PETRÉTEI, DÁVID

Generative AI at the crime scene?

Introduction

The Nobel Prize in Physics 2024 was awarded jointly to John J. Hopfield and Geoffrey E. Hinton *„for foundational discoveries and inventions that enable machine learning with artificial neural networks"* – this was in the news on the 8th of October, 2024, just the next week after I held my presentation in front of the ENFSI Scene of Crime Expert Working Group annual meeting plenary, in Budapest. The ENFSI is the European Network of Forensic Science Institutes, which should always pursue the most up-to-date forensic solutions, at least theoretically.[1]

Forensic science has already started to utilize different types of artificial intelligence, mostly pattern recognition, and prediction functions.[2] In this study, a specific type of generative artificial intelligence, the large language model (LLM) is covered, and the possibility of its utilization for crime scene report writing is explored.

Direct observation or inspection is one of the oldest methods of evidence gathering, as everything that was not said by the parties in front of the authorities (confessions), but perceived by the authority or the court itself, can be considered an inspection. Crime scene investigation is an inspection, a direct observation. According to the oldest legal provisions, the weapon

---

[1] Source: https://www.nobelprize.org/prizes/physics/2024/summary/
Accessed: 15.11.2024
[2] Lontai, M. – Pamjav, H. – Petretei, D. (2024): Artificial Intelligence in Forensic Sciences Revolution or Invasion? Part I. Belugyi Szemle 2024/4. 701-715.
Source: https://doi.org/10.38146/bsz-ajia.2024.v72.i4.pp701-715
Lontai, M. – Pamjav, H. – Petretei, D. (2024): Artificial Intelligence in Forensic Sciences Revolution or Invasion? Part II. Belugyi Szemle 2024/8. 1513-1526.
Source: https://doi.org/10.38146/BSZ-AJIA.2024.v72.i8.pp1513-1526

causing the injury, the wounds, and the torn clothing must be shown to the authority or the court, conducting the proceedings so that it can be considered. Today, crime scene investigation is only one type of inspection; from a criminalistic point of view, what the experts do during the examination is also an inspection. Henceforth, I will refer to these inspections as crime scene investigations as well.

The three most important results of a crime scene investigation are proper documentation, pieces of evidence that are recorded in a way suitable for further investigation, and synthesis, which is a comprehensive evaluation of the state and changes present at the scene to form hypotheses.[3]

Crime scene documentation

In this paper, I focus on proper documentation. Nowadays, in addition to the traditional written materials, i.e., an official report, abundant photo documentation is almost always prepared, usually arranged in a photo attachment, and rarely inserted as a text figure in the report itself. The Hungarian police have been working exclusively with digital cameras for about twenty years now, and in recent years, it is no longer required to print digital images on paper, so there is no financial or logistical limit to the number of photos.

Video recordings (referred to as *„image and sound simultaneous recordings"* in our procedural regulations) are also regularly made in cases involving criminal offenses. It should be noted that continuous image and sound recording is not mandatory during a crime scene investigation, therefore it is possible to record relevant events with several short, few-minute-long shots (e.g., undressing a dead body, or any verbal statement of an expert consultant). The continuous recording of video with sound is primarily used for legal effects and functions (the written report does not have to be

---

[3] Petretei, D. (2018): The crime scene in the light of standardization trends and the new procedural law. Rendorsegi Tanulmanyok 2018/3. 4–48
Petretei, D. (2020): Offender profiling and crime scene analysis. Rendorsegi Tanulmanyok, 2020/1. 3-49

prepared concurrently with the scene investigation, the content of the report does not have to be read out, etc.). The continuous operation of a video camera mounted in a corner is not a legal requirement during a crime scene investigation, and it usually does not make much sense either.

Today, three-dimensional visualization of scenes is practically not only possible but also increasingly widespread, even in Hungary. This requires laser scanners, structured light scanners, or simple cameras used for the photogrammetry method. Perhaps the significance of spatial digital images does not need to be emphasized so strongly: scenes can be explored, and pieces of evidence can also be observed from all sides.[4] Some pieces of evidence recorded in 3D can even be printed and morphologically precise plastic copies can be handed to the judge or the accused.[5] In the future, scenes may even be navigable in virtual reality, although initially, it would probably undermine the dignity of the court trial, if the prosecutor and defender, wearing a VR helmet that covers their face, were to duel on the scene virtually, but physically present in the courtroom.

Some smartphones even come with lidar, i.e., laser scanners, and applications capable of displaying mixed reality. Examples of these are the Apple iPhone 12 and the models above. These are not primarily intended for criminal justice purposes, but for example, when buying furniture, we can scan the chair in the store with our phone and place it in the 3D image of our living room to see if it will fit and how it will look. These laser scanners have a range of only a few meters, even in the most expensive phones, and are not a match for tripod scanners or photogrammetric images made up of several hundred photos created by a professional, but that is not their purpose either. In the future, even patrol officers may be equipped

---

[4] Metzger, M. – Ujvari, Zs. – Gardonyi, G. (2020): Application of photogrammetry for forensic purposes: reconstruction of scenes, bodies, objects in three dimensions. Belugyi Szemle 68(11):57-70, source: https://doi.org/10.38146/BSZ.2020.11.4

[5] Fulop, P. – Ujvari, Zs. – Petretei, D. – Kiss, Is. – Dudas-Boda, E. – Metzger, M. – Fullar, A. (2023): Modern Tools and Possibilities for Illustrating Expert Witness Testimonies. Ugyeszek Lapja 30 (5-6) 91-102

with such devices to record the situation in three dimensions upon arriving at the scene, while arresting the offender or aiding and rescuing the victim.

Even today, a high-quality scene sketch that highlights the essentials can be of great service. The vast majority of these are no longer made on classic green millimeter paper but with various computer applications. Typically, it is an overhead view, but it can also be a three-dimensional figure.

The report

Despite the advanced technologies for scene documentation, written reports remain an essential tool in criminal investigations. Even if the photo documentation is comprehensive, it cannot replace the observation and analysis made by an experienced investigator. Therefore, the written report is an indispensable part of scene investigations, and remains a vital component of crime scene investigation, requiring careful attention and personalized human input to be effective.

However, writing a report takes time and requires energy. The use of technology, such as speech-to-text and other tools, can make reporting more efficient, but this is still only a partial solution since it's important to write in professionally coherent, grammatically correct, and elegantly structured sentences. Furthermore, the finished text will likely be unstructured, since if we say, *„new paragraph"*, most speech-to-text software will also write that down, rather than making a new paragraph.

However, advanced language models can take sentence and word characteristics and shape them into elegant, well-formed sentences. They can handle human expressions, such as *„the floor is covered by carpeting with white dots on a green background... dark green in the background... the dots are more yellow, each one is four... no, four and a half centimeters apart... let the carpet be malachite green"*. If artificial intelligence knows what the expected output is - a structured report using professional technical terms - it can turn these fragmented pieces of information into paragraphs and complete sentences.

To test this hypothesis playfully, I downloaded the American Open AI company's ChatGPT 4 application, which is available for free for anyone and is possibly the most well-known language model on the market, onto my tablet. The first time, I asked it to write a report for a crime scene investigation of a car break-in. The result was shockingly good, with the most frightening thing being that all I gave as instructions (the so-called „prompt") was that, and yet a complete report was produced. This means that it made up the location, date, car type and model, breaking method, recorded evidence, and stolen items, purely for my entertainment. So, the second time, I gave it certain basic data: the car type, color, location, and which window was smashed. It incorporated all of these into the second report. For the third attempt, I tried to correct its „movie/TV" vocabulary to fit law enforcement jargon. I asked them to call glass „glass fragments" and evidence „an exhibit". I asked it to only consider things that we pack up and take with us as evidence, and to number them, while not numbering other abnormalities but instead calling them „other relevant remnants". The third set of minutes would have been perfectly acceptable at most police stations in Hungary.

This was obviously not scientifically rigorous testing, but rather a playful attempt. Additionally, car break-ins are perhaps one of the simplest types of crime scenes (compared to an arson or a suicide, for example). Despite all of this, the results were surprisingly promising. After two small (a few sentences) corrections, it produced a nearly flawless CSI report. When I asked ChatGPT how it learned to use the word „exhibit" instead of „evidence", it responded that it had learned from the context of other reports and that it would use that term from then on.

What would this high-quality (again: free, and accessible to anyone) technology be capable of, if we were to feed it all the police CSI reports created between 2019-2023 and all the autopsy reports from the four university medical expert institutes, and the Hungarian Institute for Forensic Sciences...? Of course, we can't do that, yet.

Concerns, or where does the ghost of the machine live?

Of course, the LLM operated by a foreign private company cannot be uploaded with real reports: we have no idea where the uploaded material goes, who can access it, and how - legally or in the event of a possible malfunction. Generative AI does not „fit" on a tablet or a phone. What we have on our device is just an endpoint; the substantive work takes place on powerful servers, somewhere in America, or perhaps in the Far East.

This is also the reason why the police do not use open source „speech-to-text" services to write reports: it is not known whether someone can copy the voice messages while they travel to the servers and back, or if someone can listen in, it can be subject to analysis, search, etc. In the case of criminal data and special personal data, such uncertainty is inadmissible.

What is the solution, or my innovation proposal?

Now, a few large companies dominate the generative artificial intelligence market, and their products can be used for free or at varying costs. However, open-source generative artificial intelligence is also being developed rapidly. For the time being, these do not match the products of large companies, but in the near future they are expected to reach the level of free platforms, e.g. represented by ChatGPT 4. And that is more than enough.

Once an open-source LLM reaches the level of current corporate LLMs, the Police or the Ministry of Home Affairs can get one immediately. It can be installed on a high-performance server purchased and set up just for this purpose only, which can immediately be isolated safely and securely protected against external interference. After that, tens of thousands of police reports or official records from the police's integrated administration system can be easily fed into it for training purposes. The same could be done with the autopsy reports of medical schools and the Hungarian Institute for Forensic Sciences, supplemented by legal and forensic handbooks and articles freely available in university repositories, as well as the legal

material of the National Database of Laws and Decrees, and the library of court decisions.

The next step would be for some volunteers, preferably trainees or former crime scene investigators or prosecutors, to start „teaching" the system. That is, they would generate reports with it, based on various imagined scenarios, specifically to correct possible errors, correct the use of words, identify confabulation, etc. In parallel, a small volunteer team of medical experts and residents would perform the same task concerning autopsy and autopsy reports. In practice, after switching on the server, the text corpus can be loaded literally in seconds, after which the „teaching" would take no more than a week.

After that, it is only a matter of a secure data connection so that the LLM-based inspection report can run on the tablets that are already regularized by the crime scene investigators. The „speech writing" function would be handled by the system via the same secure data connection; the device's microphone could even be disabled for other services. In this way, on the spot, the writer of the minutes could even have both hands free: what they said, his findings, descriptions, and measurement results would be transformed by the artificial intelligence into well-structured reports that use professional language and consist of complete sentences.

From there, it is only a step, which is science fiction for now, that the AI could ask for clarification if something is not clear to it, or if it detects an irresolvable contradiction in the communication. Also, the AI might suggest something if prompted *(„this is a rattan piece of furniture... what kind of powders are usually used to develop latent prints on it?")* - science fiction is when the protocol proactively suggests actions or corrections without being asked. However, this will probably be just one or two steps away from putting the system into operation.

Closing

Everything I have outlined is the reality of the near future. As early as the first months of 2025, an open-source LLM may emerge that is comparable to the capabilities of the current large language models and could be used to create the text of protocols. A high-performance server on which the system can be run costs no more than the price of a mid-range passenger car. The endpoints could be tablets that are already available.

I would like to point out that, to the best of my knowledge, such development is not taking place anywhere in the world. So far, not a single police force or expert institute uses a large language model to write the text of reports, and I have not found such a thing among the exponentially growing number of publications related to artificial intelligence.

This kind of utilization of artificial intelligence is completely worry-free, it does not make or support human decisions, and it does not consider the dangerousness or suspiciousness of people. It just helps the work as an educated scribe would.

Finally, let's consider: the world changes even if we do not.