HEROES

NOVEL STRATEGIES TO FIGHT CHILD SEXUAL EXPLOITATION AND HUMAN TRAFFICKING CRIMES AND PROTECT THEIR VICTIMS

KEY EXPLOITABLE RESULTS

HER⬡ES

PARTNERS

24 partners, 17 countries:
3 universities, 2 small and medium enterprises, 3 research and technology organisations,
6 law enforcement agencies, 1 international organisation, 8 NGOs and 1 government organization.

Universities

Coordinator

Small and Medium enterprises

Law Enforcement Agencies

Research and Technology Organisations

International Organisation

NGO's

Government Organization

Table of Contents

1 INTRODUCTION

Trafficking in Human Beings (THB) and Child Sexual Abuse and Exploitation (CSA/CSE) are serious problems facing our society. The rise of information and communication technologies (ICT) has inadvertently facilitated the expansion of these crimes, especially during the COVID-19 pandemic, which created new opportunities for exploitation. Law Enforcement Agencies (LEAs), civil society organizations (NGOs), and other relevant actors struggle to keep pace with criminals who exploit technological advances for THB and CSA/CSE, while the technical and legal tools available are insufficient to effectively combat this threat. Furthermore, the lack of coordination between these actors often limits the effectiveness of victim support and investigations.

To address these issues, the HEROES project introduces a comprehensive, interdisciplinary, and victim-centered approach. The project aims to overcome challenges in prevention, investigation, and victim assistance by promoting collaboration between LEAs, NGOs, prosecutors, and legislators while leveraging innovative technology. By harmonizing legal frameworks and facilitating cross-border coordination, HEROES seeks to protect victims, prosecute offenders, and prevent the spread of THB and CSA/CSE crimes.

The HEROES project is structured around three main components:

PREVENTION

The project focuses on implementing strategies that combine the use of innovative technologies with social actions to significantly reduce the risk of vulnerable individuals becoming victims of human trafficking (THB) and child sexual abuse and exploitation (CSA/CSE). Additionally, it works to raise public awareness of these crimes through educational campaigns and accessible tools that enable society to identify warning signs and take preventive action.

INVESTIGATION

Advanced technological tools have been provided to law enforcement agencies (LEAs), applying artificial intelligence and data analysis techniques to enhance the identification, tracking, and prosecution of criminals involved in human trafficking and child sexual abuse and exploitation crimes. These tools will facilitate the collection of digital evidence, the correlation of data across different jurisdictions, and the creation of more accurate criminal profiles, thereby strengthening LEAs' capabilities to address these crimes efficiently and in a coordinated manner.

VICTIM ASSISTANCE

The project ensures that victims of THB and CSA/CSE receive comprehensive support that addresses their legal, psychological, and emotional needs. Special emphasis has been placed on improving coordination between different actors, such as law enforcement agencies (LEAs), NGOs, and judicial services, which has enabled more effective assistance and reduced secondary victimization, i.e., the additional trauma victims may experience during legal and investigative processes. Moreover, best practices and protocols have been promoted to ensure care is focused on the specific needs of each victim.

The HEROES project leverages technology to transform the fight against human trafficking (THB) and child sexual abuse and exploitation (CSA/CSE). Through innovations like machine learning (ML), criminal investigations have been strengthened, collaboration between stakeholders has been fostered, and victim-centered approaches have been developed to meet their specific needs. This comprehensive approach not only promotes a more effective response to these crimes but also creates a safer environment for vulnerable communities.

2 KEY EXPLOITABLE RESULTS

The HEROES project has successfully developed a series of innovative Key Exploitable Results (KERs) designed to combat online threats against children and improve responses to Human Trafficking (THB), Child Sexual Abuse (CSA), and Child Sexual Exploitation (CSE). These solutions encompass both technological tools and social initiatives, aligning with the project's three fundamental pillars: Prevention, Investigation, and Victim Assistance.

Among the technical tools is a mobile application for detecting grooming attempts that uses artificial intelligence to identify and alert parents or legal guardians about potential grooming incidents, as well as a citizen reporting app that allows individuals to report suspicious activities to local authorities. At the same time, the project has developed comprehensive training programs and educational guides that raise awareness and empower communities to prevent these crimes.

The close collaboration between technology developers, law enforcement agencies (LEAs), and non-governmental organizations (NGOs) has been essential to achieving Technology Readiness Levels (TRL) ranging from 3 to 7. The results obtained have demonstrated their feasibility and potential for implementation in real-world settings.

However, it is essential to continue with research, development, and innovation to ensure effective adoption of these solutions by end-users. The documentation and promotion of the KERs are crucial to maximizing the project's impact. These results go beyond technological solutions, encompassing relevant scientific knowledge, best practices, and policy recommendations that address the complexities of online child safety and protection. The following sections detail and present the current KERs of the HEROES project, reflecting the results of several evaluation rounds, with the most recent conducted in Madrid, Spain, from July 8 to 10, in a live environment.

3 TECHNICAL KERS

3.1 Prevention Tools

Anti-grooming mobile app (AGapp)

Allows the detection, blocking and alerting of grooming attempt, either through messages received in messaging applications or in multimedia material such as images and video, through the use of artificial intelligence models and technologies that guarantee the security and privacy of the minor's data and preserving evidence for future investigation by law enforcement agencies (LEAs).

Partner: UCM

TRL: 6

Citizen Reporting App (CR)

Through this application, citizens can report potential incidents of CSA/E and/or THB that they have witnessed or become aware of. The report is then sent to the local police, who will evaluate the information provided and classify it to decide on the best course of action to take.

Partner: UNIKENT

TRL: 6

Identifying fake job offers (INDOOR)

A tool for detecting and analyzing fake job offers, whether individual suspicious listings or ads retrieved from job portals.

Partner: IDENER

TRL: 6

3.2 Investigation Tools

Automatic CSAM/CSEM Identification and Classification Tool (ACPIC)

Partner: INRIA - UCM

TRL: 6

Tool based on computer vision algorithms to automatically detect and classify CSA/CSE material in multimedia files (images or videos) to help LEAs save time in their investigations. This solution is a workflow using 3 separate modules, age/gender estimation, sensitive adult content detection and context/background captioning.

File Context Analysis from Seized Devices (FCA)

Partner: UCM

TRL: 6

Context analysis tool on seized devices, which enable automatic analysis of files contained on a seized device and allow agents to conduct intelligent searches, reducing analysis time and human error. Additionally, it allow for the analysis of image files to detect text within them.

Real-time Instant Messaging Application Content Acquisition (RIMA)

Partner: IDENER

TRL: 5

The RIMA tool addresses the growing problem of data capture in instant messaging applications (IMA), with a special focus on protecting minors. It uses advanced artificial intelligence algorithms to automatically analyze the content of IMAs. This enables the identification and flagging of suspicious conversations, facilitating early detection and quick action by law enforcement agencies and child protection organizations.

HEROES

Open Source Intelligence Tools (OSINT)

Partner: ARC

TRL: 7

Dockerised tool capable of retrieving intelligence from diverse social networks and other sources based on an input text. The tool's objective is to streamline criminal investigations by automating data collection and analysis, facilitating the identification of correlations and additional evidence.

P2P CSAM/CSEM Identification Tool (P2PT)

Partner: UNIKENT

TRL: 4

The tool has three main components: (1) to identify CSEA materials on P2P networks, (2) to download them, keeping records about them, and (3) to compute perceptual, average and wavelet hashes of the new items in order to be compared with those blacklisted by LEAs.

Profile/Content Generator (PCG)

Partner: IDENER, ARC, UCM

TRL: 6

Creation and management of profiles, enabling investigators to improve the efficiency of their processes and achieve accurate identifications in cases related to child sexual abuse and exploitation.

4 NON-TECHNICAL KERS

4.1 Scientific Publications

Throughout the HEROES project, a series of significant scientific contributions have been made, covering multiple areas related to the fight against human trafficking (THB) and child sexual abuse and exploitation (CSA/CSE). These publications reflect the project's interdisciplinary approach, combining technological advancements, such as machine learning and data analysis tools, with perspectives from the social sciences and humanities to address victims' needs and improve investigations. Below is a list of articles and studies published in specialized journals and international conferences, resulting from collaborative work within the HEROES project.

Publications in Journals:

- L. J. Borges Amaro, B. W. Percilio Azevedo, F. L. Lopes de Mendonca, W. Ferreira Giozza, R. de Oliveira Albuquerque, L. J. García Villalba: **Methodological Framework to Collect, Process, Analyze and Visualize Cyber Threat Intelligence Data**. Applied Sciences. Vol. 12, No. 3, pp. 1205. January 2022.
- L. J. García Villalba, J. A. Puente Fernández, A. L. Sandoval Orozco: **Analysis of MP4 Videos in 5G Using SDN**. IEEE Transactions on Intelligent Transportation Systems, Vol. 23, No. 3, pp. 2668-2677. March 2022.
- F. Casino, T. K. Dasaklis, G. Spathoulas, M. Anagnostopoulos, A. Ghosal, I. Borocz, A. Solanas, M. Conti, C. Patsakis: **Research Trends, Challenges, and Emerging Topics in Digital Forensics: A Review of Reviews**. IEEE Access. Vol. 10, pp. 25464-25493. January 2022.
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- J. Portillo-Portillo, G. Sanchez-Perez, L. K. Toscano-Medina, A. Hernandez-Suarez, J. Olivares-Mercado, H. Perez-Meana, P. Velarde-Alvarado, A. L. Sandoval Orozco, L. J. García Villalba: **FASSVid: Fast and Accurate Semantic Segmentation for Video Sequences**. Entropy. Vol. 24, No. 7, pp. 942. July 2022.
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- S. Pérez Arteaga, A. L. Sandoval Orozco, L. J. García Villalba: **Analysis of machine learning techniques for information classification in mobile applications**. Applied Sciences. Vol. 13, No. 9, pp. 5438. April 2023.
- D. Povedano Álvarez, A. L. Sandoval Orozco, J. P. García-Miguel, L. J. García Villalba: **Learning strategies for sensitive content detection**. Electronics. Vol. 12, No. 11, pp. 2496. June 2023.
- M. P. Marco Francia: **Delitos sexuales y victimización secundaria**. Perfil Criminológico. No. 34, 2023.
- C. Karapapas, G. C. Polyzos, C. Patsakis: **What's inside a node? Malicious IPFS nodes under the magnifying glass**. IFIP International Conference on ICT Systems Security and Privacy Protection. pp. 149-162. June 2023.
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- Y. Guo, S. Bettaieb, F. Casino: **A Comprehensive Analysis on Software Vulnerability Detection Datasets: Trends, Challenges, and Road Ahead**. International Journal of Information Security. Vol. 23, pp. 3311–3327. October 2024.
- J. A. Sousa Torres, D. A. da Silva, R. de Oliveira Albuquerque, G. D. Amvame Nze, A. L. Sandoval Orozco, L. J. García Villalba: **Ontology Development for Asset Concealment Investigation: A Methodological Approach and Case Study in Asset Recovery**. Applied Sciences. Vol. 14, No. 21, pp. 9654. October 2024.
- A. Chrysanthou, Y. Pantis, C. Patsakis: **The Anatomy of Deception: Measuring Technical and Human Factors of a Large-Scale Phishing Campaign**. Computers & Security. Vol. 140, pp. 103780. May 2024.
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- Y. Wang, B. Arief, J. Hernandez-Castro: **Analysis of Security Mechanisms of Dark Web Markets**. Proceedings of the 2024 European Interdisciplinary Cybersecurity Conference (EICC '24). Association for Computing Machinery, New York, NY, USA, pp. 120–127. June 2024.

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- A. López Olmos, Z. Che: **Named Entity Recognition in Spanish Texts Using RoBERTa**. Bachelor's Thesis, Complutense University of Madrid. June 2023.
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- J. Millán Ibáñez Archilla: **Tool for the Automatic Collection and Processing of Information for the Analysis of Criminality**. Bachelor's Thesis, Complutense University of Madrid. June 2024.
- M. Diaz Lupone: **Extraction of Relationships based on Named Entities in Spanish using Natural Language Processing Technique**s. Bachelor's Thesis, Complutense University of Madrid. June 2024.
- D. Cabañas González: **Analysis of synthetic image detection techniques**. Master Thesis, Complutense University of Madrid. June 2024.
- O. Zea Lavado: **Text Analysis on Android Devices for Grooming Detection**. Master Thesis, Complutense University of Madrid. September 2024.
- E. Ruiz Huguet, L. Marta Marco Simal: **iOS app for detecting explicit content in audio and tex**t. Bachelor's Thesis, Complutense University of Madrid. September 2024.
- M. Ruano Crespo: **Tool for detecting sexual content in images on iOS mobile devices**. Bachelor's Thesis, Complutense University of Madrid. September 2024.
- O. Canive Huguet: **Tool for Person Identification using convolutional neural networks**. Bachelor's Thesis, Complutense University of Madrid. September 2024.
- D. Povedano Álvarez: **Image and Video Manipulation Detection Using Deep Learning Techniques**. PHD Thesis (in progress).
- S. Pérez Arteaga: **Artificial Intelligence techniques for Grooming detection on mobile devices**. PHD Thesis (in progress).
- L. A. Martínez Hernández: **Forensic Techniques Based on the Contextual Analysis of Information from a Physical Device**. PHD Thesis (in progress).

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- G. Balnyte: **Isgirsk mane: Seksualinis vaiku isnaudojimas artimoje aplinjoe: baudziamuju bylu analize. Her Me Out. Sexual Exploitation of Children Inside the Families: Analysis of the Criminal Cases**. ISBN: 978-609-96444-0-0. December 12, 2023.
- A. Maziukaite: **Pastebek mane. Negalia turinciu asmenu pazeidziamumas prekybos zmonemis ir kitokio isnaudojimo bylose. See Me**. Vulnerability of the Disabled persons in Human Trafficking and Other Exploitation Cases. ISBN: 978-609-96444-1-7.September 01, 2024.
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- M. P. Marco Francia: **The Unbearable Lightness of Modern Sexual Slavery. Legal And Criminological Framework in Spain**. Chapter XXI in: The Palgrave Handbook of Modern Slavery. Palgrave (USA). January 2025.

4.2 **Public Deliverables**

- **D1.1** **Project Coordination Handbook**
- **D1.3** **HEROES Advisory Board and Sub Committees Report**
- **D1.6** **Gender Action Plan**
- **D3.3** **HEROES Data Protection Legal Framework V1**
- **D3.6** **Final HEROES data protection legal framework**
- **D4.2** **Legal and ethical issues about the use of Special Investigative Methods to fight CSAM/CSEM**
- **D4.4** **Manual for Early Identification of Potential Victims of Trafficking in Human Beings, Child Sexual Abuse and Child Sexual Exploitation**
- **D4.6** **Qualitative study with key multi- stakeholders involved in THB and CSA/CSE prevention programs**
- **D5.1** **Mobile and web tool to identify, geolocate, and report possible victims**
- **D5.2** **Passenger transport personnel addressing to identification and assistance possible THB victims e- learning-based training programs**
- **D5.3** **Mapping prisoner re-entry report**
- **D5.4** **Design an online THB and CSA/CSE prevention programs and to provide stakeholders with resources for prevention and response to neglect, CSA/CSE signals in child**
- **D5.5** **Enhanced training curricula on recognizing, intervening, and preventing various forms of sexual violence – V1**
- **D5.6** **Children Rights Promotion Campaign Results - V1**
- **D5.7** **Sexual exploitation of children in the context of travel and tourism campaign awareness**
- **D5.8** **Anti-Grooming Mobile App**
- **D5.10** **Design an online THB and CSA/CSE prevention programs and provide stakeholders with resources for prevention and response to neglect, CSA/CSE signals in child – V2**
- **D5.12** **Enhanced training curricula on recognizing, intervening, and preventing various forms of sexual violence – V2**
- **D7.1** **Findings on Trauma Bonding Impact in THB and CSA/CSE Victims**
- **D7.2** **Best practices guidelines for trauma bonding identification protocol**
- **D7.3** **Development of guidelines of awareness and victim's assistance resources addressing to governments and stakeholders to follow on investigation and prosecution of THB and CSA/CSE crimes**
- **D7.4** **Design and development of a training plan to health care workers and other child-serving professionals regarding THB and CSA/CSE**

- **D10.2 Project Website**
- **D10.3 Communications plan – V1**
- **D10.4 Promotional Video V1**
- **D10.5 Dissemination Plan – V1**
- **D10.9 Exploitation Plan - V1**
- **D10.10 Communication Plan - V2**
- **D10.12 Latest Version of Promotional Video**
- **D10.19 Exploitation Plan - V2**
- **D10.20 Exploitation Plan – V3**

Non-Technical KERs

BENCHMARKING DATASETS

Throughout the HEROES project, a series of significant scientific contributions have been made, covering multiple areas related to the fight against human trafficking (THB) and child sexual abuse and exploitation (CSA/CSE). These publications reflect the project's interdisciplinary approach, combining technological advancements, such as machine learning and data analysis tools, with perspectives from the social sciences and humanities to address victims' needs and improve investigations. Below is a list of articles and studies published in specialized journals and international conferences, resulting from collaborative work within the HEROES project.

Fake Job Posting Prediction
Real or Fake | Textual and meta-information about jobs to classify fraudulent job descriptions | Text

Sexual Content Detection
NDPI Pornography-2K | 140 hours of 1000 pornographic and 1000 non-pornographic videos | Video

Age and Gender Estimation
FGNet | 1002 images of 82 individuals with ages ranging from 0 to 69 | Image
Appa-Real | Face images with real and apparent age labels | Image & Video
CAF (Cross-Age Face) | 4000 images of 520 individuals taken from childhood to senior hood | Image

Synthetic Rejuvenated Face Images Generation
FFHQ | Human faces designed for benchmarking age transformation algorithms | Image
LAION-Aesthetics | Filtered images focused on visual aesthetics, selected for their pleasing appearance | Image
LAION-Face | 50 million image-text pairs, focused on human faces for face analysis tasks | Image

Pornography Detection in Images and Videos
NSFW Content | Pornography detection in images and videos | Image & Video
NSFW Images in Review | Pornography detection in review images and videos | Image & Video

Grooming Detection in Text
Perverted-Justice | Collection of text conversations for grooming detection | Text
PREDADORES-BR | Brazilian dataset focused on sexual predators' online behaviour | Text
Resolutions (Spain) | Judicial decisions from the Spanish Judiciary related to sexual crimes | Text
PAN12 Deception Detection | Sexual predator identification through text-based deception detection | Text

Named Entity Recognition (NER)
CoNLL03 | Newswire articles containing names of persons, organizations, and locations | Text
WNUT17 | Text from various sources like YouTube comments, Twitter, and Reddit | Text
Paramopama (Portuguese Corpus) | Extension of WikiNER with revised named entity tags | Text

SSH Prevention Solutions

Training curricula on recognizing, intervening, and preventing various forms of sexual violence

Partner: ICMEC

An innovative solution is offered to train key actors in the prevention, response and care of victims of Child Sexual Exploitation and Abuse (CSA/CSE) and Human Trafficking (THB), through methodologies and training resources tailored to their specific needs. Training programs have been created and are now available on ICMEC's Online Learning Platform.

This course is part of the Agents of Change program, which has trained more than 2,100 professionals on crucial issues such as online and offline child sexual exploitation, child trafficking, and sexual exploitation in the context of travel and tourism.

With this initiative, HEROES expands the program's educational offerings, increasing its visibility and international impact. The courses, accessible free of charge and available in several languages, allow professionals and students from around the world to acquire knowledge and tools to combat these crimes, promoting a more effective and global response.

Online THB and CSA/CSE prevention programs.

Partner: ICMEC

Children face significant online threats, such as Trafficking in Human Beings (THB), Child Sexual Abuse and Exploitation (CSA/CSE), and Online Child Sexual Exploitation and Abuse (OCSEA). However, there is a pronounced lack of awareness among key stakeholders, including NGOs, educators, and law enforcement, about how to recognize and address these issues.

To address this need, a **Comprehensive Educational Guide** is being introduced to:

- Educate on relevant terminology related to online crimes against children.
- Target adults who frequently interact with children, such as educators, parents, and law enforcement members.
- Provide information on online risks, early warning signs, and effective communication strategies with children.
- Ensure that the content is engaging, culturally appropriate, and globally accessible, with plans for diverse formats and languages to maximize its reach.

Training plan to health care workers and other child-serving professionals regarding THB and CSA/CSE

Partner: ICMEC

Multidisciplinary collaboration in the investigation of crimes against children is fundamental, as highlighted in numerous international directives, conventions, and reports. This collaboration has several key objectives:

1. **Address the holistic needs** of children and families by ensuring they receive comprehensive services.
2. **Improve the quality of criminal investigations** regarding Human Trafficking (THB), Child Sexual Abuse and Exploitation (CSA/CSE), thus promoting the successful prosecution of offenders.
3. **Enhance the quality of evidence** identified and gathered for civil litigation.
4. **Increase public awareness** of THB/CSA/CSE and appropriate strategies for seeking victim assistance.

However, multidisciplinary collaboration does not occur automatically; it requires knowledge, resources, and a clear structure. To address these challenges, a specialized training program is offered that illustrates the benefits of collaboration and familiarizes professionals with the developed protocol.

This training helps participants begin the process of adapting the framework to meet the specific needs of their community, facilitating the organization of protocol development and addressing key issues that need to be considered. Like the framework itself, the training acts as scaffolding that supports the work of professionals in their efforts to improve the response to suspected THB/CSA/CSE.

4.5 SSH Victim Assistance Solutions
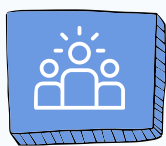
Best practices guidelines for trauma bonding identification protocol

Partner: CWCS

The challenge of trauma bonding is addressed through a comprehensive and action-oriented approach. The proposed solution focuses on breaking the traumatic bond that binds victims to their abusers by providing educational and emotional tools that empower victims. Through awareness programs, victims can learn to identify signs of abuse at early stages, recognize what a healthy relationship entails, and receive support in developing a personal safety plan. This approach facilitates a safe transition out of the abusive relationship, helping victims to regain their emotional autonomy and rebuild their lives in a safer, healthier environment.

The aim is not only to offer a way out, but also to create a support network that reinforces their well-being and promotes long-term prevention.

Guidelines of awareness and victim's assistance resources addressing to governments and stakeholders to follow on investigation and prosecution

Partner: ICMEC

Comprehensive care for victims of Child Sexual Exploitation and Abuse (CSEA) and other forms of abuse requires the implementation of Multidisciplinary Teams (MDTs), as highlighted by international best practices. These teams are essential for conducting proper investigations, providing medical and legal care, and supporting the healing process for victims. However, establishing an effective MDT can be challenging, requiring strong collaboration, a well-defined structure, and dedicated resources.

To address this need, the protocol developed by ICMEC CH provides an adaptable framework that allows any country or organization to establish or strengthen its own MDT. This protocol is designed to be customizable, ensuring that it efficiently meets the specific needs of each context.
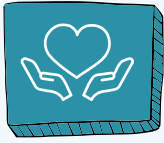
E-learning-based training programs for passenger transport personnel addressing to identification and assistance possible THB and CSA/CSE victims

Partner: TRI

Raising awareness and training transportation personnel are fundamental for identifying and understanding human trafficking. Although there is some training available in this area, a clear need has been identified to provide accessible and engaging training that enables these professionals to recognize the indicators of this issue.

With this in mind, an e-learning course has been developed specifically designed to raise awareness and train transportation personnel. This course is available for free online on the HEROES website, allowing participants to access valuable resources from anywhere.

5 INTERESTED?

What's Next?

The commitment of HEROES partners into the fight against CSA/CSE & THB won't end upon the project's conclusion. LEAs who are interested in any of the KERs described in this document are welcome to approach the project's coordinators in order to jointly discuss their potential evolution and exploitation. Our experience, not only developing preventative and forensic tools but also making field investigations in CSA/E & THB hotspots located in Asia and Latinamerica, is at their disposal .

Furthermore, to leverage the HEROES project results, the partners have identified the following directions:

- Following the available innovation uptake tools, evolve HEROES technology to release profesional tools at the disposal of LEAs
- Use the SANDBOX facilities operated by Europol for enhancing the performance of AI-based HEROES' tools. This will be achieved training the AI-models with real data coming out from closed cases
- Explore Interpol facilities to evolve and maintain HEROES tools
- Continue exploring the links between THB and CSA/CSE and identify new field scenarios in which HEROES KERs and their evolution might assist LEAs and NGOs in their continue fight against these exacrable crimes
- Push the evolution of Prot Act- cluster getting the involvement of new projects that are addressing prevention and investigation of CSA/CSE as well as victim assistance

CONTACTS

For any general inquiries or to learn more about the HEROES project, please contact us at heroes@ucm.es. For specific information regarding individual key results, you can reach out directly to our partners using the contact details provided below. We are eager to assist you and explore potential collaborations in our collective efforts to address CSA/CSE and THB.

UCM: javierv@ucm.es

UNIKENT: b.arief@kent.ac.uk

IDENER: pablo.gallegos@idener.ai

INRIA: francois.bremond@inria.fr

VUB: Nadine.El-Dekmak@vub.be

ICMPD: madalina.Lepsa-Rogoz@icmpd.org

KOPZI: centras@anti-trafficking.lt

APAV: mafaldavalerio@apav.pt

RENACER: Fundacionrenacer@fundacionrenacer.org

ARC: fran.casino@gmail.com

ICMEC: pramirez@icmec.org

CWCS: cwcs.bd@gmail.com

TRI: pinelopi.troullinou@trilateralresearch.com

KEMEA: a.pothoulaki@kemea-research.gr

GCR: k.vlachopoulos@gcr.gr

ASBRAD: projetos@asbrad.org.br

HP: v.roussakis@astynomia.gr

GDCOC: projects-GDCOC-mol@mvr.bg

ESMIR: pfernandez0003@policia.es

SIEE: magda.trindade@minterior.gub.uy

BFDP: rafaellaparca@gmail.com

PRF: alberto.torres@prf.gov.br

GI-TOC: livia.wagner@globalinitiative.net

HEROES social networks:

LinkedIn
https://www.linkedin.com/in/heroes-fct/

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https://twitter.com/heroes_fct

Facebook
https://www.facebook.com/heroesfct

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