Abstract Submission-Problem VII

AI-BASED CCTV & DIGITAL MEDIA FORENSIC ANALYSIS

Team Name: SPD - **Project Name:** Corinthian

Project Members: Lakshya Tambi, Kanishk Malhotra, Nirek Agarwal

Explanation of the Problem Statement

The investigators of today are overburdened. They must contend with an overwhelming volume of digital evidence, such as innumerable hours of CCTV footage and a vast quantity of disorganized digital files. Examining everything by hand takes a very long time and is very prone to human error.

Because of this manual method, it is nearly impossible to establish a clear timeline because it is difficult to:

- Identify specific people or vehicles within hours of footage.
- Correlate their appearances across different videos, even when they are from different cameras or times.
- Reveal hidden information from the files, like the device used or the time and location of creation.
- Identify possible evidence manipulation or tampering.
- Create a thorough, well-structured, and court-ready report outlining the results.

Ultimately, this slow, manual process means investigations are not only inefficient but also at risk of missing crucial evidence, losing time, and presenting findings that lack the complete integrity required for court.

Proposed solution

We will develop Corinthian, a robust yet user-friendly web application that revolutionizes the handling of digital evidence, after observing the difficulties faced by investigators.

How It Works

Our python-based system kicks in as soon as an investigator uploads a video. To ensure the file's integrity, it generates a distinct digital fingerprint (SHA256 hash). It automatically recognizes and tracks each person and vehicle in the video using AI tools like YOLOv8 and ByteTrack. It goes one step further for each individual, generating a biometric signature that can be compared to your internal database of known criminals.

Additionally, Corinthian will actively search for indications of tampering, like inconsistent timestamps. A tamper-evident audit trail will securely record each action, providing a transparent record of the evidence's handling.

The entire process is made efficient and reliable by the system, which then aggregates all of the findings (snapshots, timestamps, and hashes) into a polished, court-ready PDF report. You can search a timeline and create a report with just one click.

Features of the final solution to be designed

• **Evidence Integrity:** Using automatic SHA256 hashing and full metadata extraction (exiftool), we guarantee file integrity.

• **Advanced Detection & Tracking:** YOLOv8 detects people and vehicles with ≥80% mAP@0.5 accuracy, while DeepSort generates a persistent, time-stamped log of each object's movement.

• **Onboard Facial Recognition:** It will match faces against an internal offender database, creates distinctive embeddings (InsightFace).

• **Tamper-Proofing:** We will incorporate practical ways to identify indications of tampering, including anomalies in per-frame hashing, inconsistent timestamps, and re-encoding markers.

• **Court-Ready Reporting:** All significant findings and hashes are included in a one-click forensic PDF export (ReportLab). An HMAC signature can be used to further secure reports.

Enhancements

• **Easy Dashboard:** The Streamlit dashboard offers a simple interface for downloading evidence bundles (PDF, JSON, and CSV), uploading files, and viewing timelines.

• **Secure Auditing:** A role-based approval flow guarantees accountability for final reports, and an append-only SQLite audit log records each action.

• **Flexible Deployment:** The solution will support both CPU and GPU modes for a range of hardware environments and is simple to deploy using a Dockerfile.

Reason for opting for the Problem statement

For our team, this project is very personal. Despite the fact that the thief was clearly caught on CCTV, the footage was insufficient to identify the person who stole one of our members' bikes. We are motivated by this frustration; the sense that important evidence may be right there but still be useless. Our goal is to use these experiences to develop a solution that guarantees each video clip can help solve a crime and bring about justice. Making a significant impact is more important than merely solving a technical problem.

Past expertise in the area

Our team brings a unique set of skills to the project. One of our members has built an antivirus prototype that uses file hashing to detect malware and has practical experience implementing SHA256 hashing. This ability is ideal for producing safe, unchangeable reports and guaranteeing the integrity of the evidence. The remaining members of the team possess knowledge of algorithms and data structures. This indicates that we're not merely creating a system; rather, we're refining it to effectively manage enormous volumes of video data. Our ability to process thousands of video frames and produce secure hashes quickly is essential for creating a forensic tool that is both scalable and dependable.