International Journal of Digital Crime and Forensics
Volume 18 • Issue 1 • January-December 2026

Cyberpolicing Child Sexual Exploitative and Abuse Material:
A Systematic Review of Tools and Practices

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Received: October 26th, 2025 | **Accepted:** February 25th, 2026

ABSTRACT

Despite growing development of digital forensic tools for detection of child sexual exploitative and abuse material (CSEAM), victims and offenders remain a challenge to investigators and forensic experts. To understand developments and shortcomings of digital forensic approaches, a systematic literature review was carried out in IEEE Xplore, EBSCOHost Academic Search complete, and Science Direct between 2010 to 2025. A total of 41 articles out of 4,148 were selected through various filtering criteria. The review revealed seven themes covering the dark web, detection tools, crime patterns, applications based on artificial intelligence (AI) and machine learning (ML), biometric analysis, social media network analysis, and analysis of online behaviour. Despite the growing popularity of AI and ML, their application towards addressing CSEAM is scanty. Text analysis is the least commonly used feature, though text accompanies all media. Ethical implications are discussed. This research will help relevant stakeholders to strengthen the fight against CSEAM.

KEYWORDS

Child Sexual Exploitative and Abuse Material, Crime Detection, Investigation Tools, Child Pornography, Paedophilia and Pedophilia

INTRODUCTION

The problem of child sexual abuse has escalated in a disquieting manner with advances in Internet technologies providing unrestricted access, anonymity, and ease of access to novel materials (Krone & Smith, 2017; Merdian et al., 2013) by perpetrators. When child sexual offenders abuse a child and record the act, they eventually post it online or distribute it via a network. Cyberspace has thus introduced a new dimension to the ecology of children who are victims of sexual abuse images disseminated online (Martin & Alaggia, 2013). Perpetrators use the Internet to target minors, establish criminal networks, disseminate abusive information, and circulate such content to manipulate more victims (Joleby, n.d.).

Child sexual exploitative and abuse material (CSEAM) is a term used to describe sexually explicit content or objects that represent a child. It includes photos, films, live streaming, computer-generated

DOI: 10.4018/IJDCF.403438

content, and generative artificial intelligence (AI) content. It also includes printouts, pamphlets, audio, texts, books, toys, and so forth. Peer-to-peer networks (P2P), dark networks, web search engines and websites, mobile devices, social media, and other channels like e-mails, instant messages, newsgroups, bulletin boards, and chatrooms distribute CSEAM in formats including images, videos, live streaming, and recordings. While the surface web is used to access different online services, the Onion Router (Tor) is one of the common browsers that allows hosts and receivers to access the dark web anonymously. As children use social media and mobile technologies more, their self-photographs and private photos contribute to CSEAM and self-harm.

The Internet Watch Foundation (IWF) received 392,665 reports of CSEAM in 2023. Analysis of these reports revealed that 275,652 URLs were confirmed to contain the material, representing an 8% increase from 2022. In 2023, 247 out of 335 (74%) of newly identified dark web services disseminating CSEAM were evaluated as commercial (IWF, 2023a, 2023b, 2023c). Apart from the causation factors of child sexual abuse, which is a bigger concern to address, the ease of use, advances, and affordability of technology (Wortley et al., 2024) is a consistent factor in the availability and accessibility of CSEAM (Anillo et al., 2023). Protecting millions of vulnerable children worldwide requires comprehensive, long-term research into CSEAM (Lemmey & Tice, 2001). The persistent pattern of abuse presents significant challenges for the criminal justice system tasked with detecting evidence, sanctioning offenders, identifying victims, and ultimately preventing future occurrences of abuse. Law enforcement, as the initial responders to criminal cases, faces pressure to investigate unconventional cases utilizing forensic tools (Rallan & Vig, 2019).

The detection of CSEAM, which was once the responsibility of medical professionals, eventually became the primary work of investigation offices along with digital forensic experts. Doctors analysed physiological characteristics of people in abusive images by examining dentition and venous patterns (Cooper, 2011). Since approximately 2016, software has been used to identify bodily features. One such software package, IntelliGrade, analyses abusive video and image content and categorizes the different forms of sexual abuse to which children were exposed in such material. Currently, several law enforcement agencies are developing forensic tools through collaboration with academic institutions, non-governmental organizations, and businesses to enhance their detection capabilities. It is essential for forensic tools and detection methods to advance with more sophisticated techniques and methodologies.

Research on the detection of CSEAM has primarily concentrated on non-forensic methods of digital evidence, including racial biases in investigations (Thakor, 2018), technical incompetencies (Dushi, 2018), psychological impacts on investigators (Barker, 2020), and various other challenges. A few studies have examined the evolving technological measures (AlZahrani et al., 2021; Al-Khater et al., 2020; Lee et al., 2020; Steel et al., 2020) and a comprehensive investigation and prevention framework (Ngox et al., 2022). These comparable studies are either a decade old or aimed to encompass not only forensic tools but also the broader aspects of abuse prevention. The studies have indicated that the absence of data sets constitutes a barrier to the testing and evaluation of current detection systems.

Recent research (Ali & S., 2025) has addressed the gap in understanding how AI is being used to tackle online child sexual abuse (CSA), of which one of the components is CSEAM. AI has potential to reduce trauma and burden for both victims and investigators who deal with abusive images directly. However, the limited evaluation in this study and the broader focus on online CSA did not provide extensive insight on CSEAM. Another prominent survey identified that research on machine learning (ML) falls under advanced hashing cryptographic techniques and source camera identification techniques (Barletta et al., n.d.).

The identification and location of victims present challenges, partly due to a lack of awareness among responding professionals about the extent of these offenses (Martin & Alaggia, 2013). This issue remains prevalent and is largely unaddressed in the existing literature. This article aims to provide a comprehensive review of the literature on forensic techniques for victim and offender identification, material analysis, and detection of CSEAM activities including grooming.