STARLIGHT

Sustainable Autonomy and Resilience for
LEAs using AI against High Priority Threats

Newsletter Issue #3, December 2024

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MESSAGE FROM THE PROJECT COORDINATOR

Welcome to the third edition of the STARLIGHT newsletter!

As we reflect on the past year, the STARLIGHT project has continued to demonstrate significant progress in fostering AI adoption for European Law Enforcement Agencies (LEAs).

We are now entering the fourth and final year of the project, having reached several key milestones across technical, ethical, and operational domains. The past year has been marked by extensive collaboration among our 50 partners across 18 European countries, including 15 LEAs.

STARLIGHT has continued to make significant contributions as part of the H2020 framework, advancing security-focused research and innovation. Our consortium has been active in co-development cycles, pilot demonstrations, and workshops, testing advanced AI tools tailored to LEA needs. The 3rd Pilot held in Lisbon, alongside the 5th ToolFest, allowed us to test and demonstrate our tools in real-world scenarios and receive invaluable feedback from end-users to inform their final refinements.

From the technical perspective, over 50 AI tools have been developed or enhanced, addressing real-world challenges in law enforcement.

All the tools in the co-development cycles will be assessed under the Accountability Principles for AI (AP4AI) framework, aligning with the EU AI Act and setting a clear and concrete path toward compliance with ethical, legal, and societal expectations. This progress reinforces STARLIGHT's commitment to transparency, accountability, and the protection of fundamental rights in AI applications.

Our dissemination and communication efforts have remained a key pillar of the project. In this period, STARLIGHT produced an expert video series, attended high-profile conferences such as the InCyber Forum, RISE-SD and CERIS annual events, and actively engaged with the AI and security community. These activities have strengthened STARLIGHT's outreach to policymakers, industry leaders, and civil society.

As we approach the final stages of the project, the STARLIGHT consortium remains committed to ensuring that our tools, frameworks, and research have a lasting impact on LEAs and their ability to navigate the complexities of modern security challenges.
I encourage you to stay engaged with our journey through our website, social media channels, and upcoming events.

Thank you for your continued support as we work together towards a safer, more secure Europe.

Warm regards,
Dr. Nizar Touleimat, CEA-List

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 101021797.

HIGHLIGHTS OF YEAR THREE

We have had a busy 12 months since our last update and are pleased to share an overview of the events and activities we have been involved in during the third year of our project.

October 16th to 17th, 2024: Research and Innovation Symposium for European Security 2024 (RISE-SD), Chalkidiki, Greece.

September 26th, 2024: The ALIGNER Project Final Event, Leuven, Belgium.

September 25th, 2024: CERIS Annual Event, Brussels, Belgium.

September 20th, 2024: ENACT Annual Event, Lisbon, Portugal.

September 19th, 2024: Innovation Uptake in Policing Conference, Vilnius, Lithuania.

September 17th to 20th, 2024: Security Essen 2024, Essen, Germany.

September 13th, 2024: European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases, Vilnius, Lithuania.

June 21st to 23rd, 2024: ESS Security Colombia 2024, Bogotá, Colombia.

May 27th, 2024: LREC-COLING 2024, Joint International Conference on Computational Linguistics, Language Resources, and Evaluation, Turin, Italy.

May 24th, 2024: LAGO's 1st Workshop, Paris, France.

May 22nd to 23rd, 2024: Security Mission Information and Innovation Group (SMI2G), Paris, France.

May 21st to 23rd, 2024: IOT Solutions World Congress 2024, Barcelona, Spain.

May 21st, 2024: CERIS Workshop on Impact of Climate Change on Security Practitioners, Brussels, Belgium.

May 13th to 14th, 2024: The ALIGNER 7th Workshop, online.

May 8th to 9th, 2024: TECNOSEC, Madrid, Spain.

April 16th to 18th, 2024: Expo Seguridad Mexico 2024, Mexico City, Mexico.

April 15th to 16th, 2024: CYCLOPES Dissemination Event, Vienna, Austria.

March 26th to 28th, 2024: InCyber Forum, Lille Grand Palais, France.

March 25th to 27th, 2024: CEPOL Workshop on Artificial Intelligence, Budapest, Hungary.

March 5th, 2024: CERIS—Foresight and Key Enabling Technologies, Brussels, Belgium.

December 14th to 15th, 2023: CERIS Fighting Crime and Terrorism/Resilient Infrastructure Annual Event, Brussels, Belgium.

November 29th to 30th, 2023: GRACE Project Final Event, Madrid, Spain.

October 24th to 25th, 2023: Security Research Event (SRE) 2023, Brussels, Belgium.

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MAIN ACHIEVEMENTS IN YEAR THREE

As **Work Package 2 (WP2), STARLIGHT Framework specification for trustworthy, accountable, responsible, and transparent AI in support of LEAs,** progresses into its final stages, efforts remain focused on creating a sustainable community that fosters a cohesive AI landscape for law enforcement agencies. This includes ensuring that tools and frameworks meet operational needs while upholding ethical and transparent AI practices.

The Orchestrator platform, developed under WP9, plays an important role in enabling collaboration and interoperability across STARLIGHT tools. It simplifies complex data processing by allowing LEAs to execute multi-stage tool pipelines through a unified interface, eliminating the need to interact with individual tools. While the core functionality has been rolled out, additional components are scheduled for completion to enhance its capabilities.

Over the past year, WP2 has facilitated hands-on engagement with practitioners during events such as the General Assembly in Lisbon. These sessions allowed LEAs to test and evaluate tools within realistic scenarios, providing feedback on functionality, reliability, and ethical considerations.

Moving forward, WP2 is working closely with technical partners to finalise the remaining components, ensuring the tools align with LEA operational requirements while adhering to ethical and legal standards.

WP3, STARLIGHT community building and management of the project, has played an essential role in building and managing the STARLIGHT community, focusing on a shared approach for gathering end-user requirements and guiding solution development.

Over recent months, WP3 has worked closely with the European Anti-Cybercrime Technology Development Association (EACTDA) to develop a streamlined approach, from need identification through to solution industrialisation.

This methodology, intended as a model for future European projects, forms the foundation of WP3's current efforts to implement co-development cycles (CODEVs) that reflect the highest maturity levels for LEA tools.

WP3 is finalising the selection of CODEVs to launch an exploitation phase by the end of 2024. A kick-off meeting is planned to initiate the official process of deploying the STARLIGHT tools in operational contexts.

This transition from development to practical application marks a significant step in strengthening the STARLIGHT AI Community of Expertise, ensuring that collaborations among LEAs, technical experts, and industry partners remain active beyond the project's completion. In partnership with the Lithuanian Cybercrime Centre of Excellence for Training, Research, and Education (L3CE), WP3 is also preparing CODEV teams to participate in the upcoming Innovation Uptake workshop in Vilnius, scheduled for January 2025. This workshop will further reinforce STARLIGHT's engagement with its community and deepen its impact.

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WP4, Ethical, legal, societal, and privacy impact and assessment, has recently achieved several milestones, including the submission of three key deliverables on privacy by design, algorithmic bias, and practitioner acceptance.
Ethics and legal checks were completed for the third pilot, and indicators for the TRL Calculator were updated to support ongoing project evaluations.
Looking ahead, WP4 will focus on producing actionable guidance for upcoming deliverables to continue to ensure that technical work packages align with legal and ethical standards. Partners have also conducted meetings and prepared responses to the Second External Ethics Check Report by the European Commission.
The next priority for WP4 is to finalise actionable to-dos and key takeaways for the next deliverable. These will be incorporated into CODEV mission guidance letters to help technical work packages fully comply with ethics and legal requirements.

WP5, European Training/Testing Datasets fostering AI in support of LEAs continues to make progress with data preparation, having uploaded 12 tools and 66 datasets to the STARLIGHT repository, accessible to LEAs upon request. The scheduled deliverable was submitted on time, and work on the next one is on track for December.
Documentation on legal and ethical considerations for each dataset is now complete, and an amendment to extend WP5 activities with a final deliverable is under review to ensure thorough monitoring of these aspects until project end.

WP6, AI-based multi-source data sensing and understanding remains highly active, with over 50 tools either developed from a low TRL or adapted and enhanced during the project. These tools support all WP6 tasks, with 24 reaching higher TRL levels and participating in project pilots.
Thirteen CODEV tasks are underway, utilising over 30 tools, with plans for new tools and collaborations to enter the final CODEV cycle.
Showcasing these tools at the project's ToolFests has fostered fruitful collaborations between tool providers and LEAs. Discussions have also begun on adopting the most mature tools through EACTDA's Tools4LEAs initiative.
In parallel, WP6 is advancing compliance efforts with early implementations of the Accountability Principles for AI (AP4AI) framework to align the tools with the EU's AI Act requirements. GDPR and data compliance are ensured through structured procedures, while independent ethics committees provide oversight and approvals to support ongoing activities and assess potential future impacts.

Most tasks in **WP7, AI-based tools supporting enhanced LEAs' investigation and intelligence capabilities,** have been involved in co-development cycles and tool presentations at the Lisbon General Assembly ToolFest back in September 2024.
Achievements for the past year include the completion of the backend for the knowledge base, providing a strong foundation for investigation support, and the development of a Multimedia Search and Exploration Tool that gained significant interest at the ToolFest and was accepted at the CBMI 2024 conference.
The Clustering Tool was enhanced with new functionality, enabling users to reorganise topics based on feedback from real-case scenarios, improving document grouping and adaptability to new data.
The Entity Fusion Toolset, Crowd Analysis Tool—capable of tracking individuals in CCTV footage and reprojecting them into a Bird's Eye View—and the Dark Vessel Detector were further refined and successfully demonstrated.
Additionally, the Geo-Temporal Crime Forecasting Tool released its first version, now dockerised for streamlined deployment, while the Trend Detection Tool continues to advance.
An explainable tool for cybersecurity scenarios was developed to enhance investigative transparency, and a simulation tool was created to generate crowd scenarios for training AI algorithms.
These tools are being continually refined based on user feedback during pilot demonstrations, ensuring they meet LEAs' operational needs and support the project's goals.

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In months 30 to 36, **WP8, AI-based tools supporting enhanced LEAs' investigation and intelligence capabilities,** focused on advancing AI-based cyber defence solutions, particularly Network Intrusion Detection Systems (NIDS), to enhance LEAs' investigation and intelligence capabilities.

Our researchers fine-tuned AI algorithms, increasing detection accuracy and reducing false positives.

A notable innovation was the introduction of a forensic mode for offline network data analysis, addressing LEAs' need for detailed examination of network traffic.

A key achievement was the development of the Trustworthy Cyber-Attack Detector (TCAD), leveraging machine learning and granular computing methodologies to detect and classify network threats with high precision. TCAD analyses NetFlow traffic over varying time windows, significantly enhancing detection accuracy.

Furthermore, integrating NIDS with explainable AI (xAI) capabilities enables a more interpretable framework for analysing cyber threats.

Two scientific papers presented at ARES 2024 showcased these advancements, highlighting STARLIGHT's contributions to trustworthy AI-based cyber-attack detection and innovative approaches to network security.

Ongoing efforts are focused on refining these tools to address the complex and evolving needs of LEAs.

WP9, STARLIGHT Framework for trustworthy, accountable, responsible and transparent LEA AI solutions is focused on creating a framework that empowers LEAs with the AI tools and resources they need to tackle a variety of challenges.

Through WP9, we're providing LEAs with an integrated platform that allows them to share and use AI tools, datasets, and models collaboratively.

This framework is anchored by three key components: the Repository, the Orchestrator, and Federated Analytics, each designed to enhance how LEAs interact with data and tools.

The Repository is a marketplace where technical partners can upload their tools, models, and datasets. With over 100 active users from both LEAs and technical teams, the Repository serves as a dynamic space for resource sharing and discussion. Thanks to containerisation approaches, deploying new tools is quick and seamless, enabling efficient tool integration.

The Orchestrator simplifies complex data processing by allowing LEAs to run multi-stage tool pipelines without interacting with each individual tool. This streamlined approach supports a consistent user experience and removes the need to navigate different interfaces.

Meanwhile, the Federated Analytics component offers secure, distributed statistical analysis. Using a central STARLIGHT server, each LEA data remains local and anonymous while contributing to a larger, collective insight shared across the network.

These components collectively support STARLIGHT's mission to provide LEAs with practical and secure AI resources.

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In its third year, **WP10, Pilot demonstration and user evaluation in operational environments**, is approaching the project's final phase. The third pilot, which was successfully completed at Polícia Judiciária's premises in Lisbon in September 2024, provided valuable insights from end-users, furthering tool optimisation based on LEA requirements.
The project's seven planned pilots, encompassing both online and in-person events, continue to evaluate STARLIGHT tools against practical scenarios, with the TRL assessment tool supporting ongoing evaluation efforts. The 4th pilot is scheduled for December 2024 and will be held online.

WP11, Fostering the adoption of AI in support of the EU LEAs, has advanced its dissemination and communication efforts, focusing on expanding project visibility and impact. Key activities include producing expert video interviews, participating in major events, and engaging stakeholders.
The expert video series features insights from STARLIGHT consortium researchers and practitioners, exploring AI's ethical, legal, and societal implications for law enforcement. Dissemination efforts have also included participation in workshops with related projects and events like the CEPOL Workshop on AI and the InCyber Forum.
We have maintained an active online presence through regular updates on X (formerly Twitter), LinkedIn, and the project website, which serves as a key resource. Over the last period, four deliverables have been submitted, highlighting progress across the work package.
The dissemination strategy has evolved with multi-modal campaign activities, including follow-up action plans and participation in the Lithuanian Innovation Uptake in Policing Conference. Exploitation efforts have focused on CODEV results, policy recommendations, and pathways for AI-driven transformation of EU law enforcement agencies.
Work continues on standardising best practices, developing performance indicators, and facilitating AI Act compliance. This includes deploying a self-assessment tool for CODEVs to align with EU AI Act requirements.

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STARLIGHT Spotlight: Advancing Collaborative AI for Law Enforcement

DARK WEB CATEGORISATION WITH COLLABORATIVE AI

BY SANDER BRINKHUIJSEN AND DR. MARK VAN STAALDUINEN (CFLW), MADELON MOLHOEK AND DR. SASKIA LENSINK (TNO)

In the current digital age, law enforcement agencies face increasingly complex challenges as criminal activities shift to digital environments and grow in scale. Analysing large volumes of crime-related data demands sophisticated tools to identify online threats and categorise illicit activities. Artificial Intelligence (AI) has emerged as a powerful tool in this space, offering speed and scalability. However, responsible AI deployment requires more than technical proficiency; it calls for a balanced approach that combines AI with expert oversight to mitigate risks and ensure trustworthy outcomes. This article explores Collaborative AI, a framework that combines the strengths of AI and experts for responsible implementation of AI.

Necessity of AI for Data Analysis

Data's vast and diverse nature presents a considerable challenge for manually analysing large amounts of data. Within CODEV ID06 of the STARLIGHT project, CFLW Cyber Strategies (CFLW) works with the European Union Agency for Law Enforcement Cooperation (EUROPOL), the Swedish Police Authority (SPA), the Technological centre specialising in Artificial Intelligence, Visual Computing and Interaction (Vicomtech), the Centre for Research and Technology Hellas (CERTH), the Centre of Excellence in Terrorism, Resilience, Intelligence & Organised Crime Research (CENTRIC), Engineering Ingegneria Informatica (ENG), and TNO to develop solutions for processing large-scale datasets.

Through the Dark Web Monitor, CFLW has scraped billions of pages from the Dark Web, collecting terabytes of data. Processing this data manually would not be feasible, given its volume and complexity.

AI proves invaluable in such cases, providing the means to rapidly process, categorise, and analyse large datasets, enabling law enforcement agencies to quickly identify the most relevant information, detect patterns, and prioritise their investigations more effectively.

While AI provides scalability and consistency, algorithms lack contextual understanding, which can lead to misinterpretation of key data points. Criminal behaviour and tactics constantly shift, and models trained on older data can quickly become outdated, losing effectiveness.

Effective AI must be updated continuously to adapt to new criminal tactics and emerging trends. This “life-long learning” concept applies as much to AI models as to the experts who manage them.

The Collaborative AI Framework

Collaborative AI is a framework for responsible implementation of AI structured around the human-in-the-loop approach. This approach ensures that domain experts actively engage with AI systems throughout their lifecycle, monitoring behaviour and intervening when necessary.

Standardised performance metrics like accuracy and precision provide a good initial indication of an AI’s effectiveness, but these metrics are not sufficient in a real-world environment.

Collaborative AI extends beyond relying on quantitative metrics, advocating for qualitative assessments that involve reviewing misclassifications to uncover biases or other unexpected behaviours that could compromise model trustworthiness.

Before deploying a model in operational settings, domain experts must confirm its consistency and transparency, ensuring no indication of unpredictable or unexplainable outcomes.

This focus on transparency safeguards against potential misuse and bolsters confidence in AI systems, establishing a foundation of accountability and ethical application.

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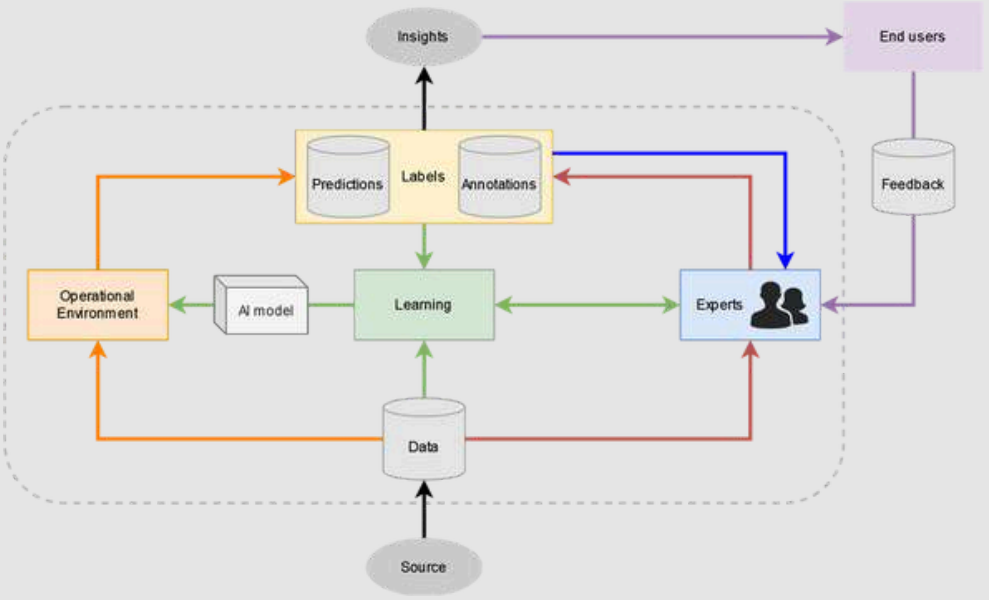
Bridging the Gap: Human Expertise and AI in the Fight Against Crime

Furthermore, Collaborative AI recognises that both AI and experts are susceptible to errors. AI systems, particularly in production environments, are imperfect and bound to produce misclassifications. Likewise, experts introduce mistakes due to cognitive limitations like fatigue.

Collaborative AI addresses these challenges through a bidirectional feedback loop. Experts can correct AI misclassifications and feed these adjustments into the model during retraining. Conversely, AI systems can request expert input on ambiguous or challenging cases. This mutual exchange of feedback fortifies the model's accuracy and reliability, while helping experts remain attuned to emerging patterns.



Collaborative AI Framework for Responsible Dark Web Data Analysis

Conclusion

As AI becomes an integral part of law enforcement's fight against crime, Collaborative AI presents a responsible, forward-looking approach that leverages the strengths of both AI and experts. AI provides scalability and data-driven consistency, while experts contribute contextual knowledge, adaptability, and a nuanced understanding of complex cases. This Collaborative AI framework improves the quality of AI systems. It builds trust, establishing AI as a trusted ally in law enforcement's mission to uphold security in a rapidly digitalising world.

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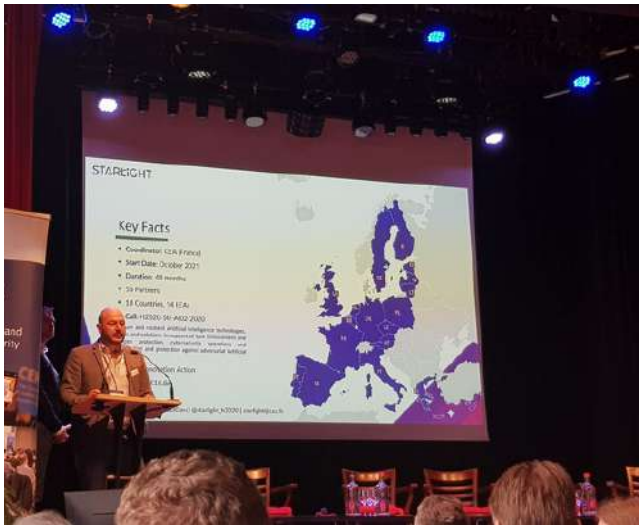

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Project Details

- **Project title:** Sustainable Autonomy and Resilience for LEAs using AI against High priority Threats.
- **Starting date:** 01/10/2021.
- **Duration in months:** 48.
- **Topic:** SU-AI02-2020, Secure and resilient Artificial Intelligence technologies, tools and solutions in support of Law Enforcement and citizen protection, cybersecurity operations and prevention and protection against adversarial Artificial Intelligence.

Strategic Goals

- Improve the widespread **UNDERSTAND**ing of AI across LEAs.
- Provide opportunities to LEAs to **EXPLOIT** AI tools and solutions.
- Ensure that LEAs can **PROTECT** their own AI systems.
- Raise LEAs' expertise and capacity to **COMBAT** the misuse of AI-supported crime and terrorism.
- **BOOST** AI for LEAs in Europe.

Consortium

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