear that un-chaperoned internet use by children leaves them vulnerable to child pornographers through e-mail, chat rooms, websites, web cameras and Internet cafes (UNICEF, 2005). Though the rapid technological change makes it difficult for the authorities to combat child pornography, this does not mean that there is no solution for this.

This study shows that child pornography is a general concern. It also shows that the Philippines has more of these cases in Asia. Thus, it is the responsibility of our lawmakers to strengthen our laws, policies, and guidelines to combat child pornography effectively. Additionally, protection of children starts at home. Teaching self-protection skills begins in the home with the parent (Kenny, Capri, Ryan, & Runyon, 2008).

REFERENCES

Arnagh, D. (1998). A safety net for the Internet: Protecting our children. *Juv. Just.*, *5*, 9.

Blei, D. M., Ng, A. Y., & Jordan, M. I. (2003). Latent dirichlet allocation. *Journal of machine Learning research, 3*(Jan), 993-1022.

Canada Borders Services Agency (CBSA) (2017). *Child Pornogaphy Seizure at Emerson results in a 20-month jail sentence*. Retrieved from https://www.canada.ca/en/border-services-agency/news/2017/08/child_pornographyseizureatemersonresultsin20-monthjailsentence.html

Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.

Cybertip.ca (2016, January). *Child Sexual Abuse Images on the Internet: A Cybertip.ca Analysis.* Retrieved from http://s3.documentcloud.org/documents/2699673/Cybertip-ca-CSAResearchReport-2016-En.pdf

International Justice Mission (IJM) (n.d.). *Two Young Teens Rescued as Visayas Anti-Trafficking Police Lead Tenth Operation This Year.* Retrieved from http://news.ijm.org/two-young-teens-rescued-as-visayas-anti-trafficking-police-lead-tenth-operation-this-year/

Jenkins, P. (2001). *Beyond tolerance: Child pornography on the Internet*. NYU Press.

Johnson, A. K. (2011). International child sex tourism: Enhancing the legal response in South East Asia. *The International Journal of Children's Rights*, *19*(1), 55-79.

Kenny, M. C., Capri, V., Ryan, E. E., & Runyon, M. K. (2008). Child sexual abuse: from prevention to self-protection. *Child Abuse Review*, *17*(1), 36-54.

Krone, T. (2004). *A typology of online child pornography offending*. Australian Institute of Criminology;.

Liu, Y., Poshyvanyk, D., Ferenc, R., Gyimóthy, T., & Chrisochoides, N. (2009, September). Modeling class cohesion as mixtures of latent topics. In *Software Maintenance, 2009. ICSM 2009. IEEE International Conference on* (pp. 233-242). IEEE.

Mary Allen (2016, July 20). *Police-reported crime Statistics in Canada, 2015.* Retrieved from http://www.statcan.gc.ca/pub/85-002-x/2016001/article/14642-eng.htm#moreinfo

MomSecure (2016, November 29). *The Importance of Protecting Our Children's Innocence.* Retrieved from https://momsecure.com/blog/ways-protect-childrens-innocence/

Norton, M. J. (1999). Knowledge discovery in databases.

RA 9775 (2009, November 17). Republic Act No. 9775. Retrieved from http://hrlibrary.umn.edu/research/Philippines/RA%209775%20-%20Anti-Child%20Pornography%20Act%20of%202009.pdf

Rouse, Margaret (2017). Data Mining. Retrieved from http://searchsqlserver.techtarget.com/definition/data-mining

Smith, S. F. (2007). Jail for Juvenile Child Pornographers: A Reply to Professor Leary. *Va. J. Soc. Pol'y & L.*, *15*, 505.

Sundell, Allison (2017, August 23). Police: 3 elderly Seattle brothers arrested on child pornography charges. USA Today. Retrieved from https://www.usatoday.com/story/news/nation-now/2017/08/23/police-3-elderly-seattle-brothers-arrested-child-pornography-charges/592851001/

Taylor, M., & Quayle, E. (2003). *Child pornography: An internet crime*. Psychology Press.

The Eyes Of A Child Lyrics – Air Supply (n.d.). Retreived from http://www.lyricsfreak.com/a/air+supply/the+eyes+of+a+child_20004964.html

Trinidad, A. C. (2005). *Child pornography in the Philippines*. Psychosocial Trauma and Human Rights Program, UP Center for Integrative and Development Studies and UNICEF Manila.

UNICEF (2016, June 7). *UNICEF Study: 8 in 10 Filipino youth in danger of sexual abuse.* Retrieved from https://www.unicef.org/philippines/media_25534.html#.Wf3a_FuCzIU

UNICEF (2005, April 5). UNICEF launches study on child pornography in the Philippines. Retrieved from https://www.unicef.org/philippines/archives/news/050505.html.

United States Department of Justice (2017). Melrose Man Sentenced to 60 months for Child Pornography Offenses. Retrieved from https://www.justice.gov/usao-ndny/pr/melrose-man-sentenced-60-months-child-pornography-offenses

Victims of Violence (n.d.). Research Library – Child Pornography. Retrieved from http://www.victimsofviolence.on.ca/research-library/child-pornography/

Villafania, Alexander (2016, June 8). UNICEF: PH still among the top sources of child pornography. *ABS-CBN News.* Retrieved from http://news.abs-cbn.com/nation/06/08/16/unicef-ph-still-among-top-sources-of-child-pornography

Wortley, R. K., & Smallbone, S. (2006). *Child pornography on the internet*. Washington, DC: US Department of Justice, Office of Community Oriented Policing Services.

Yildirim, I. (2012). Bayesian inference: Gibbs sampling. *Technical Note, University of Rochester.*