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AI Technologies in Forensic Tactics

Abstract: The Bar Association of the Republic of Azerbaijan, in cooperation with the International Organization for Legal Research and the Department of Law of the National Aviation Academy, has developed a model (an intelligent system) of a synchronized assemblage of methodologies — generative artificial intelligence, program evaluation and review technique (PERT), network forecasting and management, probabilistic logic, and others — which can be successfully applied to the construction of forensic (criminalistic) investigative tactics for a criminal case and the execution of individual investigative actions.

The system will enable investigators to clarify a number of issues relevant to determining the direction of the investigation. Among them are the following: 1) the nature of the incident that occurred; 2) whether the crime took place at the location being examined; 3) the perpetrators' routes of entry to and exit from the scene (particularly important for locating perpetrators and tracking traces); 4) how many perpetrators were present at the scene and whether they were familiar with the surroundings; 5) the time of the commission of the crime; 6) how long the perpetrators remained at the scene; 7) how the perpetrators moved within the scene and which objects or items they touched; 8) the instruments or means employed by the perpetrators; 9) the objectives pursued by the perpetrators in committing the crime and whether they achieved those objectives; 10) what traces were left by the perpetrators at the scene and what traces remained on them and on their clothing; 11) who could have observed the events at the scene and from which vantage points.

Keywords: information technology; information system; artificial intelligence; forensic tactics; tactical technique; tactics; combination.

A tactical technique is the most rational and effective method of action or the most appropriate course of behavior under given circumstances for an individual conducting an investigative action, organizational or operational-search activity [8, p. 354-356].

In criminalistics, a tactical combination is understood as a specific combination of tactical techniques of investigative actions, organizational and investigative-search activities, applied to solve general and specific investigative tasks and determined by these tasks and the investigative situation [10].

The specific objectives of a tactical combination are:

- creation of conditions for carrying out one or several investigative actions, organizational and operational-search activities;

- creation of conditions ensuring the effectiveness of one or several investigative actions, organizational and operational-search activities;

- resolution of a conflict situation through reflection;

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- ensuring the preservation of sources of information;

-other influences on the investigative situation with the aim of changing or using it [3, p. 152-153].

A tactical combination may consist of a specific integration of:

a) tactical techniques employed within a single investigative action;

b) tactical techniques of various investigative actions, organizational and operational-search activities;

c)identical and different types of investigative actions, organizational and operational-search activities;

d) tactical techniques, investigative actions, organizational and operational-search activities [3, p. 151-152].

A tactical combination is typically carried out within the framework of a specific criminal case the investigation of which, as a whole, represents a combination of certain actions by the investigator and other persons involved in solving the crime.

At the same time, a tactical combination in the investigation of one criminal case may simultaneously serve as a tactical combination for another criminal case or constitute a tactical combination carried out within the framework of the investigation of two or more criminal cases. At the core of such combinations lies information about the interconnection of criminal cases, which after the combination is carried out are merged into a single proceeding or about the connections between persons involved in two cases concerning independent crimes [8].

The combination of tactical techniques from one investigative action with those of another does not constitute a basis for concluding the existence of any kind of combined investigative actions, since each investigative action, being independent is conducted according to a specific procedural order.

Tactical techniques have a similar nature, although they are generally not procedurally regulated, yet are employed in specific situations. Tactical techniques of various investigative actions are combined rather than mixed or intertwined, but they do not replace one another.

A similar nature applies to the combinational combination of investigative actions, organizational measures, and operational-search activities.

A tactical combination - is an open system of tactical techniques, investigative actions, organizational and operational-search activities the elements of which, forming subsystems, determine the type of combination.

Tactical combinations are classified into complex ones, the content of which is a system of tactical techniques, investigative actions, organizational and operational-search activities, and simple ones, consisting of a system of tactical techniques applied within a single investigative action.

Complex tactical combinations are further classified into homogeneous, consisting of identical actions and measures, and heterogeneous (overarching and localized types) consisting of various techniques, actions, and measures.

Simple tactical combinations are subdivided into reflexive ones, whose aim is the reflexive management of a person opposing the investigation, and into securing and controlling ones, carried out to verify the proper course of the investigation, the conduct of individual investigative actions, and so forth [1].

The admissibility of a tactical combination is determined by the admissibility of its objectives, the tactical techniques, investigative actions, organizational and operational-search activities that

constitute its content, as well as by the legality and ethicality of their combination and their impact on the investigative situation and its components [8, p. 396].

In criminalistics and forensic psychology, the issue of the legitimacy of means of influence has been studied in sufficient detail, and the conditions (criteria) for the admissibility of a given technique or influence method necessary for recognizing it as lawful have been clearly formulated. These include:

-legality, i.e., the conformity of a means or method of influence to the letter and the spirit of the law;

- selectivity of influence, i.e., its direction only toward specific individuals while remaining neutral in relation to others;

- morality, i.e., the means of psychological influence must conform to the principles of morality and be ethical [3, p. 220-221].

A tactical technique must not: humiliate the honor and dignity of the participants in the investigation; influence the position of an innocent person by inducing the acknowledgment of nonexistent guilt; justify the commission of a crime and diminish its social danger; contribute to the false accusation of innocent persons or to charging the guilty with a greater scope of liability than corresponds to their actual guilt; foster in the accused or other individuals base motives and emotions, the giving of false testimony, or the commission of other immoral acts; be based on the investigator's oral or written communication of knowingly false information*;undermine the authority of law enforcement agencies and the court [7, p. 165; 9, p. 195].

As noted, the Bar Association of the Republic of Azerbaijan, together with the International Organization for Legal Research and the Department of Law of the National Aviation Academy, has developed a model (an intelligent system) for the use in criminal proceedings of a synchronized set of methodologies of generative artificial intelligence, program evaluation and analysis technique (PERT), network forecasting and management, probabilistic logic, and others [2, p. 20-33], which can successfully be applied to the development of forensic tactics of criminal case investigation and the conduct of individual actions.

The mechanism of the model consists of a complex of the core properties of transformers (Claude (Anthropic), Gemini (Google DeepMind), Mistral Chat, ChatGPT, You.com Chat, Kimi (Moonshot AI), and others), supplied with matrix-structured sources of specialized information and proprietary dialogue algorithms, designed for continuous operation under all possible situations of criminal proceedings. These were developed through modern methods of activity analysis, temporal logical relations, cybernetic techniques of operating with utilities, and other approaches adapted to solving the tasks of criminal procedure[13; 12; 14; 15; 16; 18].

The sources of specialized information include judgments and rulings of the judicial authorities of the Republic of Azerbaijan at all levels in specific criminal cases from September 2000 to the present, procedural documents of inquiry bodies the prosecutor's office and investigative authorities, as well as complaints and motions of the defense in specific criminal cases for the same period. They also encompass references to the official websites of the President of the Republic of Azerbaijan, the Constitutional Court, the Supreme Court, appellate and other courts, the Milli Majlis, the Ministry of Justice (https://e-qanun.az), other ministries and agencies of Azerbaijan, UN subdivi-

*This provision is considered debatable [3; 8; 9].

sions, a number of international organizations, the ECHR and others, altogether more than 60 sources.

All specialized and potentially usable information was generated based on a specially developed block matrix, conventionally designated as object, subject, operational, trace, and background blocks. This approach allowed for a detailed analysis of situations and the construction of logical connections in the process between participants, actions, and consequences

Besides, all databases were systematized according to the following parameters:

a) structural systematization by levels of information: factual level (events, actions, documents recorded in the case); legal level (norms applicable to these facts); evaluative level (opinions of the participants in the process, conclusions of the investigator, prosecutor, court); metadata (source, date, author, authenticity of the information);

b) systematization by stages of criminal proceedings: pre-investigation check; initiation of a criminal case; preliminary investigation; trial proceedings; appellate/cassation proceedings; execution of the sentence;

c) systematization by type of source: procedural documents (protocols, rulings, judgments); parties' opinions (explanations and testimony, complaints, motions); legislative acts; case law; media and digital evidence (video, audio, photos, logs, etc.);

d) systematization by function in the process of proof: prosecution evidence; defense evidence; neutral facts; circumstantial evidence;

e) semantic systematization: use of ontologies (hierarchical models of concepts, e.g., subject - role - action - consequence); cognitive maps (representation of connections between concepts and actions); scenario structures (typical models of behavior or event development, e.g., "detention without protocol - confession - appeal");

f) temporal systematization (chronology): creation of timelines displaying events, their documentation, actions of subjects, shifts in positions, comparison of factual and legal chronology;

g) Systematization according to the degree of reliability/credibility: confirmed facts (judicially established); parties' versions; unverified information; contradictory data [19].

The system of flexible, logically structured dialogue algorithms, synchronized within a matrix in accordance with the fundamental laws of logic and the basic logical operations derived from them, and most importantly, the correlations between the blocks makes it possible to adapt the system to a real user and a specific situation.

The logical connections and contradictions in the actions and decisions forming the algorithms were identified through a methodology of analyzing the arguments, objectives, motives, and consequences of these actions, based on the principles for determining logical relationships and contradictions.

In particular, the algorithms were based on provisions according to which:

- the essence of the causal relationship lies in the fact that if one action leads to a certain outcome, a logical connection is established between them;
- in a goal-oriented relationship, an action is performed for the sake of a specific goal;
- the use of a means to achieve a goal constitutes a logical dependence;
- private actions must logically fit within the overall strategy or value system [4; 5; 6].

Contradictions within the algorithms were minimized through the application of the following principles:

- incompatibility of statements, i.e., the notion that two statements cannot be true simultaneously;

- inconsistency with stated goals, i.e., when actions do not correspond to declared objectives or values;

- discrepancy between words and actions, i.e., when behavior fails to confirm or contradicts stated assertions;

- temporal inconsistency, i.e., when a decision made in the past contradicts a decision in the present without any change in circumstances or logic [17; 13].

Now to the essence of the matter: the application of artificial intelligence technologies in criminalistic tactics. According to Article 139 of the Criminal Procedure Code of the Republic of Azerbaijan, during the conduct of criminal prosecution, the following are established solely on the basis of evidence: the fact and circumstances of the criminal incident; the connection of the suspect or the accused with the criminal incident; the elements of a crime in the act provided for by the criminal law; the guilt of the person in committing the act provided for by the criminal law; the circumstances mitigating or aggravating the punishment provided for by the criminal law; and ehe circumstances on which a participant in criminal proceedings or another person involved in the criminal proceedings bases their request [11].

The above and other provisions of the law schematically define the informational field of criminal proceedings and the instruments (evidence) employed in its formation, while tactics serve as a means of searching for and verifying evidence.

Let us consider the above by examining the tactics of certain investigative actions and organizational measures.

The crime scene examination belongs to the category of investigative actions that, by their very purpose, are primary and urgent. This is explained by the necessity of obtaining information about the circumstances of the event in its initial, unaltered state, since any delay leads to the loss of physical evidence and changes in the trace pattern. The urgency of the crime scene examination is further determined by the need for the prompt acquisition of information for the purpose of organizing the search for the perpetrator, as well as for conducting other investigative actions aimed at solving the crime [8, p. 399].

The tactics of crime scene examination are preceded by the selection of a method that determines the sequence of the inspection. Traditionally, such methods include the concentric method (from the periphery to the center), which is most appropriate when the center of the crime scene is not clearly defined, and attention should be focused on individual traces and physical evidence that help determine the center and nature of the event. The eccentric method (from the center to the periphery) is characteristic of crimes where the event has a clear center (e.g., a corpse or the center of a car collision). Examining the center of the scene creates the necessary prerequisites for the targeted discovery of other traces related to the perpetrator's actions at the scene. The frontal (linear) method is applied when inspecting large areas where the crime scene is associated with numerous dispersed traces and physical evidence. Other methods may also be employed for the crime scene examination, in particular, mentally dividing the area into squares, sectors, or other sections that are most convenient for the purposes of the inspection, depending on the layout of the premises or the characteristics of the terrain. Inspection methods can also be combined depending on the situation of the examination and the set of traces and physical evidence discovered during the inspection.

The system will enable investigators to clarify a number of issues relevant to determining the course of the investigation. Among them are the following: 1) the nature of the incident that took place; 2) whether the crime occurred at the location under examination; 3) the routes of entry and exit used by the offenders (particularly important for tracing the perpetrators and their tracks); 4) the number of offenders present at the crime scene and whether they were familiar with the environment; 5) the time of the crime; 6) he duration of the offenders' presence at the scene; 7) the manner in which the offenders moved within the crime scene and the objects or items they touched; 8) the tools or means employed by the offenders; 9) the objectives pursued by the offenders in committing the crime and whether they achieved them; 10) the traces left by the offenders at the crime scene and those that remained on them and their clothing; 11) who could have witnessed the incident at the crime scene and from where.

The analysis of the circumstances of the incident, traces, and physical evidence, as well as the determination of their causal relationships, allows for the identification of so called negative circumstances. These can be defined as circumstances that contradict the expected or lawful development of events. For example, the presence of a significant number of wounds on a corpse combined with the absence of blood constitutes a negative circumstance, indicating that the crime was committed elsewhere and the body was moved. Negative circumstances can be divided into two groups: negative circumstances associated with the absence of traces that should logically exist based on the situational analysis and negative circumstances involving the presence of traces when the natural course of events would not imply their occurrence. For instance, during the examination of a corpse of a person who allegedly committed suicide by hanging, the expert concluded that the strangulation mark had a postmortem character. The presence of such traces indicates that death did not result from suicide. Such a circumstance is considered negative and points to the staging of the event [8, p. 403].

An object discovered during a crime scene inspection is initially analyzed in terms of its substance and purpose as commonly understood by human perception. Subsequently, the analysis is directed toward identifying in the discovered object (trace, material evidence) such characteristics that indicate its use in the criminal event. This stage of analysis makes it possible to establish connections linking a particular object with the criminal act, thereby determining the range of circumstances significant for the process of cognition in investigation. In the mental analysis of objects carried out during a crime scene inspection, elements of factual analysis are employed, in particular such methods as measurement, observation with the aid of scientific and technical means, and comparison. The use of magnifying glasses, light filters, ultraviolet lamps, and dusting powders, in many cases, adds to the results of the mental analysis a certain number of newly detected characteristics, the proper evaluation of which largely determines the possibility of considering the discovered object as material evidence.

The instrument that establishes the logical connection between the discovered object, the actions of the persons involved in the crime, and other pieces of evidence is the causal relationship (connection), which reconstructs the event as if from mosaic fragments. If the crime scene environment and its constituent objects, correlated with the criminal act, are examined from this perspective, it becomes evident that all of them represent consequences of certain causes. The analysis of such consequences provides the basis for a mental ascent to the cause that generated them and thereby to the establishment of the sought after fact [8, p. 404-405].

In the course of the crime scene examination, the generalization of analytical results makes it possible to accumulate information, synthesize it through the establishment of causal relationships, and serves as the basis for constructing a mental model of the event. The nature and scope of evidentiary information determine the completeness and validity of a mental model. Each model of the event in relation to the investigation of any category of crimes possesses a greater or lesser degree of probability, on the one hand, due to the available information, and on the other, due to the number of circumstances that must be clarified in order to establish the objective truth in the case. In those cases where the circumstances of the first group are expressed more clearly than those of the second group, the substantiation of the proposed version concerning the criminal event will be more significant, and its mental model more complete. The complexity of advancing versions as the construction of models of the event lies in the fact that such constructions are not arbitrary processes of creative imagination unrestricted by the availability of real material. The analysis and evaluation of evidentiary material impose clear constraints on the modeling process, directing the investigator's reasoning toward the established set of circumstances and guiding the identification of their potential causal relationships [8, p. 405].

Of greatest significance from the perspective of the cognitive role of models constructed in the course of a crime scene examination is the fact that their emergence and dissolution (disintegration) occur in accordance with the discovery and evaluation of evidentiary information. Therefore, they are not only dynamic (fluid) but also continually arising and disintegrating, depending on the substantiation of the components of the model, which ultimately determine its reliability.

An experiment - is the alteration of the conditions of an observed phenomenon and its interrelations. The purpose of an experiment - is to ascertain the nature of the phenomenon under observation. A forensic experiment constitutes one of the forms of applying the experimental method of inquiry within the framework of preliminary investigation and judicial proceedings in criminal cases. It is an independent, verification-oriented investigative action consisting of conducting controlled experiments for the purpose of testing hypotheses and uncovering evidence relevant to the case. Its procedural order is prescribed by criminal procedure law. This constitutes a fundamental distinction between a forensic experiment and experimental research methods employed in other fields of knowledge.

The conduct of an investigative experiment pursues the following objectives: a) verification and illustration of the available data; b) discovery of new evidence; c) testing of investigative versions; d) establishing circumstances that facilitated the commission of the crime.

In evaluating the results of a forensic experiment, the following rules, based on the laws of formal logic, are applied: if it is established during the tests that the traces could have been formed only in a particular manner, then the results must be regarded as reliable; positive results of the tests allow only for a probabilistic conclusion regarding the facts under verification (they may or may not have occurred); negative results of the tests make it possible to conclude that, in reality, such an act or phenomenon could not have taken place; the results of the experiment cannot be assessed as reliable if the experimental actions yield contradictory or divergent data [8, p. 411].

In the investigation of many criminal cases, a search constitutes one of the most significant investigative actions, consisting in the examination of premises, areas of terrain, and individuals (or their clothing) for the purpose of locating and seizing physical evidence relevant to the investigation, as well as discovering wanted persons and corpses.

The factual basis for conducting a search may consist of any information obtained from procedural sources (testimonies of witnesses, victims, suspects, defendants), operational sources (data obtained by law enforcement officers in the course of investigative activities), and other sources containing information about the sought objects relevant to the case.

The psychological features of conducting a search consist in establishing psychological contact with the persons subjected to the search.

To establish psychological contact with the persons subject to the search and to increase the effectiveness of the search, the following tactical techniques may be used:

1. engaging the person to be searched in conversation, using dialogue on various topics while observing their reactions to the search conducted by operational officers or technical assistants;

2. observing the behaviour of all persons being searched (mood, facial expression, etc.) during the search;

3. considering that persons subject to search bear no liability for false explanations, for evasion or for refusal to give explanations during the search. Therefore, they may at times attempt to distract the search team from the location of a hiding place, provoke a conflict, etc. Conversely, if the searched person genuinely does not possess the sought items, they may also become anxious and react negatively. In all such cases, an experienced investigator will be able to sense and analyse the psychology of the person searched;

4. questioning the persons searched about their work, profession, and hobbies, which often relate to the choice of locations for concealing items and the methods of hiding sought objects;

5. depending on the nature and dimensions of the sought objects, hypothesizing where, in the given environment, a particular person could have hidden them, etc.

Skillful use of the above tactical techniques, together with the investigator's imagination and experience, is the key to a successful search.

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Kriminalistika taktikasında süni intellektin texnologiyaları

Xülasə: Azərbaycan Respublikasının Vəkillər Kollegiyası Beynəlxalq Hüquq Tədqiqatları Təşkilatı və Milli Aviasiya Akademiyasının Hüquq kafedrası ilə birlikdə cinayət işində və fərdi hərəkətlər icraatında uğurlu taktiki işlərin həyata keçirilməsində istifadə oluna bilən generativ süni

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intellekt, proqramların qiymətləndirilməsi və təhlili (PERT), şəbəkə proqnozlaşdırılması və nəzarəti, ehtimal məntiqi və s. üçün sinxronlaşdırılmış metodlar toplusunun modelini (intellektual sistem) işləyib hazırlanmışdır. Sistem müstəntiqlərə istintaq yolunu müəyyən etmək üçün həlledici olan bir sıra məsələlərə aydınlıq gətirməyə imkan verəcək. Bunlara aşağıdakılar daxildir: 1) baş vermiş hadisənin xarakteri; 2) cinayətin hadisə yerinin yoxlanıldığı yerdə baş verib-verməməsi; 3) cinayətkarların hadisə yerinə daxil olma marşrutları və onların getmə marşrutları (xüsusilə cinayətkarların axtarışı və izlərin axtarışı üçün vacibdir); 4) cinayət yerində nə qədər cinayətkar olub və onların vəziyyətlə tanış olub-olmaması; 5) cinayətin törədildiyi vaxt; 6) cinayətkarların hadisə yerində nə qədər qalması; 7) cinayətkarların cinayət yerində necə hərəkət etdikləri, hansı əşyalara və ya predmetlə toxunduqları; 8) cinayətkarların hansı alətlərdən və vasitələrdən istifadə etdikləri; 9) cinayətkarlar cinayəti törədərkən hansı məqsədləri güdürdülər, bu məqsədə çatdılarmı; 10) cinayət törətmiş şəxslər tərəfindən cinayət yerində hansı izlər qalıb, onların üzərində izlər qalıb və hansı geyimlərdə idilər i; 11) cinayət yerində baş verənləri kim və haradan görə bilərdi.

Amar sözlər: informasiya texnologiyaları; informasiya sistemi; süni intellekt; kriminalistik taktikası; taktiki üsül; taktika; birləşmə.

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Технологии ИИ в криминалистической тактике

Аннотация: Коллегией адвокатов Азербайджанской Республики совместно с Международной организацией правовых исследований и кафедрой права Национальной Академии авиации разработана модель (интеллектуальная система) синхронизированной совокупности методик генеративного искусственного интеллекта, оценки и анализа программ (PERT), сетевого прогнозирования и управления, вероятностной логики и др., которая с успехом может быть использована для построения криминалистической тактики расследования по уголовному делу и производству отдельных действий.

Система позволит следователям выяснить ряд вопросов, имеющих значение для определения путей расследования. Среди них можно назвать следующие: 1) характер события, имеющего место; 2) произошло ли преступление там, где осматривается место происшествия; 3) пути проникновения преступников на место и пути их ухода (особенно важно для розыска преступников и розыска следов); 4) сколько было преступников на месте происшествия и знакома ли им обстановка; 5) время совершения преступления; 6) сколько времени преступники пребывали на месте; 7) как передвигались преступники на месте происшествия,

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каких объектов или предметов они касались; 8) какими орудиями или средствами действовали преступники; 9) какие цели преследовали преступники, совершая преступление, достигли ли они этой цели; 10) какие следы оставлены преступниками на месте происшествия, какие следы остались на них, их одежде; 11) кто и откуда мог видеть происходящее на месте происшествия.

Ключевые слова: информационная технология; информационная система; искусственный интеллект; криминалистическая тактика; тактический прием; тактика; комбинация.

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