

# Automatic Image and Video Understanding for Investigations of Child Sexual Abuse

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The *multimedia explosion* poses a difficult challenge to forensic investigators of child sexual abuse (CSA), who find themselves confronted with a flood of digital images and videos to be evaluated under severe time pressure. Here, image and video analysis offers a powerful tool to increase the efficiency of this process by a computer-aided prioritization, filtering, and linking of material. Several commercial solutions<sup>1</sup> do already provide functionality for a similarity matching of seized images and videos with reference datasets, for detecting nudity, or for an efficient visualization of content.

This raises the question whether advanced computer vision can be exploited even further in this domain. In our presentation, we follow this line of thought and present two innovative approaches from our recent research<sup>2</sup>:

- **Automatic CSA detection** [1]: Can a computer automatically recognize if an image or video shows child abuse? This is obviously a challenging problem. However, recent advances in visual recognition suggest that – though accuracy is far from perfect – a prioritization and filtering of content by its “suspiciousness” is possible. Following this idea, we present a system for CSA detection that combines multiple information sources such as image texture/color, motion, audio, and facial age estimation. While prior work in the area has been targeted at detecting pornography in general, our work is explicitly targeted at *child* pornography. Results of an evaluation conducted with police partners indicate that – with error rates in the range of 11 – 24% – CSA detection is less accurate than regular porn detection but may be a powerful tool for content filtering.
- **Establishing Connections between Cases** [2]: Are two cases of child abuse connected? This is another important question to investigators, who apply image search techniques to match the crime scenes of new *query* cases and known reference cases. In this context, we present a *local feature matching* technique that allows investigators to search for objects

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<sup>1</sup>NetClean Analyze, ZIUZ VizX 2, Videntifier Forensics, LTU Image Seeker, FTK Forensic ToolKit

<sup>2</sup>This research has been / is being conducted in the projects iCOP (EU Safer Internet Programme, SI-2010 TP-2601002), INBEKI (German Federal Ministry of Education and Research, 13N10787), and FIVES (EU Safer Internet Programme, SIP-2008-TP-131801).

of interest like toys (even if these appear in front of different backgrounds) and to conduct a transitive matching of crime scenes (even if there is only indirect visual overlap with the query case). Results on a case dataset provided by police practitioners are presented.

## References

- [1] A. Ulges, A. Stahl, Automatic Detection of Child Pornography using Color Visual Words, in: Proc. Int. Conf. Multimedia and Expo, 2011.
- [2] A. Ulges, C. Schulze, Scene-based Image Retrieval by Transitive Matching, in: ACM International Conference on Multimedia Retrieval, 2011.