# Investigating the Availability of Child Sexual Abuse Materials in Dark Web Markets: Evidence Gathered and Lessons Learned

Yichao Wang, Budi Arief, Virginia N. L. Franqueira, Anna Grace Coates, Caoilte Ó Ciardha
Institute of Cyber Security for Society (iCSS), University of Kent
Canterbury, United Kingdom
{yw300,b.arief,v.franqueira}@kent.ac.uk,annagraceclark825@gmail.com,c.c.ociardha@kent.ac.uk

## ABSTRACT

Child sexual exploitation and abuse (CSEA) and the associated distribution of child sexual abuse material (CSAM) are serious offences online and offline. They are exacerbated by the increased popularity of dark web markets, in which vendors and buyers can exchange CSAM while hiding their identities. The aim of this paper is to improve our understanding of the CSEA landscape in dark web markets. We reviewed and collated four groups of keywords (a total of 198) for the detection/discovery of potential CSAM on the dark web market. This allowed us to conduct a systematic data collection (i.e., scraping) on dark web markets containing CSAM to create a new text-based dataset and perform further analysis. We found that CSAM is more public in the Chinese market, but not in the mainstream English market. To illustrate this point, we detected 724 CSAM items in the two Chinese dark web markets studied, but none in the eight English markets. While the prices of these CSAM remain low, we found that there were 3,449 sales over the 44-week observation period, implying that CSAM has been commercialised to some extent. We also noticed that mainstream cloud-based data storage services were used for the distribution and sharing of CSAM. We hope that the findings presented in this paper can help relevant stakeholders to understand the CSAM landscape in the dark web market better, which in turn may be used to devise more effective countermeasures to combat CSEA and CSAM.

## CCS CONCEPTS

• **Security and privacy → Human and societal aspects of security and privacy**; **Social aspects of security and privacy**;

## KEYWORDS

child sexual exploitation and abuse (CSEA), dark web, child sexual abuse material (CSAM), online child sexual abuse

## 1 INTRODUCTION

Child sexual exploitation and abuse (CSEA) is recognised as a serious crime, especially in Western countries. CSEA affects millions of children worldwide [29] and is continuously growing [24], although still under-reported [6, 16]. It is considered an EU priority in the "fight against organised and serious international crime" for the period of 2022-2025 [7], and is the subject of a National Strategy in the UK [14]. The first known mega forum of CSEA operating in the dark web was taken down in 2017 by the Taskforce Argos, led by the Australian Police [19]. Since then, the dark web has been increasingly used for CSEA-related activities by providing a higher level of anonymity compared to the surface web. The dark web is currently the main platform for discussion, consumption and distribution of CSAM [8, 22]. In particular, the dark web has become the hub for like-minded individuals to share CSAM, exchange tips and manuals to avoid detection, encourage abuse, and reward contributions under a structure and *modus-operandi* akin to other organised crimes [5].

It is therefore important to understand this harmful ecosystem better in terms of marketplaces, in order to devise further effective countermeasures to fight CSAM. Previous studies have focused on the motivation and the broad categorisation of CSAM content on the dark web [15, 31, 32]. However, a question remains regarding whether there are some relevant (and revealing) CSAM-related details in the dark web markets' characteristics, such as CSAM products on offer and the words used in advertising or describing these CSAM products, market policies and trends, as well as other operational aspects. This is the key research question that the study presented in this paper aims to address.

In this paper, we report findings and lessons learned from our investigation into the features and characteristics of CSAM in both English and Chinese dark web markets. A couple of prior studies have found that CSAM is most likely to be found in Chinese dark web markets [35, 40]. We aim to confirm or refute those preliminary findings by conducting a more in-depth investigation of this distressing (yet interesting) social and cultural observation.

**Contributions.** We reviewed and collated four groups of keywords for the detection/discovery of potential CSAM on the dark web market, based on findings from previous studies. This allowed us to conduct a systematic data collection (i.e., scraping) on dark web markets containing CSAM to create a new text-based dataset. The analysis of this dataset provides a novel perspective on the policies and trends of two Chinese dark web markets trading CSAM, and also on the protections guarding eight English markets identified. Obtained insights can be useful for researchers and law enforcement agencies (LEAs) in their effort to combat CSAM.

The rest of the paper is organised as follows. We describe and recap the related work in Section 2. We explain the methodology used in our research, including how we screened and obtained our keywords, our data collection process, and the ethical considerations in Section 3. We show our key results and findings in Section 4, while we discuss the implications of those results, as well as some limitations of our current research, along with ideas for future work in Section 5. Finally, we conclude our paper in Section 6.

## 2 RELATED WORK

Current CSEA literature in the dark web mainly relates to analysis of online forums, communities and networks of offenders and their group dynamics. There is still a gap in understanding marketplaces

of CSAM not protected by private channels, e.g., in terms of trends, types of products on offer and their economic aspects.

Kloess and van Bruggen [18] conducted a systematic literature review on the dynamics of CSEA's forums in the dark web from the perspective of *trust*. They found that a delicate balance takes place between distrust (i.e., the risk of betrayal among forum participants) and trust building. The latter is evidenced by cooperation (e.g., exchange of advice), reputation (e.g., elaboration on past criminal activities), and engagement (e.g., production and sharing of novel CSAM). Woodhams et al. [39] analysed the behaviour of 53 suspected CSEA offenders, who were active in four invite-only The Onion Router (TOR) forums on the dark web, which enforced specific requirements for membership. Their dataset was composed of forums' postings, chat and private messages, released by law enforcement spanning across two years (2014-2016).

The pandemic has increased the prevalence of "live distance child abuse" including the capture of self-generated CSAM resulting from manipulation and blackmailing of children, contributing to offerings in the dark web [6]. Findings by Liggett et al. [22] suggested that a big portion of CSAM is distributed in the dark web free of charge. A smaller portion, however, is commercially explored in marketplaces including services related to physical offenses (such as in the context of tourism or travel, and trafficking), purchases per download (where monetary value is proportional to novelty) and revenue per clicked advertisements. Dalins et al. [4] identified that 31% of 232k pages from 7,651 TOR virtual domains crawled in the dark web were related to CSAM "marketplace/for sale". They focused on motivation and broad categorisation of content, but did not analyse any actual marketplaces.

## 3 METHODOLOGY

In this section, we explain the methodology we followed in our study. We also describe our ethical considerations and the careful handling of the collected data.

### 3.1 Approach

In order to understand what terms are used in practice to refer to CSAM and related activities, we used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) approach [23] to build a list of related terms. We incorporated these terms into a custom crawler (that we developed and configured specifically for this study) to collect the pertinent data from the dark web, and analysed the data obtained.

*3.1.1 PRISMA Eligibility Criteria.* Literature related to the search terms and/or keywords used to find or sell CSAM on the dark web were selected for inclusion. The creation, discovery, or refinement of search terms and/or keywords for CSAM on the dark web had to be included in the methodology, results, or discussion of relevant literature. Given the anonymity of the dark web, there were no inclusion criteria specific to age or demographics. Book chapters, dissertations/theses, commentaries, conference papers and publications, annual reports, government and official documents, and legal materials were included.

Literature would be excluded if the method for finding CSAM on the dark web was solely done through hash values (e.g., PhotoDNA), file or folder names, age or body part detection, or IP addresses.

**Table 1: Search terms used in the literature search queries**

| | |
|---|---|
| | ("child sexual abuse material" OR "child sexual exploitation material" OR "indecent images of children" OR "illicit images of children" OR "child pornography" OR "child abuse material" OR "child abuse images" OR "child sexual abuse markets" OR "child exploitation market" OR "online child sexual exploitation" OR "child sexual abuse images" OR "child sexual abuse images online" OR "online child sexual exploitation and abuse" OR "child sexual exploitation and abuse") |
| AND | ("dark web" OR "dark net" OR "darknet" OR "deep web" OR "network" OR "livestream" OR "peer to peer network" OR "surface web" OR "peer to peer sharing" OR "The Onion Router" OR "webcrawl" OR "webscrape") |

Literature would also be excluded if the focus – while related to CSAM – was unrelated to the finding or selling of it on the dark web (e.g., longevity of CSAM, structure of dark web). Further, literature would be excluded if its ultimate focus was on the ethics or philosophy of censorship on the dark web. Trade publications, magazines, news articles, newspapers, wire feeds, and encyclopedias were excluded.

*3.1.2 Search Strategy.* The following databases were searched from May to July of 2022: SCOPUS, IEEE Xplore, ACM Digital Library and EBSCO, which included PsycNet and PsychINFO. Reference screening and contact with authors furthered the identification of relevant literature and retrieval of keywords and/or search terms used to find or sell CSAM on the dark web. Following data extraction, searches were completed on Google Scholar to ensure that pertinent literature was not missed.

Search terms were chosen according to their presence in relevant literature. They are intentionally broad to ensure the inclusion of pertinent literature and to account for the varied terminology for CSAM in particular. The boolean operator "AND" was added between the two separate search categories. Table 1 shows the search terms used in our search queries. Translated search terms in Chinese were also used in the China Online Journals database [34].

*3.1.3 CSAM Related Keywords.* Sixteen articles (all in English) were selected in the end [2, 9–13, 17, 21, 25–28, 33, 36–38]. The authors from eight sources were contacted for the full list of CSAM keywords or search terms mentioned in their articles. Two articles were subsequently removed due to a lack of response or inability to produce the requested materials. Combining the search terms and keywords from all sources resulted in 669 unique words, terms, or phrases associated with CSAM in varying degrees of proximity.

We then screened, selected and divided the obtained English keywords into three groups: (1) keywords directly related to CSAM, (2) keywords related to young-age, and (3) keywords related to sex.

To the best of our knowledge, there is no literature reporting on Chinese keywords related to CSAM. Therefore, an effort was made to translate English keywords into Chinese to fill this gap. These keywords were snowballed and updated during the screening period. It is worth mentioning that several keywords in English may be covered by one keyword in Chinese. Let's take the English term

**Table 2: The four groups of keywords that we obtained and screened (n=198, case insensitive) — the asterisk (*) represents a wild card denoting any letter(s)**

| | |
|---|---|
| CSAM related keywords (n=53) | babyj, baby cduk, babyjdog, babyshivid, childfugga, childlover, childporn, childsex, ddoggprn, eurololita, fallenangelfuns, halyavapictures, hussyfan, kdquality, kdv, kidzilla, kinder, kinderficker, kingpass, lola*, loli*, loll*, lsm, lso, lsobar, mafiasex, nimphets, nympet, nymphets, paedo*, pedfilia, pedo*, pedphilia, phtc, pthc, ptsc, qqazz, QWERTY, R@ygold, raygold, reelkiddymov, yamad, youngvideomodels, pjk, rbv, hmv, komorka, jagget, gomon, cjb, propthc, t4c, tihjj |
| Young-age related keywords (n=31) | {"X y", "X-yo", "Xyo", "X year", "X years", "X years old", "X y", "X ano", "X y/o"} (where X is between 0 and 17, or "one", "two", "three" etc.), adolescent, babe*, baby, bebe, boy*, chaby, child*, diaper, enfant, florian boy, gamine, girl*, infant*, kid*, kindergarten, post-pubescent, postpubescent, pre-pubescent, prepubescent, preteen*, pretten, toddler, tween, underage, young, hairless, little, smooth, school, angels |
| Sex related keywords (n=100) | anal, anale, animalsex, anus, ass, assfuck, asslick, BDSM, bitch, blowjob, bondage, defloration, dfloration, dildo, doggy, doggysex, ejac, ejaculation, erotic, eurosex, exhib, facia, fellation, fetish, fisting, fuck*, gangbang, gay, groupsex, handjob, hardcore, hentai, incest, inzest, jailbait, JOP, lesbian, lickin*, liluplanet, lingerie, masterbate, masterbating, mastur*, naked, nakie, naturist, necrofilia, nude, nudity, nudist*, oral, orgasm, orgy, penetrat*, penis, pnis, pntration, porn*, prostitu*, purenudism, pussy, rape*, sex*, shemale, sodom*, soumise, spank*, sperm*, suce, suck*, swallow, transexual, twink, vagina, virgin, voyeur, webcam, whore, xxx, yasuda, zofilia, zoofilia, zoophilia, cum*, upskirt, sado*, nua, nse, jizz, jeezy, abuse, spread*, torture, shower, erection, pee, piss, cunt, jacking off, cock* |
| CSAM related keywords in Chinese (n=14) | 萝 莉(lori), 幼(young), 初 中(junior school), 高 中(high/senior school), 中 学(middle/secondary school), 小(young/little/small), 岁(age/year), 童(child), 年轻(young/teen), 少(young), 妹(sister), 弟(brother), 孩(child), 未成年(underage) |

"paedophile" which can be translated in Chinese to "恋童" or "恋童癖". The first translation is composed of two terms: "love" ("恋") and "child" ("童"). Therefore, the latter Chinese term is enough to represent "child", "paedophile", "kid", "baby" and so on.

Table 2 provides a summary of the 198 CSAM-related keywords (and their classification into four groups), in both English and Chinese languages. The English keywords were collated from our literature survey, while the Chinese keywords were compiled based on translation of the English keywords.

*3.1.4 Data Collection & Analysis.* We used Python with the Scrapy web-crawling framework [20] to implement a custom crawler, which ran weekly. In an initial phase, we validated the data collected to ensure that valuable textual information was obtained rather than media file (i.e., images and videos). We identified eight dark web markets in English and two in Chinese after the keywords had been sorted. The eight English markets were: *AlphaBay Market, ASAP Market, Tor2door Market, Vice City Market, Colombia Connection, Nemesis Market, Royal Market, Kingdom Market.* The two Chinese markets were: *Chinese Exchange Market* and *cabyc* (initials of Chang'an Nocturnal City in Chinese). From this initial phase, we found that those eight English markets did not contain relevant textual information related to CSAM. Therefore, as per our preliminary results, we resumed data collection and processing for both Chinese markets, creating a new text-based dataset for further analysis.

## 3.2 Ethical Considerations

Due to the nature of the dark web and CSAM, no images were collected during the data collection process, and the process was automated. This means that we only got the textual content of the pages through a pre-defined process. We also removed the tags with *<img>* in the HTML code and then replaced all *src* attributes with invalid values. Appropriate parameters were used during the data collection process to ensure no additional pressure was placed on the server. The ethics of this study was reviewed and approved by our university's research ethics committee (Ref: 057-04-2021).

# 4 RESULTS

In this section, we present our findings and results, including market policies, market trends and the characteristics of CSAM products.

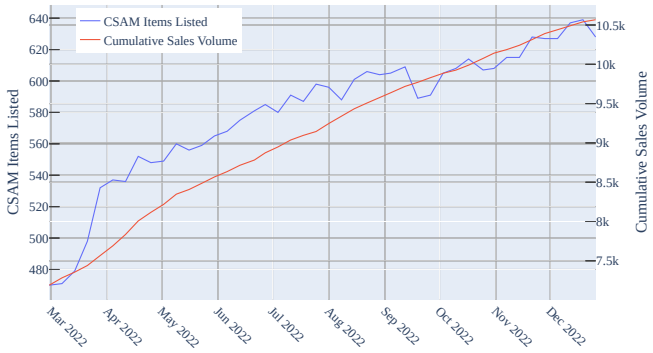
## 4.1 Markets' Policy

We reviewed and checked ten popular dark web markets, as detailed in the previous section. We also attempted preliminary data collection at this stage. We quickly found that there are stricter policies in the English market that prohibit the sale of CSAM products. However, CSAM products were present in the Chinese markets.

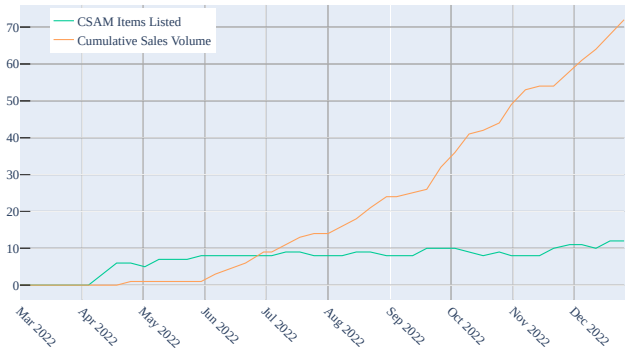
The mainstream English dark web markets usually ban pornographic materials of any kind. For example, the *AlphaBay Market* states the following market policy: "No erotica/porn/softcore of any sorts (logins for major sites are okay). Child porn, animal abuse videos cover this rule - we have never previously allowed anything like this and we will not start doing now as it is something we strongly oppose." [1].

In this case, "logins" refer to login credentials for accessing third-party clear web (pornographic) sites; such credentials are often sold on the dark web markets. The *ASAP Market* is an exception in terms of this kind of policy; its market rules only vaguely specify that no threats or actual violence are allowed.

We attempted further checks but no CSAM products were returned. As a result, we did not find any items related to CSAM in those major English-language dark web markets. Instead, there were many vendors who sell "premium accounts" (usually hacked accounts or for cashing stolen credit cards) from clear web porn sites – but not the CSAM items themselves.




**(a) The number of CSAM items listed and their cumulative sales volume in *Chinese Exchange Market* during the time period observed; Note that there are two different scales**




**(b) The number of CSAM items listed and their cumulative sales volume *cabyc* during the time period observed**

**Figure 1: The number of CSAM items listed and their cumulative sales volume comparison in both Chinese dark web markets during the time period observed**

In comparison, we found a number of CSAM items on offer in the Chinese dark web markets. Regarding the market policy, *Chinese Exchange Market* does not specify nor restrict which specific products are available or unavailable for sale. *cabyc* do claim that "This site prohibit child pornography and fake cryptocurrency transactions, [...]" [3]. However, we still found CSAM items being sold on this market. This means that operators in this market may not be strict in enforcing their policy when reviewing listed items.

## 4.2 Markets' Trend

We found 724 unique CSAM-related items listed during the 44-week period between March and December 2022[1], of which 704 unique items are from the *Chinese Exchange Market* and the remaining 20 from the *cabyc* market. Given that both markets are not CSAM-focused (i.e. there are other types of items listed), the results come from their "pornography" category.

Figure 1 shows the number of CSAM items listed (when the time of each data collection was done) and their cumulative sales volume (i.e., sum of the cumulative sales since the item was first listed, for all items) over the time period observed. The *Chinese Exchange Market* is a more established dark web market with a total sales volume of 3,377, where the earliest CSAM-related item was listed in July 2018 (see Figure 1a). The *cabyc* market, on the other hand, is new and only appeared in early 2022, therefore, its sales volume is 72 during the observation period (see Figure 1b).

Table 3 shows the monthly numbers of CSAM items listed and sold in *Chinese Exchange Market* and *cabyc*. In *Chinese Exchange Market*, the sales were greater in the first few months, and then showed a slight downward trend. The average monthly sales volume is greater than 300. We speculate that people tend to buy newly listed items. There are two potential factors that may have affected sales: (i) there was only a small net increase in items from May 2022, compared to the previous two months, and (ii) DDoS issues on the TOR network in October 2022 caused low accessibility[2] [30].

[1]Please note that the *cabyc* market has 43 weeks' worth of data due to website maintenance.

[2]Even though such issues still exist at the time of writing, there was a significant impact on accessibility in this particular market in October 2022.

**Table 3: The monthly numbers of CSAM items listed and sold in the *Chinese Exchange Market* and *cabyc***

| | *Chinese Exchange Market* | | | *cabyc* | | |
|---|---|---|---|---|---|---|
| **Month** | **# Listed** | **# Sold** | **% Sold** | **# Listed** | **# Sold** | **% Sold** |
| **Mar-22** | 537 | 376 | 70% | 0 | 0 | 0% |
| **Apr-22** | 569 | 551 | 97% | 6 | 1 | 17% |
| **May-22** | 579 | 450 | 78% | 8 | 0 | 0% |
| **Jun-22** | 594 | 307 | 52% | 8 | 8 | 100% |
| **Jul-22** | 603 | 271 | 45% | 9 | 5 | 56% |
| **Aug-22** | 617 | 429 | 70% | 9 | 10 | 111% |
| **Sep-22** | 622 | 256 | 41% | 10 | 8 | 80% |
| **Oct-22** | 621 | 312 | 50% | 11 | 17 | 155% |
| **Nov-22** | 635 | 249 | 39% | 11 | 9 | 82% |
| **Dec-22** | 660 | 176 | 27% | 13 | 14 | 108% |

In *cabyc*, as this was an emerging market at the time, there was only one sale in the first three months of observation. However, as the market operated longer, more consistent transactions began to be made, even with the limited number of items listed compared to *Chinese Exchange Market*. TOR issues do not appear to have had an impact on this market.

It is worth highlighting that these two markets have slightly different policies: *Chinese Exchange Market* has no strict restriction on selling CSAM items; whereas *cabyc* does but it is not enforced.

## 4.3 Characteristics of Items on Sale

We collected 724 records from 156 different vendors. Figure 2 shows the number of newly listed CSAM items (monthly) in the *Chinese Exchange Market*, based on our observed data. The earliest items appeared in the market in July 2018. The market became more active after July 2021 with at least ten items being added almost every month.

Product descriptions often use indecent language to describe scenes. A large number of vendors also include images in their product descriptions, as we found the filename extension for images in their descriptions. Regarding delivery, vendors use web-based cloud storage services for distribution. For example, the most commonly used is MEGA.

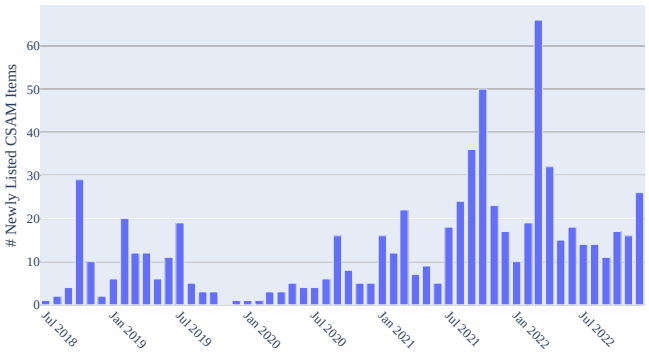



**Figure 2: The number of newly listed CSAM items in *Chinese Exchange Market* monthly**

Multiple CSAM items are usually included in one purchase. Moreover, some vendors offer a list of different types of CSEA videos to promote themselves. We also noticed that even though these materials are sold on the Chinese dark web market, there are a large number of materials from other countries and regions in the studied Chinese markets. Although the majority of items indicated the age and gender of the child involved in the title of the post, sometimes more ambiguous terms were used, such as *lolita*, *underage*, and *secondary school student*. In some cases, the vendor claimed that the CSEA videos came from Japanese or European forums. This would suggest the presence of materials for reselling.

The median price of items on offer was very low. For the *Chinese Exchange Market*, the median price was only 5 USD, while for the *cabyc* market it was 3 USD. On the other hand, the median sales volumes for all CSAM items were 6.5 and 1 in those two markets, while on average, the sales volumes were 15 and 3.6, respectively.

## 5 DISCUSSION

The results of this research provide some useful insights and evidence to better understand the current stage of CSAM trends on the dark web market.

English language CSEA dark web markets seem to adopt measures aiming to minimise the risk of being detected by LEAs, by making channels more private and restricting access to members that fulfill certain requirements [18, 39]. In China, however, since LEAs may be more focused on dealing with such harmful activities on the surface web, the Chinese dark web markets seem to operate more openly. This explains why we could collect data more easily for the latter but not the former.

Based on the nature of the observed Chinese dark web markets, the aim of the vendors appears to be more about profit-making, rather than the traditional sharing and exchange of CSAM. To some extent, since accessing the TOR network has become pretty easy (i.e. there is less need for complex network knowledge to configure and use TOR), CSAM has been commercialised in the Chinese dark web market. Furthermore, although the results show fluctuations in sales, the general trend is upwards. Almost every month at least ten items have been added to *Chinese Exchange Market* since July 2021. Remember that this is a comprehensive market, so other items (e.g. stolen data, drugs, other digital items) are also listed on that market. This means that CSAM items are being exposed to a wider range of people.

It is worth noting that CSAM items from diverse countries and regions have already been appearing in the Chinese dark web markets. This means that multilingual speakers (or even, someone who might have been using existing automated language translation technologies) are distributing materials that were originally in their own language into foreign language markets. However, there is a lack of multicultural studies in this field. We noticed that existing studies have mainly revolved around English-speaking cyberspace, yet there are limited studies on the dark web markets using other languages such as Chinese or Russian.

Finally, some of the CSAM items are shipped using web-based cloud storage services such as MEGA, Baidu Web Drive (Baidu Wangpan), or even Microsoft OneDrive. Those storage providers face many challenges to detect CSAM in their platforms. First, fuzzy hashing technology (e.g., PhotoDNA) is only able to detect variations of known CSEA images, which means they do not have the ability to recognise novel images. Second, end-to-end encryption prevents even the detection of known CSEA images.

### 5.1 Limitations and Future Work

Our Chinese keywords may not be very comprehensive as they were not supported by the literature. The application of linguistics and machine learning has the potential to provide more opportunities in the future. This is because these techniques may lead to the discovery of more slang terms commonly used by criminals.

For future work, the effectiveness of different types of keywords can be assessed by the results returned. Moreover, more complex query conditions can be added when crawling data. For example, when both “pupil” and “data” are present in returned results, it is more likely to be leaked data rather than CSEA-related.

Similarly, at the time of writing, ChatGPT is becoming popular. This tool can be utilised to generate a number of keywords for retrieving CSAM and has the ability to be improved by users’ input. This could pose a huge challenge for the future. For example, users could potentially abuse similar tools to avoid keyword detection; more emerging, obscure terms may appear in the CSEA community.

## 6 CONCLUSION

In this paper, we aimed to study the CSEA landscape in the dark web markets. For that, we systematically compiled a list of CSEA-related keywords from the literature to identify potential English and Chinese dark web markets trading CSAM. These keywords were then utilised by our scraper to collect text-based dataset over a 44-week period between March-December 2022, resulting in the identification of 724 CSAM items being listed on two Chinese dark web markets but none on the eight English dark web markets observed.

In particular, we found that CSAM items were being sold on both Chinese dark web markets without the need for memberships or any other gate keeping practice in place. The two Chinese markets selling CSAM items adopted a relaxed policy with regard to this type of product. Sales figures in both of these Chinese markets showed an upward trend with regard to the volume of the items being sold. It is worth noting that these CSAM items were sold cheaply,

with a median price of 5 USD in the *Chinese Exchange Market*, for example. Moreover, there was an indication that CSAM items originating from other countries and regions have been appearing in the Chinese dark web markets for reselling. Finally, we noticed that mainstream web-based cloud storage services were being used for distribution and sharing of CSAM.

## ACKNOWLEDGMENTS

This work was supported by a funding from the University of Kent's Institute of Cyber Security for Society (iCSS, https://cyber.kent.ac.uk); and the European Commission under the Horizon 2020 Programme (H2020), as part of the HEROES project (https://heroes-fct.eu/, Grant Agreement no. 101021801).

## REFERENCES

[1] AlphaBay Market. 2022. Terms of Service AlphaBay Market.
[2] Christopher Bagley. 2003. Diminishing Incidence of Internet Child Pornographic Images. *Psychological reports* 93, 1 (2003), 305–306.
[3] Chang'an Nocturnal City. 2022. Trade Rule - cabyc.
[4] Janis Dalins, Campbell Wilson, and Mark Carman. 2018. Criminal Motivation on the Dark Web: a Categorisation Model for Law Enforcement. *Digital Investigation* 24 (2018), 62–71.
[5] Europol. 2020. Exploiting Isolation: Offenders and Victims of Online Child Sexual Abuse During the Covid-19 Pandemic. https://www.europol.europa.eu/cms/sites/default/files/documents/europol_covid_report-cse_jun2020v.3_0.pdf
[6] Europol. 2021. European Union Serious and Organised Crime Threat Assessment (SOCTA). https://www.europol.europa.eu/cms/sites/default/files/documents/socta2021_1.pdf
[7] Europol. 2022. EU Policy Cycle - EMPACT. https://www.europol.europa.eu/crime-areas-and-trends/eu-policy-cycle-empact
[8] Alain M. P. Fonhof, Madeleine van der Bruggen, and Frank W. Takes. 2019. Characterizing Key Players in Child Exploitation Networks on the Dark Net. In *Complex Networks and Their Applications VII*, L.M. Aiello, C. Cherifi, H. Cherifi, R. Lambiotte, P. Lió, and L.M. Rocha (Eds.). Springer, Cham, 412–423.
[9] Raphaël Fournier, Thibault Cholez, Matthieu Latapy, Isabelle Chrisment, Clémence Magnien, Olivier Festor, and Ivan Daniloff. 2014. Comparing Pedophile Activity in Different P2P Systems. *Social Sciences* 3, 3 (2014), 314–325.
[10] Raphaël Fournier and Matthieu Latapy. 2015. Temporal Patterns of Pedophile Activity in a P2P Network: First Insights about User Profiles from Big Data. *International Journal of Internet Science* 10, 1 (2015), 8–19.
[11] Richard Frank, Bryce Westlake, and Martin Bouchard. 2010. The Structure and Content of Online Child Exploitation Networks. In *ACM SIGKDD Workshop on Intelligence and Security Informatics*. ACM, New York, NY, USA, 1–9.
[12] Bryce G. Westlake and Martin Bouchard. 2016. Criminal Careers in Cyberspace: Examining Website Failure Within Child Exploitation Networks. *Justice Quarterly* 33, 7 (2016), 1154–1181.
[13] Sean Hammond, Ethel Quayle, Jurek Kirakowski, Elaine O'Halloran, and Freda Wynne. 2009. An Examination of Problematic Paraphilic Use of Peer to Peer Facilities. , 65–73 pages.
[14] HM Government. 2021. Tackling Child Sexual Abuse Strategy 2021. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/973236/Tackling_Child_Sexual_Abuse_Strategy_2021.pdf
[15] Tegan Insoll, Anna Katariina Ovaska, Juha Nurmi, Mikko Aaltonen, and Nina Vaaranen-Valkonen. 2022. Risk Factors for Child Sexual Abuse Material Users Contacting Children Online: Results of an Anonymous Multilingual Survey on the Dark Web. *Journal of Online Trust and Safety* 1, 2 (02 2022).
[16] Interpol. 2022. INTERPOL Global Crime Trend Summary Report. https://www.interpol.int/en/content/download/18350/file/Global%20Crime%20Trend%20Summary%20Report%20EN.pdf
[17] Kila Joffres, Martin Bouchard, Richard Frank, and Bryce Westlake. 2011. Strategies to Disrupt Online Child Pornography Networks. In *2011 European Intelligence and Security Informatics Conference*. IEEE, 163–170.
[18] Juliane A. Kloess and Madeleine van der Bruggen. 2021. Trust and Relationship Development Among Users in Dark Web Child Sexual Exploitation and Abuse Networks: A Literature Review From a Psychological and Criminological Perspective. *Trauma, Violence, & Abuse* (2021), 15248380211057274.
[19] Christopher Knaus. 2017. Australian Police Sting Brings down Paedophile Forum on Dark Web. https://www.theguardian.com/society/2017/oct/07/australian-police-sting-brings-down-paedophile-forum-on-dark-web
[20] Dimitrios Kouzis-Loukas. 2016. *Learning Scrapy*. Packt Publishing Ltd, Birmingham, UK.
[21] Bénédicte LeGrand, J Guillaume, Matthieu Latapy, and Clémence Magnien. 2009. Technical Report on Dynamics of Paedophile Keywords in Edonkey Queries. Measurement and Analysis of P2P Activity Against Paedophile Content Project.
[22] Roberta Liggett, Jin R Lee, Ariel L Roddy, and Mikaela A Wallin. 2020. The Dark Web as a Platform for Crime: an Exploration of Illicit Drug, Firearm, CSAM, and Cybercrime Markets. *The Palgrave handbook of international cybercrime and cyberdeviance* (2020), 91–116.
[23] David Moher, Alessandro Liberati, Jennifer Tetzlaff, Douglas G. Altman, and The PRISMA Group. 2009. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLOS Medicine* 6, 7 (07 2009), 1–6.
[24] National Crime Agency. 2022. National Crime Agency Annual Report and Accounts 2021-2022. https://www.nationalcrimeagency.gov.uk/who-we-are/publications/606-national-crime-agency-annual-report-2021-2022/file
[25] Jeremy Prichard, Caroline Spiranovic, Paul Watters, and Christopher Lueg. 2013. Young People, Child Pornography, and Subcultural Norms on the Internet. *J. of the American Society for Information Science and Technology* 64, 5 (2013), 992–1000.
[26] Jeremy Prichard, Paul A Watters, and Caroline Spiranovic. 2011. Internet Subcultures and Pathways to the Use of Child Pornography. *Computer Law & Security Review* 27, 6 (2011), 585–600.
[27] Chad MS Steel. 2009. Child Pornography in Peer-to-Peer Networks. *Child Abuse & Neglect* 33, 8 (2009), 560–568.
[28] Chad MS Steel. 2009. Web-based Child Pornography: Quantification and Qualification of Demand. *International Journal of Digital Crime and Forensics (IJDCF)* 1, 4 (2009), 58–69.
[29] Marije Stoltenborgh, Marian J Bakermans-Kranenburg, Lenneke RA Alink, and Marinus H van IJzendoorn. 2015. The Prevalence of Child Maltreatment across the Globe: Review of a Series of Meta-Analyses. *Child Abuse Review* 24, 1 (2015), 37–50.
[30] Tor Project. 2022. Network DDoS | Tor Project status. https://status.torproject.org/issues/2022-06-09-network-ddos/
[31] Madeleine van der Bruggen and Arjan Blokland. 2021. A Crime Script Analysis of Child Sexual Exploitation Material Fora on the Darkweb. *Sexual Abuse* 33, 8 (2021), 950–974.
[32] Madeleine van der Bruggen and Arjan Blokland. 2022. Profiling Darkweb Child Sexual Exploitation Material Forum Members Using Longitudinal Posting History Data. *Social Science Computer Review* 40, 4 (2022), 865–891.
[33] Vasja Vehovar, A Ziberna, M Kovacic, Andrej Mrvar, and M Dousak. 2009. *An Empirical Investigation of Paedophile Keywords in Edonkey P2P Network*. Technical Report. Citeseer.
[34] WanFang Data. 2023. China Online Journals (COJ). https://www.wanfangdata.com.cn/
[35] Yichao Wang, Budi Arief, and Julio Hernandez-Castro. 2021. Toad in the Hole or Mapo Tofu? Comparative Analysis of English and Chinese Darknet Markets. In *2021 APWG Symposium on Electronic Crime Research (eCrime)*. IEEE, 1–13.
[36] Bryce Westlake, Martin Bouchard, and Richard Frank. 2017. Assessing the Validity of Automated Webcrawlers as Data Collection Tools to Investigate Online Child Sexual Exploitation. *Sexual Abuse* 29, 7 (2017), 685–708.
[37] Bryce G Westlake and Martin Bouchard. 2016. Liking and Hyperlinking: Community Detection in Online Child Sexual Exploitation Networks. *Social science research* 59 (2016), 23–36.
[38] Bryce G Westlake, Martin Bouchard, and Ashleigh Girodat. 2017. How Obvious is It? The Content of Child Sexual Exploitation Websites. *Deviant behavior* 38, 3 (2017), 282–293.
[39] Jessica Woodhams, Juliane A. Kloess, Brendan Jose, and Catherine E. Hamilton-Giachritsis. 2021. Characteristics and Behaviors of Anonymous Users of Dark Web Platforms Suspected of Child Sexual Offenses. *Frontiers in Psychology* 12 (2021), 1–11.
[40] Gengqian Zhou and Jianwei Zhuge. 2020. Adapting to Local Conditions: Similarities and Differences in Anonymous Online Market Between Chinese and English Speaking Communities. In *International Conference on Digital Forensics and Cyber Crime*. Springer, Springer International Publishing, Cham, 164–181.