## Exploring News at Scale with On-the-Fly Graphs

GraphGeeks webinar - Jan. 15 2025



Robert Caulk, PhD Elin Törnquist, PhD Wagner Costa Santos



### **Global News Sources**

⅍₀ Thousands of news sources
№ 200+ countries
♦ 16 languages



### **Enriched Content**

- **Entity extraction**
- 💓 Sentiment analysis
- 📢 Reporting voice
- A Provocative content
- 音 Topic category
- Sentity relationships
- 🔀 Translation
- 📝 Summarization

#### $\rightarrow$ Fully synthetic

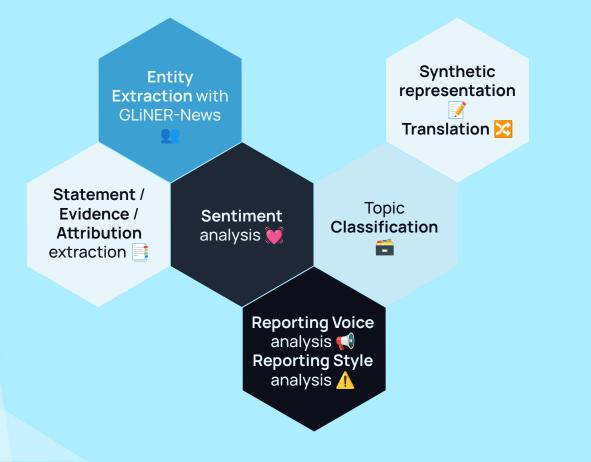
Knowledge Base

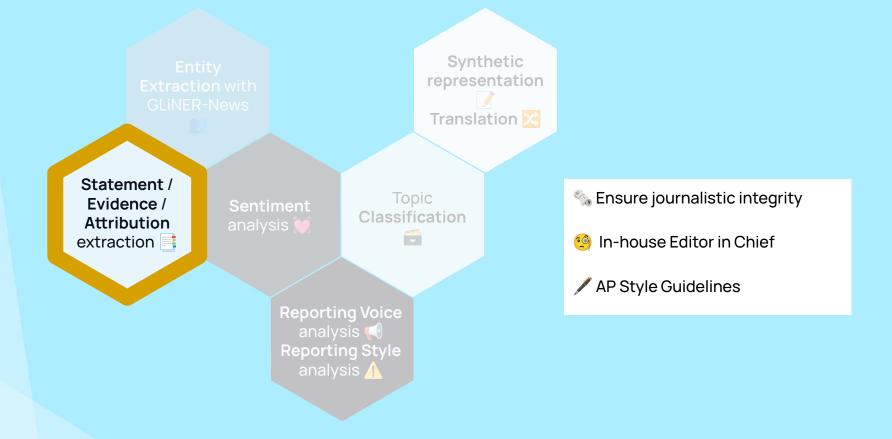
Chat with the news
Narrative tracking
Knowledge graphs

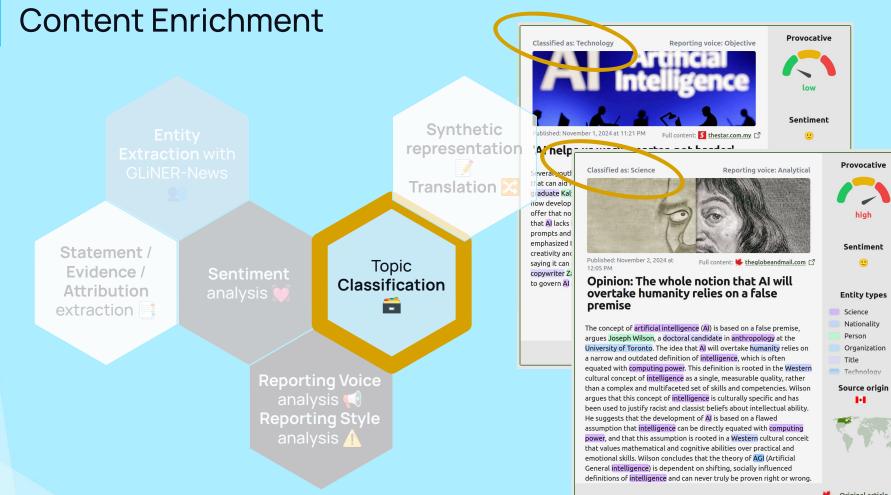


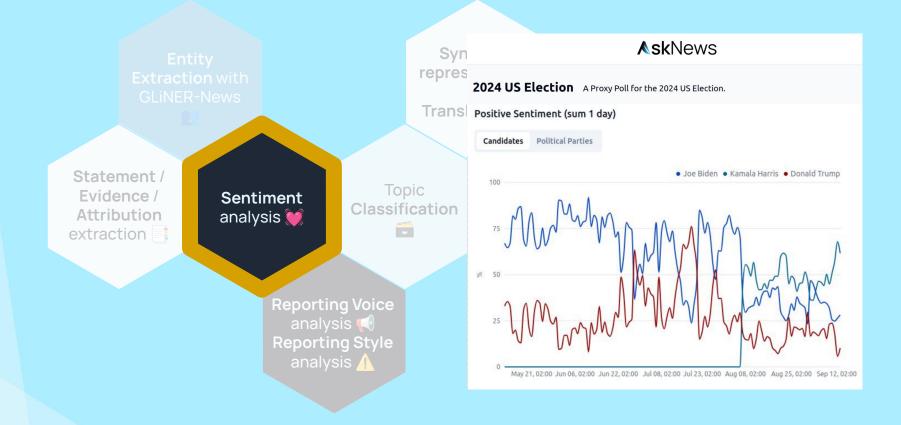
#### Goal

# Provide high-quality, real-time, information to readers, analysts, and LLMs









Entity Extraction with GLiNER-News

Statement / Evidence / Attribution extraction

Sentiment analysis 💓



#### 'AI helps us work smarter, not harder'

Several youths believe that artificial intelligence (AI) is a useful tool that can aid in creativity and workflow, rather than a threat. Fresh law graduate Kalyani Rajendran said, 'AI is not a threat because no matter how developed AI will be, there is always something only humans can offer that no AI can replicate.' SEO content specialist Lee Wen Xi added that AI lacks human quality and creativity, but can be useful for quick prompts and tasks. An executive, who wished to remain anonymous, emphasized the importance of upskilling and using AI to enhance creativity and efficiency. Journalism student Lui Yee Min defended AI, saying it can be an inspiration for creativity and save time. Junior copywriter Zahid Hanafi suggested thai proper guidelines are needed to govern AI and prevent copyright violations.

Reporting Voice analysis 📢 Reporting Style analysis 🚹 Classified as: Science

Published: November 2, 2024 at

Opinion: The whole notion that AI will

The concept of artificial intelligence (AI) is based on a false premise,

equated with computing power. This definition is rooted in the Western

than a complex and multifaceted set of skills and competencies. Wilson

been used to justify racist and classist beliefs about intellectual ability.

power, and that this assumption is rooted in a Western cultural conceit that values mathematical and cognitive abilities over practical and emotional skills. Wilson concludes that the theory of AGI (Artificial General intelligence) is dependent on shifting, socially influenced definitions of intelligence and can never truly be proven right or wrong.

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argues that this concept of intelligence is culturally specific and has

He suggests that the development of AI is based on a flawed assumption that intelligence can be directly equated with computing

argues Joseph Wilson, a doctoral candidate in anthropology at the University of Toronto. The idea that AI will overtake humanity relies on

a narrow and outdated definition of intelligence, which is often

overtake humanity relies on a false

12:05 PM

premise





Entity types

Provocative

Science Nationality Person Organization Title Technology

Source origin



💺 🛛 Original article

Entity Extraction with GLiNER-News

Statement / Evidence / Attribution extraction

Sentiment analysis 💓



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Reporting Voice analysis ( Reporting Style analysis (



Classified as: Science

Reporting voice: Analytical



#### Opicion: The whole notion that AI will overtake humanity relies on a false premise

The concept of artificial intelligence (AI) is based on a false premise, argues Joseph Wilson, a doctoral candidate in anthropology at the University of Toronto. The idea that AI will overtake humanity relies on a narrow and outdated definition of intelligence, which is often equated with computing power. This definition is rooted in the Western cultural concept of intelligence as a single, measurable guality, rather than a complex and multifaceted set of skills and competencies. Wilson argues that this concept of intelligence is culturally specific and has been used to justify racist and classist beliefs about intellectual ability. He suggests that the development of AI is based on a flawed assumption that intelligence can be directly equated with computing power, and that this assumption is rooted in a Western cultural conceit that values mathematical and cognitive abilities over practical and emotional skills. Wilson concludes that the theory of AGI (Artificia General intelligence) is dependent on shifting, socially influenced pitions of intelligence and can never truly be seven right or wrong.





Sentiment

Entity types

Science Nationality Person Organization

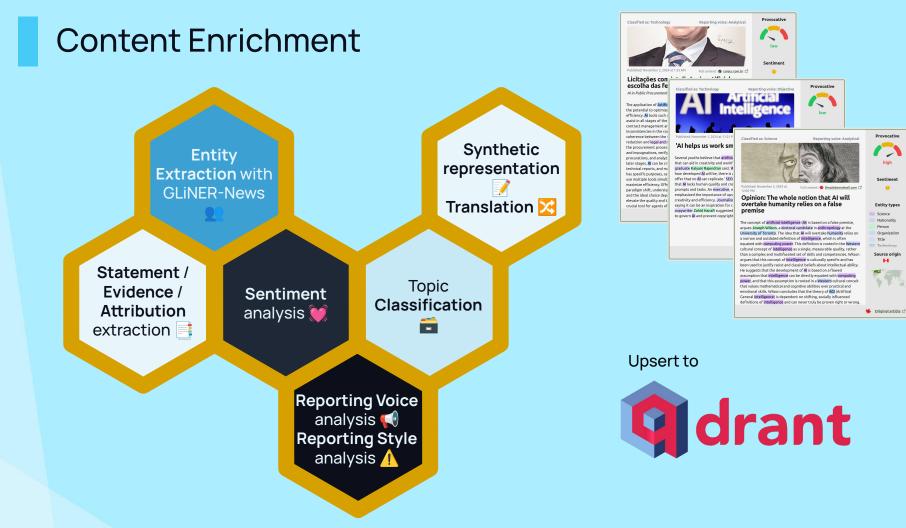
- Title
- Technology

Source origi

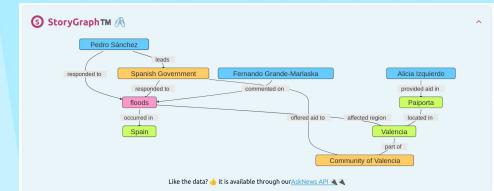
I+I

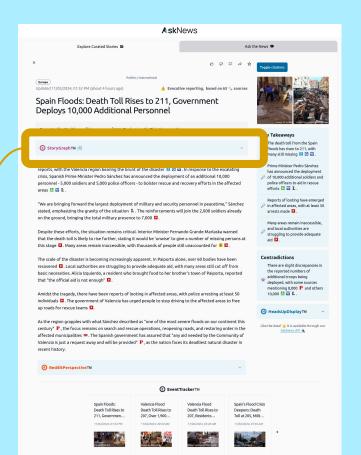






### **Entity Relationships**





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### What is an Entity Relationship Graph?

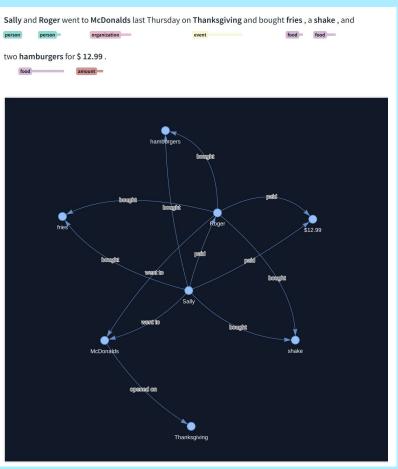
Extracting the key people, organizations, locations, products, etc. and identifying their relationships



### Why Entity Relationship Graphs?

Entity relationship graphs enable:

- Graph Database indexing
- Extraction of hidden insights
- Token-optimized information passing to LLMs
- Abstract filtering



### Selecting a base model

Requirements:

- On-premise (open-source)
- Lightweight (high throughput)
- Good base reasoning
- 4k+ context window

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Published Apr 23, 2024 • 4 min read

### Introducing Phi-3: Redefining what's possible with SLMs

By Misha Bilenko, Corporate Vice President, Microsoft GenAl

#### Problem:

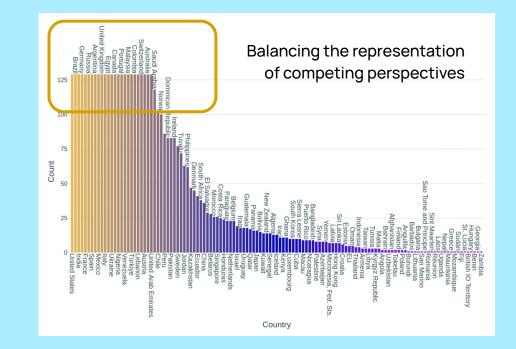
Knowledge graphs are hard to make! How do we build our training dataset?

#### Solution:

Use expensive models, like GPT-4o and Claude-3.5, to build high-quality entity-relationship graphs on a representative dataset.

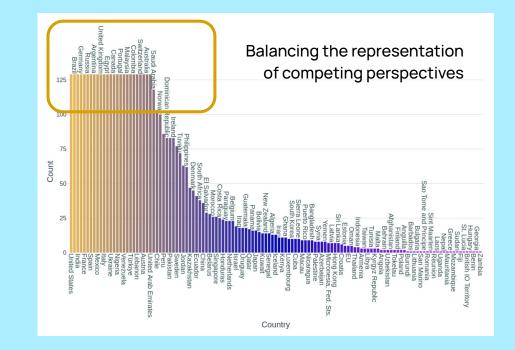
Selecting the data:

1. Geographical diversity



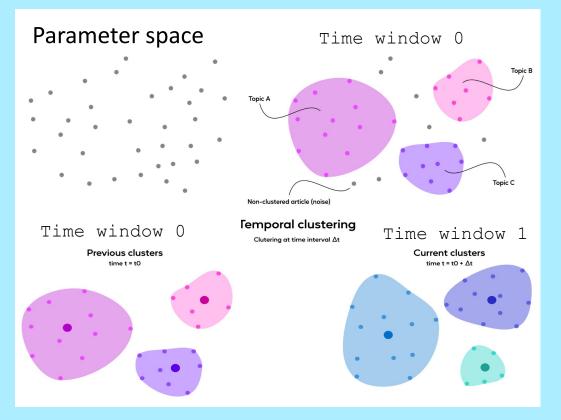
Selecting the data:

- 1. Geographical diversity
- 2. Linguistic diversity



Selecting the data:

- 1. Geographical diversity
- 2. Linguistic diversity
- 3. Topic diversity



#### Labeling the data:

 Write high-quality synthetic representation (Middle East) Updated 12/04/2024, 08:14 PM (about 17 hours ago)

🛕 Evocative reporting, based on 51 🗞 sources

### Battle for Hama Intensifies as Death Toll Surpasses 700 in Syrian Conflict

International / Politics

Generated by AI with a confidence score of 68%. Predominantly objective reporting with a notable presence of investigative elements.

#### 🗿 StoryGraphTM 👧

The battle for control of Syria's strategic city of Hama has intensified, with both government and opposition forces claiming significant gains. Syrian army units, backed by Russian air support, have pushed back anti-government groups more than 20 kilometers from Hama's outskirts <sup>(9)</sup>  $\psi$ , while opposition forces report capturing four settlements including the Armored Corps School near the city center (1).

In a significant development, Major General Saeed Hassan, commander of the Syrian Army's special forces, was reportedly injured in a targeted artillery attack during a military meeting in the Jabal Zain al-Abideen area 🎍 . The Syrian Observatory for Human Rights reports that the death toll has risen to 704 since November 27, including 361 rebels, 233 government forces, and 110 civilians 🕿 📱 .

The conflict has triggered a humanitarian crisis, with tens of thousands of civilians forced to flee their homes 
U. UN Special Envoy for Syria, Geir Pedersen, warned that without de-escalation and movement toward a political solution, 'Syria will be in grave danger of greater division, deterioration, and destruction'
O.

International involvement continues to deepen, with Russia and Iran supporting government forces while Turkey backs opposition groups  $\mathfrak{A}$ . Turkish forces have sent reinforcements to the town of Azez  $\mathfrak{A}$ , while Iranian-backed Iraqi fighters have been deployed to support Assad's forces  $\mathfrak{A}$ . The Russian Foreign Ministry reports being in 'close contact' with Iran and Turkey to stabilize the situation  $\mathfrak{O}$ .

https://asknews.app/en/stories/Battle-for-Hama-Intensifies-as-Death-Toll-Surpasses-700-in-Syrian-Conflict

#### Labeling the data:

- Write high-quality synthetic representation
- 2. Extract entity-relationship graphs with GPT-40

International / Politics Middle East Updated 12/04/2024, 08:14 PM (about 17 hours ago) Evocative reporting, based on 51 % sources Battle for Hama Intensifies as Death Toll Surpasses 700 in Syrian Conflict Generated by AI with a confidence score of 68%. Predominantly objective reporting with a notable presence of investigative elements. StoryGraphTM 🧥 Russia in close contact with in close contact with Maior General Saeed Hassan Iranian-backed Iragi fighters Russian air support supports Iran Turkey hacking commander supports supporting supports sent reinforcements to Azez Syrian government forces opposition forces control battle control battle Hama Like the data? 👍 it is available through our AskNews API 🔌 🔌

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https://asknews.app/en/stories/Battle-for-Hama-Intensifies-as-Death-Toll-Surpasses-700-in-Syrian-Conflict

### Phi-3-Graph

#### **Extracted information**

OpenAl is an American artificial intelligence (Al) research organization founded in December 2015 and headquartered in San Francisco, California. Its mission is to develop "safe and beneficial" artificial general intelligence..

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     "type": "organization",
     "detailed_type": "ai research organization"
      "id": "San Francisco".
      "type": "location",
     "detailed_type": "city"
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],
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     "to": "San Francisco",
     "label": "headquartered in"
   1,...
```

### Fine-tuning

### Huggingface transformers

- SFTTrainer for efficient supervised training,
- PEFT for parameter-efficient fine-tuning,
- QLoRA for quantized low-rank adaptation

#### • • •

from transformers import (AutoTokenizer, AutoModelForCausalLM, BitsAndBytesConfig, TrainingArguments, EarlyStoppingCallback) from trl import SFTTrainer from peft import LoraConfig

class ModelTrainer: def setup model and tokenizer(self): bnb config = BitsAndBytesConfig( load in 4bit=True, bnb\_4bit\_use\_double\_quant=True, bnb\_4bit\_quant\_type="nf4", bnb\_4bit\_compute\_dtype=torch.bfloat16 self.model = AutoModelForCausalLM.from pretrained( self.model id, device\_map="auto", attn implementation="flash attention 2", torch dtype=torch.bfloat16, quantization\_config=bnb\_config, trust remote code=True, use cache=False

self.tokenizer =
AutoTokenizer.from\_pretrained(self.tokenizer\_id,
trust\_remote\_code=True)

### **Fine-tuning**

### Huggingface transformers

- SFTTrainer for efficient supervised training,
- PEFT for parameter-efficient fine-tuning,
- QLoRA for quantized low-rank adaptation

•••	
continued	
<pre>def setup_trainer(self, train_dataset, eval_dataset):     peft_config = LoraConfig(         lora_alpha=8,         r=6,         bias="none",         target_modules="all-linear",         task_type="CAUSAL_LM",         )</pre>	
<pre>args = TrainingArguments( output_dir=self.output_dir, num_train_epoches5, per_device_train_batch_size=4, gradient_accumulation_steps=1, per_device_eval_batch_size=8, eval_accumulation_steps=2, gradient_checkpointing=True, logging_steps=10, save_strategy="steps", evaluation_steps=100, bfle=True, tf32=True, learning_rate=2e-4, max_grad_norm=0.3, varmup_ratio=0.03, lr_scheduler_type="cosine", metric_for_best_model="ison_similarity_avg", greater_is_better=True, } }</pre>	
<pre>self.trainer = SFTTrainer(     model=self.model,     args=args,     train_dataset=train_dataset,     eval_dataset=eval_dataset,     peft_config=peft_config,     max_seq_length=3072,     tokenizer=self.tokenizer,     packing=False,     compute_metrics=self.compute_metrics, )</pre>	
<pre>def main():     trainer = ModelTrainer(         model_id="microsoft/Phi-3-mini-4k-instruct",         tokenizer_id="microsoft/Phi-3-mini-4k-instruct",         output_dir=f"models/{output_model_name}"     )</pre>	
<pre>trainer.setup_model_and_tokenizer() trainer.setup_trainer(chatml_train_dataset, chatml_eval_dataset) trainer.train_model() trainer.save_model()</pre>	

### Fine-tuning

#### **Custom metrics**

JSON Similarity - compare to reference model

$$S = \frac{S_N + S_E}{2}$$

where:

$$S_N = \frac{1}{2} \left( \frac{|N_r \cap N_p|}{|N_r|} + \frac{|N_r^{id} \cap N_p^{id}|}{|N_r^{id}|} \right)$$
$$S_E = \frac{|E_r \cap E_p|}{|E_r|}$$

With the following definitions:

- $N_r$ : Set of (node id, node type) pairs in reference graph
- $N_p$ : Set of (node id, node type) pairs in predicted graph
- $N_r^{id}$ : Set of node ids in reference graph
- $N_p^{id}$ : Set of node ids in predicted graph
- ${\cal E}_r: {\rm Set}$  of (source, target) pairs in reference graph edges
- ${\cal E}_p: {\rm Set}$  of (source, target) pairs in predicted graph edges

 $|\cdot|: \mbox{Cardinality of a set}$ 

#### JSON Consistency - account for orphaned edges

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$$C = \frac{|E_v|}{|E_p|}$$

With the following definitions:

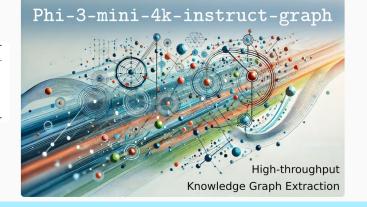
 $E_p$ : Set of all edges in predicted graph  $E_v$ : Set of valid edges in predicted graph  $|\cdot|$ : Number of elements in a set

### Entity Relationships - Phi-3-Graph

Loss Metric	Claude Sonnet 3.5	Phi-3-mini-4k-graph Fine-tuned	Phi-3-mini-4k (base)
Parsing Error rate	0.0%	0.0%	2.5%
Node Similarity	0.64	0.78	0.64
Edge Similarity	0.41	0.49	0.30
JSON Consistency	0.97	0.99	0.96
JSON Similarity	0.67	0.75	0.63

Performance comparison across our Phi-3-mini fine tune for various loss metrics and state of the art models.





#### https://asknews.app/en/blog-articles/outperforming-claude-3-5-sonnet-with-phi-3-mini-4k-for-graph-entity-relationship-extraction-tasks



### Phi-3-Graph - the good

**Story**: In a coordinated law enforcement operation, Vasily Burakov was apprehended in the Tver region for the fatal shooting of two police officers in Shchelkovo, a suburb of Moscow. The attack, which took place on April 7, led to the death of one officer and left another in serious condition. Burakov who fled the scene and was in hiding, was located following a six-hour manhunt that ended with his arrest in a local forest. Upon his capture, Burakov admitted to the crime and has since been charged with attempted murder of law enforcement officers and illegal possession of firearms. The incident has stirred significant concern as it highlights the dangers faced by officers in the line of duty, particularly in operations related to drug trafficking. The Russian Ministry of Internal Affairs and the Russian Federal Security Service are continuing their investigation into the circumstances surrounding the shooting and the subsequent flight and arrest of Burakov.

#### GPT-40 output:

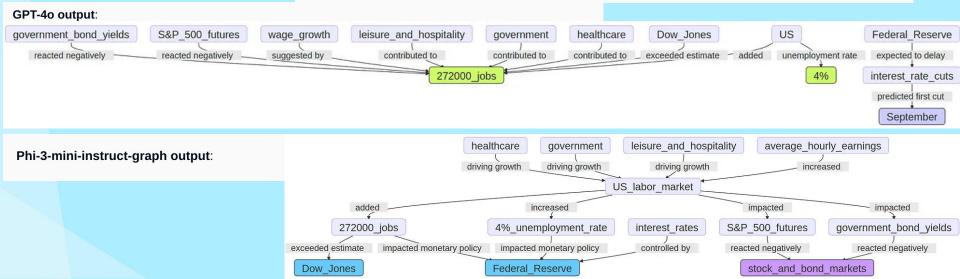


#### Phi-3-mini-instruct-graph output:



### Phi-3-Graph - the ambiguous

**Story**: In a surprising display of resilience, the US labor market added 272,000 jobs in May, far exceeding the Dow Jones consensus estimate of 190,000 and countering the narrative of a labor market slowdown. Despite the robust job growth, the unemployment rate ticked up to 4% the highest it has been since January 2022. The sectors of healthcare, government, and leisure and hospitality were the main drivers of this growth, while average hourly earnings increased, suggesting a continued trend of wage growth. The implications of the strong job report are significant for the Federal Reserve's monetary policy. Initially, there were expectations that the Fed might cut interest rates to support the economy. However, the unexpected surge in job creation and wage increases may lead the Fed to hold off on any rate cuts, with some experts now predicting that the first rate cut might not occur until September. The labor market's strength is seen as a key factor that could keep the Fed in a holding pattern. The stock and bond markets reacted negatively to the report, with S&P 500 futures dropping and government bond yields rising, reflecting investor concerns that the Fed might delay interest rate cuts due to the strong job market data. The current situation presents a complex scenario for the Fed, which is balancing the need to manage inflation with the desire to support economic growth and maintain labor market strength.



### Phi-3-Graph - JSON consistency

**Story**: In a tragic confrontation, a 16-year-old boy was fatally shot by police in Perth, Western Australia after stabbing a man and refusing to surrender his weapon. The incident, which took place in the suburb of Willetton has been characterized by authorities as having 'hallmarks' of terrorism due to the boy's reported online radicalization. He had been previously identified as a risk and was part of a de-radicalization program. The police had been tipped off about a potential attack the evening before, but were unable to prevent the stabbing. When they arrived at the scene, the boy, armed with a 30-centimeter kitchen knife charged at the officers despite being tased twice and was subsequently shot. The victim of the stabbing is currently in a stable but critical condition. This event has raised significant concerns regarding the spread of radicalization among young people in Australia and the challenges of intervening effectively. Western Australia Premier Roger Cook and Australian Prime Minister Anthony Albanese have both addressed the incident, emphasizing the country's commitment to combating violent extremism. The incident is under investigation, and a meeting between religious leaders and city authorities has been scheduled to address community concerns.

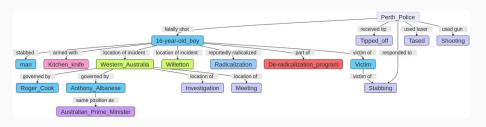
Claude 3.5 Sonnet output:



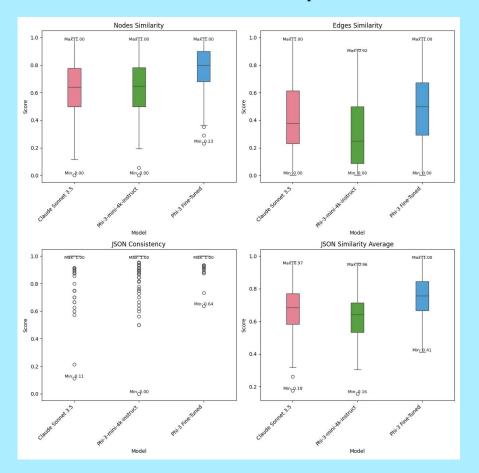


Phi-3-mini-instruct-graph output:





### Phi-3-Graph - Performance comparison



### Phi-3-Graph - Cost comparison

Hosting 2x A100 SXM (runpod.io)

\$ 3.88/ hour => \$93.12 / day

**OpenAl (GPT-4o)** 

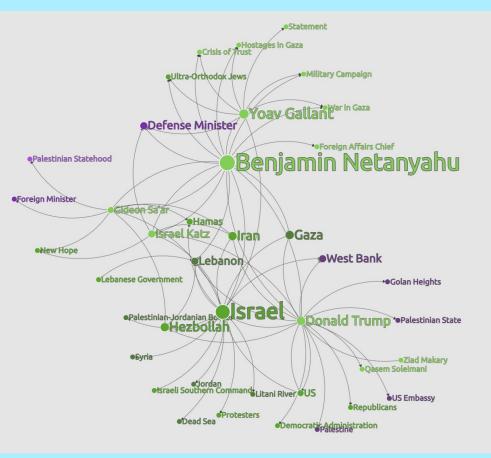
Input pricing: 271.5M (905 x 300k) Tokens (\$5.00 / 1M): Total \$ 1357,00 / day

Output pricing: 157.5M (525 x 300k) Tokens (\$15.00 / 1M): Total \$ 2362,50 / day

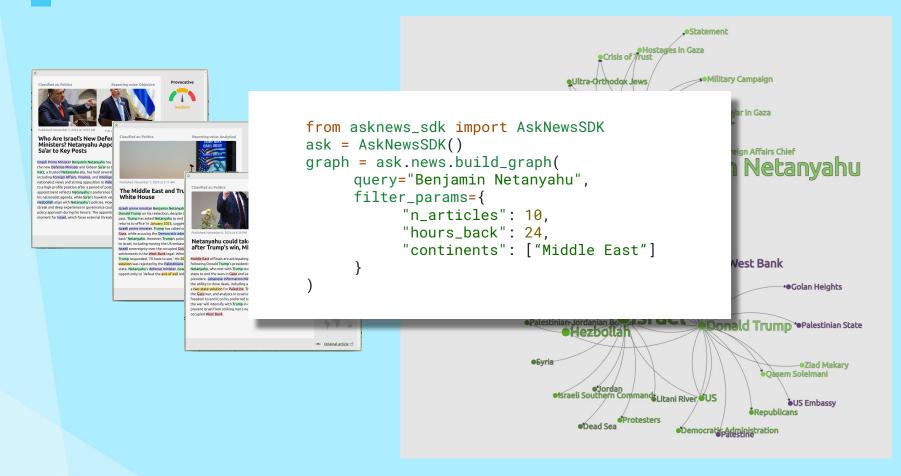
Total: \$ 3719.50 / day

### In action

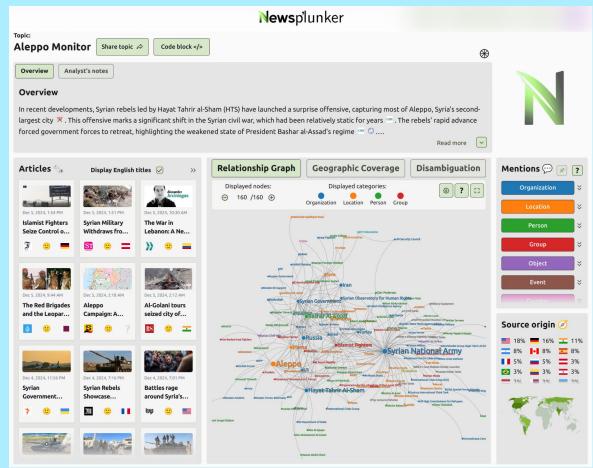




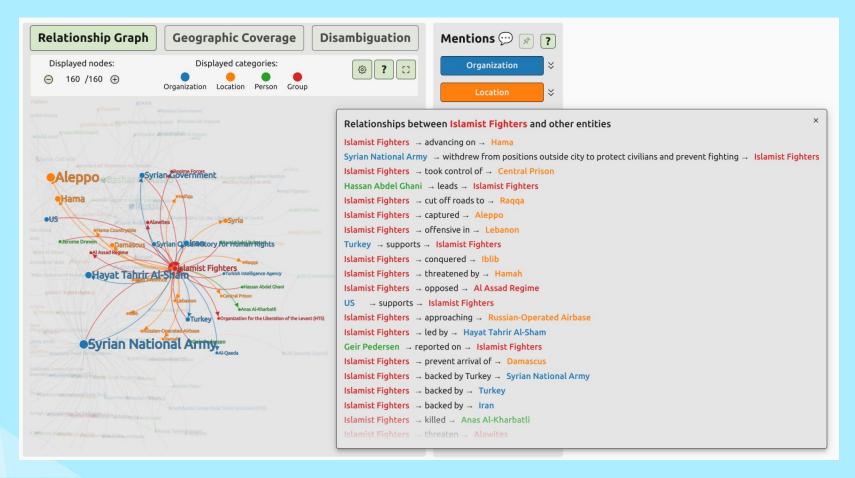
### One line of code



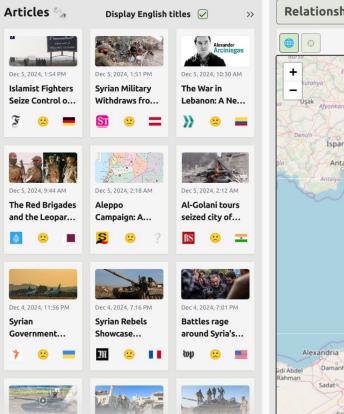
### In Action

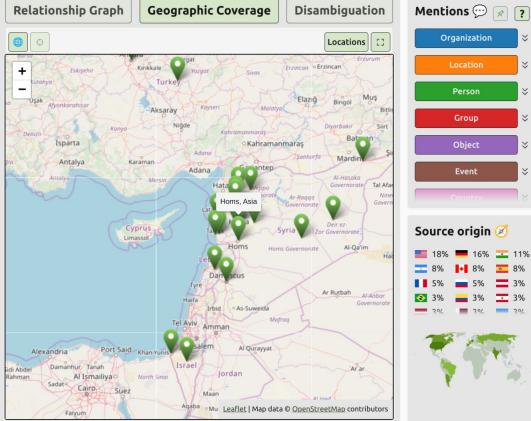


### In Action



### **Geographical Coverage**





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### **Article Analytics**



### **Event Forecasting**

#### Forecasts by Vor Forecast guery: "Who will win the United States Presidential Election?" Articles 🗞 Display English titles 🗸 Summary 📝 × The 2024 US presidential election is a highly contested race between Democratic candidate Kamala Harris and Republican candidate Donald Trump. The election outcome will hinge on key swing states such as Pennsylvania,... Nov 4, 2024, 9:17 AM Nov 4, 2024, 8:17 AM Nov 4, 2024, 7:47 AM The American Ruchir Sharma 2024 US Election: A... The US econo.. Presidential... Donald Trump Resolution Criteria 🤝 н 10 ... Slightly Favored This question resolves to the candidate who receives at least... Probability @ LLM self-confidence ③ Nov 4 2024 6:47 AM Nov 4 2024 6:42 AM Nov 4, 2024, 6:38 AM Unique Information 🤞 🛛 🗧 2024 US **US Elections** How the Presidential... American... 2024: How are... Polymarket predictions and Donald Trump is slightly favored to win, with a narrow electoral college D H. . betting platforms give Trump a... advantage potentially driven by underestimated Republican turnout and favorable conditions in pivotal swing states. Nov 4, 2024, 2:19 AM Nov 4, 2024, 4:18 AM Reasoning 🧠 Aaru's Al Model Why is the US Based on Our Predicts Kama... presidential ra... Election... Historical trends and polling biases have often understated Republican support, especially for Trump. Despite economic concerns which... Т 孤 濕 🙁 💻 Live Web Search Results 🌐 30 Timeline 🕕 November 1, 2024 November 3, 2024 November 4, 2024 2024 National: 2024 November 3, 2024 November 5, 2024 Presidential President: Presidential Election... general electio.. Election Polls:... Election Day, where voters will decide the Final national and state-level polls 270 270 released showing tight outcome. race. Polls continue to show November 4, 2024 November 3, 2024 June 24, 2024 tight margins, with differing results from Latest Polls 2024 Silver Kamala Harris vs. betting markets and Denald Trees



https://asknews.app/en/newsplunker-view/3b7496cd-35eb-4ed3-aeb5-300c6babf3f1







# AskNews

News, when quality matters.



AskNews Discord

### The Team



Robert Caulk, PhD Founder/CEO

- Research
- Communication
- Systems architecture
- Cluster management



Elin Törnquist, PhD Director of Transparency Research

- Research
- Visualization



#### Wagner Costa Santos Software Developer

- Front-end
- Research



Emre Süzen Software Developer

• Cluster management



Timothy Pogue Large-scale Systems Engineer

- Cluster management
- System architecture



