

# Formation of a network of events from news messages based on generative artificial intelligence

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**Abstract.** The article provides a methodology for forming a network of events in news reports based on generative artificial intelligence and an example of its application. The revolution in the field of artificial intelligence allows solving the task of not only detection but also the formation of a causal network of events, in which the causes and consequences of events are clearly indicated. Thanks to the use of generative artificial intelligence, convenient methods of extracting events from texts, their filtering, and ranking have been obtained. Identification of causal relationships is also carried out using artificial intelligence, which greatly simplifies work with natural language, the algorithms of which are embedded in large linguistic models. Visualization and analysis of formed networks can be carried out using traditional network analysis tools.

**Keywords:** GenAI, Event Detection, Connection Extraction, Event Network, Causal Network, Network Visualization, GraphViz

## Introduction

Detection of new events from text news messages is a traditional task in the field of natural language processing, the solution of which is devoted to many scientific works [1, 2].

Along with this, the revolution in the field of artificial intelligence (GenAI) makes it possible to solve the task of not only detection but also the formation of a causal network of events, in which the cause and effect events are clearly indicated. To solve this problem, the authors successfully used various LLMs, in particular, ChatGPT (<https://chat.openai.com/>), Llama-2 (<https://www.llama2.ai/>), Gemini (<https://gemini.google.com/app>).

Further analysis of such a network also with the help of generative artificial intelligence makes it possible to identify chains of events similar to those found in scenario analysis [3]. The difference is that the nodes of traditional causal networks are concepts, that is, notions, and the proposed technology allows some events to be considered as nodes. Formed networks can act as navigators in the world of events, and be tools for conducting investigations. Analysis and visualization of causal networks of events can be performed with conventional network analysis tools such as Gephi [4] or GraphViz [5]. As in the case of traditional causal networks, in this case, nodes with the largest initial degree (events that are the cause of many events of consequences) can be identified, chains of different lengths can be determined, the links of which are events, events that are the consequences of many causes, events that are good "mediators", which combine many causes and effects, i.e. are connecting links of many causes and effects at the same time, etc.

## Description of the methodology

The methodology of forming a network of events contained in news reports involves the implementation of the following stages:

1. Receiving news messages corresponding to some target topic using existing news search systems (free or proprietary).
2. With the help of GenAI, the detection of events contained in news messages, the creation of an array of short notations of these events. It is used for this **Prompt 1**.
3. Detection of original events among the selected array using **Prompt 2** to the GenAI system.
4. Causality linking original events with special **Prompt 3**.
5. Formation and visualization of the network using graphic tools.

While the Gephi system allows you to visualize, identify clusters, calculate, and analyze the parameters of formed causal networks, programs built on the basis of GraphViz allow you to create interactive semantic maps using the SVG graphic format. At the same time, each node or edge of the network may contain hyperlinks to Internet resources, in particular to search engines Google, Google News, Bing, Bing News, etc., or corporate news systems.

## Application example

Let's consider an example related to the events and their interpretations regarding the downing of Russian planes in February 2004.

To do this, at the first stage, an array of target documents is formed, for which a request is made in the news database for the "aircraft downing" switch. Among the received documents, several with headings are considered:

- Ukrainian Forces Shot Down Russian Vital A-50U AWACS Using Soviet-Era S-200 Missile
- Ukraine claims to have shot down Russian AEW&C aircraft A-50 near Black Sea
- Russia Grounds Aircraft After Losing Advanced A-50 Spy Plane: Kyiv

...

At the second stage, for each of the found documents, it is applied **Prompt 1**:

Name the main events described in the text. Give the name of each event in three to four words. No explanation is needed. Here is the text:  
[According to information published on February 24, 2024, by "Pravda" a Ukrainian newspaper, the Ukrainian armed forces shot down on February 23, 2024, one A-50U Airborne Warning and Control System \(AWACS\) aircraft, crucial for the Russian forces deployed in Ukraine...](#)

As a result of multiple execution of such prompts, an array of event markings is formed, not all of which are original. That is, repetitions, and retellings in different words are possible:

- Ukrainian Forces Shoot Down A-50U AWACS
- A-50U Shot Down on February 23, 2024
- First A-50 Radar Plane Downed on January 14, 2024
- S-200 Missile System Intercept
- Significance of A-50U Loss
- A-50U's Role in Russian Military

- Second A-50U Downed
- Impact on Russian Air Force
- Vulnerabilities in Contested Airspace
- Evolving Dynamics of the Conflict

...

In the third stage, events are filtered, that is, original ones are selected, for which the entire array of selected event labels is provided to the GenAI system and executed **Prompt 2**:

From the named events, choose the original and most important ones. Remove duplicates. Here are the events:

- «UKRAINIAN FORCES SHOOT DOWN A-50U AWACS»
- «A-50U SHOT DOWN ON FEBRUARY 23, 2024»
- «SECOND A-50U DOWNED»

...

The response of the GenAI Gemini system, for example, looks like this:

**Here are 10 original and most important events, removing duplicates:**

**UKRAINIAN FORCES SHOOT DOWN A-50U AWACS (February 23, 2024):** This event stands out as the focal point and starting point of the series.

**S-200 MISSILE SYSTEM INTERCEPT:** This details the specific system used by Ukraine, providing crucial context about the military engagement.

**SIGNIFICANCE OF A-50U LOSS:** This offers an analysis of the event's broader impact, highlighting its importance beyond just a single downed plane.

**A-50U'S ROLE IN RUSSIAN MILITARY:** This explains the strategic value of the A-50U, emphasizing the loss for Russia.

**IMPACT ON RUSSIAN AIR FORCE:** This delves into the potential consequences for the Russian Air Force after losing the A-50U.

**VULNERABILITIES IN CONTESTED AIRSPACE:** This expands the discussion to the wider situation of contested airspace and potential vulnerabilities.

**EVOLVING DYNAMICS OF THE CONFLICT:** This acknowledges the ever-changing nature of the war and how this event might contribute to those changes.

**UKRAINIAN MILITARY DOWNS RUSSIAN AWACS PLANE:** This is a more general version of the first event, capturing the essence without redundancy.

**DISPUTE OVER CAUSE OF DOWNED PLANE:** This acknowledges the ambiguity surrounding the incident and the need for further clarification.

**VIDEO SHOWS A-50'S BURNING WRECKAGE:** This provides concrete evidence of the event, adding visual proof and strengthening the claims.

These 10 events offer a concise and varied look at the reported downing of an A-50U AWACS aircraft, providing context, analysis, and different perspectives on the incident and its potential implications.

At the fourth stage, the GIS system forms causal-consequential relationships among the detected original events, for which the **Prompt 3**:

Give pairs of interrelated events according to the principle of cause and effect. Here are the events:

- «UKRAINIAN FORCES SHOOT DOWN A-50U AWACS»
- «UKRAINIAN MILITARY DOWNS RUSSIAN AWACS PLANE»
- «DISPUTE OVER CAUSE OF DOWNED PLANE»

The Gemini system's response to this prompt looks like this:

**10 Pairs of Interrelated Events:**

**Cause:** Ukrainian Forces Shoot Down A-50U AWACS Plane (cause) **Effect:** Video Shows A-50's Burning Wreckage (evidence of the event)

**Cause:** S-200 Missile System Intercept (specific action) **Effect:** Ukrainian Forces Shoot Down A-50U AWACS Plane (successful outcome)

**Cause:** A-50U's Role in Russian Military (strategic importance) **Effect:** Significance of A-50U Loss (greater impact due to its role)

**Cause:** Ukrainian Military Downs Russian AWACS Plane (general event) **Effect:** Impact on Russian Air Force (potential consequences due to the type of aircraft)

**Cause:** Dispute Over the Cause of Downed Plane (uncertainty) **Effect:** Evolving Dynamics of the Conflict (potential for increased tension)

**Cause:** A-50U AWACS Plane Downed (event) **Effect:** Vulnerabilities in Contested Airspace (raised concerns about vulnerabilities)

**Cause:** Video Shows A-50's Burning Wreckage (evidence) **Effect:** Dispute Over Cause of Downed Plane (may fuel the dispute)

**Cause:** Significance of A-50U Loss (impact) **Effect:** Evolving Dynamics of the Conflict (potential for escalation or negotiation)

**Cause:** Ukrainian Military Downs Russian AWACS Plane (event) **Effect:** Significance of A-50U Loss (increased significance due to Ukrainian action)

**Cause:** Evolving Dynamics of the Conflict (changing situation) **Effect:** Impact on Russian Air Force (may require adjustments in Russian air strategy)

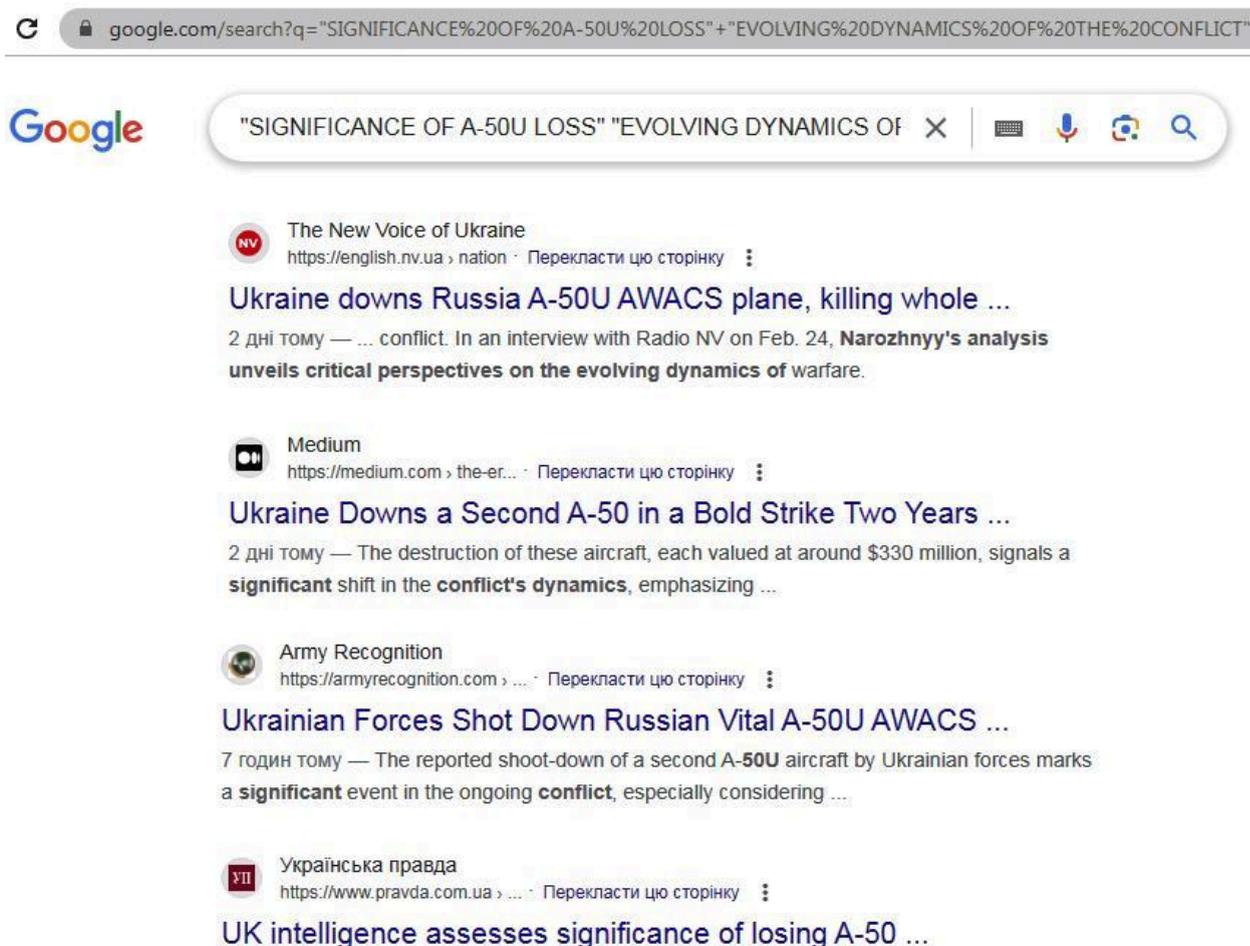
At the fifth stage, the selected events are grouped into a CSV file, the records of which have the format "event cause; event-effect". This file can be loaded into network analysis and visualization programs. Fig. 1 shows the data input interface in the CSV2Grap program (<https://bigsearch.space/uli.html>), developed based on the GraphViz library. As a result of the execution of this program, a display of the graph of events is formed (Fig. 2). Each edge and node of this graph is a hyperlink with corresponding requests to the Google system (Fig. 3).

**Conclusions**

The article describes the methodology of building networks of events in news messages based on generative artificial intelligence. an example of the application of this methodology is given.



**Figure 2** – A graph corresponding to the event network generated by the CSV2Graph system



**Figure 3** – Results of activating the hyperlink on the edge "SIGNIFICANCE OF A-50U LOSS" – "EVOLVING DYNAMICS OF THE CONFLICT"

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