An Exploration of the Potential Use of NLP Techniques in Social Media Platforms for Profiling Potential Paedophiles

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ABSTRACT

Social Medial Platforms are now widely used by children and teenagers, where privacy, safety and their security online are often compromised. This has led to children being exposed to paedophiles while they are innocently using different types of social media platforms.

The paedophiles lure children by creating simple conversation starters in the form of relatable simple chats, which can be the first step to online child abuse. Although there has been an abundance of tools trying to protect children from online child abuse, the challenge remains far from being solved yet.

This paper focuses on how NLP techniques can be used on creating an effective way of protecting children against child online abuse while they are using online social media platforms. Informed from an extensive study of relevant literature and implementation cases, this research presents some of the key insights identified. Among the key findings are: Recent surveys confirming a significant increase in online child abuse even though there are some profiling tools available.

The main conclusion drawn from this paper were that current approaches to fight online child abuse are deficient because they fail to accurately identify the words that paedophiles use when communicating with children on social media platforms.

This paper argues for the use of an NLP tool, that can detect potential paedophiles using the common keywords they use when communicating with children online, hence the proposal towards curbing child online abuses smartly.

CCS CONCEPTS

• Computing Methodologies • Security and Privacy   • Social and Professional Topics

KEYWORDS

Artificial Intelligence, Paedophile, Natural Language Processing, Social Network Sites.

1   Introduction

Social media and online communities have become an important communication channel for both young and old people. The access and use of Information and Communication Technology (ICT) is increasing in African countries. In 2009, only 6.5% of Namibian population were using the Internet but the percentage increased rapidly to 30.2% in 2018 of which 37% is used on Facebook applications [2].

Artificial Intelligence (AI) lies at the core of many sectors that have embraced new information technologies [3]. The complexity of AI-powered systems has lately increased to such an extent that almost no human intervention is required for their design and deployment. Since decisions are now derived from systems such as smart systems, there is an emerging need for understanding how such decisions are furnished by AI methods [4]. Because AI will most likely have more fundamental effects on human lives as compared to other technologies, stronger forms of cooperation that address broader policy and governance challenges in addition to regulatory and technological issues, are needed.

Today's generation is surrounded by both traditional and digital media. Traditional media includes television and radio whilst examples of digital media are social media like YouTube videos, video blogs, Facebook, WhatsApp, and other social Applications (Apps). Digital media have become the mostly used form of media because they allow information sharing in different formats like text, photographs, videos, and audio [5]. Social media have many benefits such as creativity, education as well as development of media literacy.

The increasing use of Social Network Sites (SNS) such as Facebook has attracted the attention of many people including children with both positive and negative implications [6]. Social media technologies have high impact on the creation and sharing of information, communication between children themselves, and creating an environment of meeting new people. Studies show that social media patterns and rates among older children and adolescents have continued to grow over the past decade, aided, in part, by the recent rise in mobile phone use among children and teenagers [5]. At the same time, social media are also detrimental to young users since they also expose children to several online risks which negatively impact on their psychological and physical well-being [7]. As evidenced by the use of social media platforms by paedophiles to get access to children as referenced by Viana et al. [37].

The main contributions of this paper include a recommendation of NLP technique that will be used to identify potential paedophiles thereby preventing children from falling prey of such perpetrators. Additionally, the recommended NLP technique should be designed in such a way to allow the safe usage of the Internet by children as it will encompass ways through which parents can monitor their children's use of online facilities. Since the Internet now occupies an important place in the education of children due to the advent of diseases such as COVID-19, this study contributes to the goals of ensuring that the undesirable elements that harm the child are addressed to curb abuses directed towards children online.

The rest of this paper is outlined as follows: the objectives of the study are outlined in section 2, research methods that were used for populating this paper are explained in section 3. The analysis of literature is given in Sections 4. Section 5 discusses the main research findings. Lastly, the conclusions from the main discussion and the direction for future research are outlined in section 6.

2 Objectives

This paper is an extract from ongoing research, whose main objective is to explore how the NLP techniques in social media can be used to create a child-friendly online environment. In this exploratory study paper, we specifically focused on the following sub-objectives:

- Identify potential NLP technologies used for profiling paedophile Online
- Explore the potential use of NLP techniques in social media platforms for identifying potential paedophiles

In this research, profiling involves the analysis of sequences of an individual or mixed profile to identify the persons that these profiles belong to [40].

3 Methodology

The study used desktop review and qualitative analysis as a methodology to achieve the objective of this research. Desktop review was used as an important method of collecting, organizing and evaluating available information to gain an understanding of NLP techniques from different important sources. Information from these different sources was then analysed and evaluated using qualitative methods as defined by [9]. Systematic Literature Review (SLR) libraries such as Google Scholar, IEEE Xplore Digital Library, ACM Digital Library, ScienceDirect, Springer-link, and ACL Anthology were used to find information on computational and interdisciplinary research on sexual risk detection to ensure comprehensive coverage of the relevant literature. The researchers used combinations of the following keywords: NLP techniques used in social media. Our initial search resulted in unique papers. Next, we examined the paper title, abstract, keywords, results, and conclusions to identify relevant studies that met the peer-reviewed published work, published between 2017 to 2022, focus on online sexual child abuse (our definition of sexual risks includes sexual predation, sexual grooming, Paedophile, sexual abuse, social network sites) and contained an algorithmic approach or a system text classification and multi-modal data (including NLP, Machine Learning, etc.) inclusion criteria. Qualitative methods were employed to analyse the data obtained on online child abuse from these sources.

Table 1 below presents the SLR process that was employed for data collection:

1	Research Objective	Identify potential NLP technologies used for profiling paedophile Online
	Method	Qualitative
	Strategy	Desktop Review
	Data Analysis	Content Analysis was used.
2	Research Objective	Explore the potential use of NLP Techniques in social media platforms for identifying potential paedophiles
	Method	Qualitative
	Strategy	Desktop Review
	Data Analysis	Thematic analysis will be used.
3	Tools	Interview, Survey and Questionnaire
	Metadata for Search	Title, abstract, keywords
	Selected Digital Libraries	Google Scholar, IEEE Xplore Digital Library, ACM Digital Library, ScienceDirect, Springer-link, and ACL Anthology
	Inclusion	Published in the last 5 years, Computer science, presented technologies used in designing NLP Paedophile Systems and work that focus on designing an application that protect children from abuse online by Perpetrators.
	Exclusion	Discussed online child abuse but not in line with computer science or NLP Techniques, work is not clear enough, duplicate information
	Quality criteria	Is the research objective clearly specified? Was the study design to achieve our aim? Is the study aimed to address NLP technologies that identify paedophiles online? Does the study clearly explain the techniques used in designing NLP systems? Are the information provided in the study adequate for our study?

4 Online Sexual exploitation on Children by Paedophiles

Child abuse involves actions of maltreatment which injure the child in a variety of ways and violates their human rights [15]. While child sexual abuse is the participation of a child in a sexual activity that he or she does not fully understand, of which he is unable to give informed consent, or for which the child is not prepared according to their development stage, or that violates the laws or taboos of society [34]. Children can be abused by other children or adults [16].

Social media has changed the landscape of child pornography and child abuse in Namibia. There is an increase in child trafficking, cyber grooming, and abuse for private and commercial purposes [32]. Online grooming has negative effects that has led to the development of a trusting relationship that can cause sexting and convincing children to meet the perpetrators who are old people who misrepresent themselves as children or another teenager. Most children are deceived by these perpetrators that will lead them to be involved in sexual acts and the production of child abuse and distribution of pornography study materials to children. In this light, online child sexual exploitation also may involve recruitment and advertisement of children for prostitution and other forms of exploitation [18].

There are different types of Online child exploitation and abuse that can be used by child perpetrators using the Internet. These are comprised of virtual or text-based online dialogues that are sexually suggestive and video-based that might result in cyber prostitution [23]. Furthermore, there is the non-consensual sharing or receiving of unwanted sexually explicit photos and videos as well as the production, access to, and distribution of online child sexual materials even if the abuse is done offline [24].

Live streaming is also employed to abuse children online. This happens when online child sexual activities that are transmitted by an 'operator' through webcam and audio interface, and watched remotely in real-time by viewers who request, order, pay and dictate how the sexual activity will be carried out on or by children [25]. To this end, the groomer will blackmail the children for sex, money and other favours known as "sexual extortion of children" or "sextortion" [26]. Besides, consensual sexting facilitates the proliferation of flirtatious or even sexual relationships in the online space [27]. The sharing of the messages and images has brought about a risk that some children are involved in spreading of Sexually Transmitted Diseases (STD) and being pregnant. Some children are creating relationships with someone whom they do not know or who is in another country and those individuals will send different images about themselves.

5 Results

5.1 The traits, characteristics, and behaviour of online paedophiles

With the increase of privacy and anonymity offered by new technologies, there is no longer the need to possess Child Sexual Abuse Material (CSAM) anymore; offenders can simply view content online without leaving any traces on their devices. Offenders initiate talks about sex with the child whom they are contacting using different types of online platforms. Table 2 summarises the traits, characteristics, and behaviour of online paedophiles.

Table 2: The traits, characteristics, and behaviour of online paedophiles

Traits, characteristics, and behaviour of online paedophiles	Source
They force Children to produce sexual content	[38]
They chat with underage children in private environment about personal matters	[37]
They use SNS that contain text that contain different forms of abusive content	[46]
They pay children to watch tailor made sexual material	[38]
They view what children uploaded anonymously.	[41]
Paedophile have carnal knowledge of children as their sexual partners and engaged in sexually abusive and threatening behavior, thereby victimizing the online victim	[42],[43]
They sexually desensitize victims to develop relationships that lead to the sexual satisfaction of the needs of the offender or attacker	[44]
They use messages with words that are pejorative or with sexual content	[45]
They are creating child pornography online and sometimes introduce children to such online sexually materials	[37]

The Paedophile uses offensive language on social network. They distribute abusive images using online platforms which result in commission of crime. The social network children are spending time on, may led them to get in touch with unknown contact details in this case Paedophile materials. Children will become a victim of Porn Industry as images and data may be used by porn content creators (Paedophiles) [47].

5.2   Overview of NLP tools

There are several profiling tools, but most of them are used for business purposes. There are Social Media Consumer Profiling tools such as Klout, ALEXA, Comscore, Social Listening, Facebook Insights [29, 36]. All these profiling tools are used for business purposes and to increase influence on consumers and social community and to create a competitive strategy for the company.

The ALEXA profiling tool that can be used to conduct a simple search of your site to reveal a basic demographic breakdown including age, gender, the education level of site visitors, whether visitors have children, and whether they are browsing your site from home, school, or work [29]. Additionally, ALEXA provides information on upstream and downstream site visits, which can reveal related interests and Internet usage behaviour [29]. This toolkit provides parents with control to manage their children's use of the product including device time limit and ability to view children's activities via parental dashboard in the app.

Another tool, the Child Exploitation Network Extractor (CENE) is used to aid the rescue of child victims and discovering the webpages used to commit cybercrime [30]. With this tool the authors are trying to trace the websites that are used and if possible, to involve the law enforcement agencies to shut down these sites. In the digital forensics' realm, there is a risk assessment tool that is aimed at child sexual exploitation called a cryptographic ratchet-based protocol. [31]. This tool examines the risk factors of the child. Most of the tools that are available records and process user speech or uses according to the rank, hence using online social influence on social media network. Social network analysis and analytics have become key drivers of learning about clients and businesses. However, only a few studies have considered them for online child exploitation. Many children will benefit from the provision of accurate information relating to biological, social cultural, relational, and psychological and spiritual when it comes to sexuality. This information will be gathered by children from schools, churches or even at home. This help with a safe and a positive view when it comes to sexuality in the world and all forms of sexual exploitation will be protected. This will lead to the reduction of sexual abuse to children and adolescence because children will have a chance of learning the positives and negatives of sexual exploitation at school or home

Klout score is a tool that shows the influence rate for each user, by incorporating information for the user from multiple networks and communities. The correctness of the score is validated by showing that users with higher scores are able to spread information more effectively in a network in this case perpetrators. It uses several comparisons to other ranking systems to show that highly influential and recognizable users across different domains have high Klout scores [36].

6   Discussion

Table 2 summarises traits, characteristics, and behaviour of online paedophiles. It is clear from Table 2 that an NLP tool that can be used to detect paedophiles should detect words that are used:

- When paedophiles chat with children about sexual material
- Pay children to watch sexual content
- When users exchange messages
- When heuristic information is sent such as number of unknown friends, and photos
- NLP tool must address the data scarcity faced by abuse detection research while minimizing harm caused by the data

The information regarding the use of NLP techniques and NLP technologies for profiling children online when using social media were analysed. Table 3 below shows the tools and where best they are used.

Tool	Text Classification	Target Group	Application	Identify Paedophile Keywords
Klout	NO	Everyone	for influence of social media in general	NO
ALEXA	NO	Children	Used for speech recognition using online devices and uses voice	NO
Comscore	NO	Everyone	Identify young people exposed to alcohol and the need of audience on social media	NO
Social Listening	NO	Everyone	monitoring public online conversations to access key insights about your brand, industry and competitors	NO
NLP Profiling System	SHOULD	For children	detect paedophiles	IT SHOULD

It is apparent that the existing tools are not able to identify the common keywords that are used by perpetrators when communicating with children and some are designed for everyone which makes it difficult when there is a need to detect paedophiles. Hence the researcher will investigate common keywords that are used by potential paedophiles to woo and lure children into a web of sexual exploitation.

This paper explored NLP techniques that can be harnessed to prevent the online abuse of children who are increasingly turning to social media for interactive purposes.

The researcher will identify characteristics of social profiles of sexual exploitation offenders and common keywords that they use when abusing children using digital technology and proposing a system that uses Natural Language Processing (NLP) to stem off potential online child abuse information sent by paedophiles.

To our knowledge, this study ranks as one of the first to explore the use NLP Techniques in social media to create a child-friendly online environment to identify potential paedophiles due to the fact that other tools are NLP techniques that are too general and not responsible for the abuse of children online. NLP Tool to de developed will be able to identify characteristics of online offenders along with the aspect of offending behaviour. The aim will be to create a data dictionary to provide a detailed information for creating common keywords that are used by perpetrators when communicating with children online. In other words, the NLP

techniques will detect the common keywords and their synonyms used by paedophile online and block or remove them thereby reducing child online exploitation. Thus, the NLP tool will be able to be used for chat log screening to detect potential paedophiles to create a child-friendly environment when children are using online social media.

The proposed NLP paedophile profiling system will enable children, parents, and law enforcement to use this system on their Facebook, Instagram, or other social media accounts. The NLP system will automate the identification of children who are at risk of paedophiles.

7   Conclusion

Based on the above discussion, the researchers believe that it is feasible for an NLP tool to detect the potential paedophiles to make online social media a haven for children. Therefore, the next phase of this research is to evaluate critically the set of criteria of keywords used by paedophiles to lure, chat, or convince children to trust them initially and develop an NLP driven system that profile online paedophiles.

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