Sentinel: AI-Powered Threat Intelligence - Team XGBoosted

Chan Ding Hao
Hoo Kai Sng
Lew Choon Hean
Yip Kai Men

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PROBLEM STATEMENT

Addressing the **pain points** of ISD personnel

ISD's Mission

1. Countering **Terrorism** and **Violent Extremism**
2. Guarding against **Espionage**
3. Contending with **Communalism**
4. **Cybersecurity** threats and risks

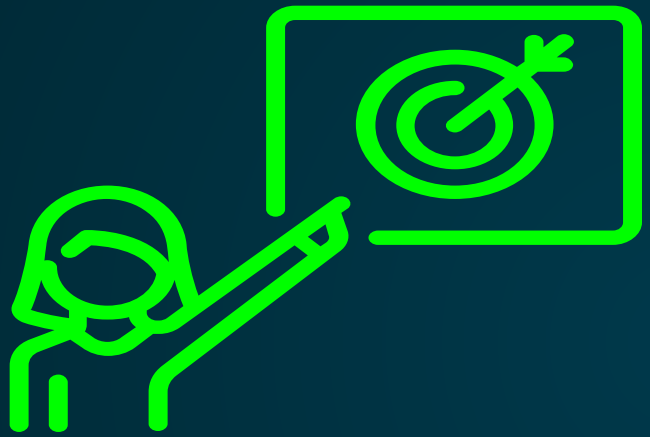
Abbreviated as TCCE

ISD

- ISD's mission to protect Singapore from **TCCE** threats shapes our approach to developing Sentinel
- Ensuring our solution extracts information in these key areas for effective threat detection and analysis

Source : https://www.mha.gov.sg/isd/keeping-threats-at-bay

User Personas



ISD Research Analyst

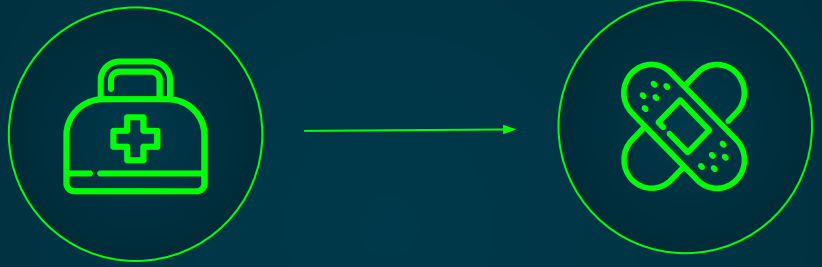
- Extracts and analyzes intelligence from security trends.
- Assesses policies to safeguard Singapore's security.
- ISD analysts need to analyse data that reflects the true security landscape.

Source :https://www.mha.gov.sg/isd/be-part-of-isd/career-opportunities

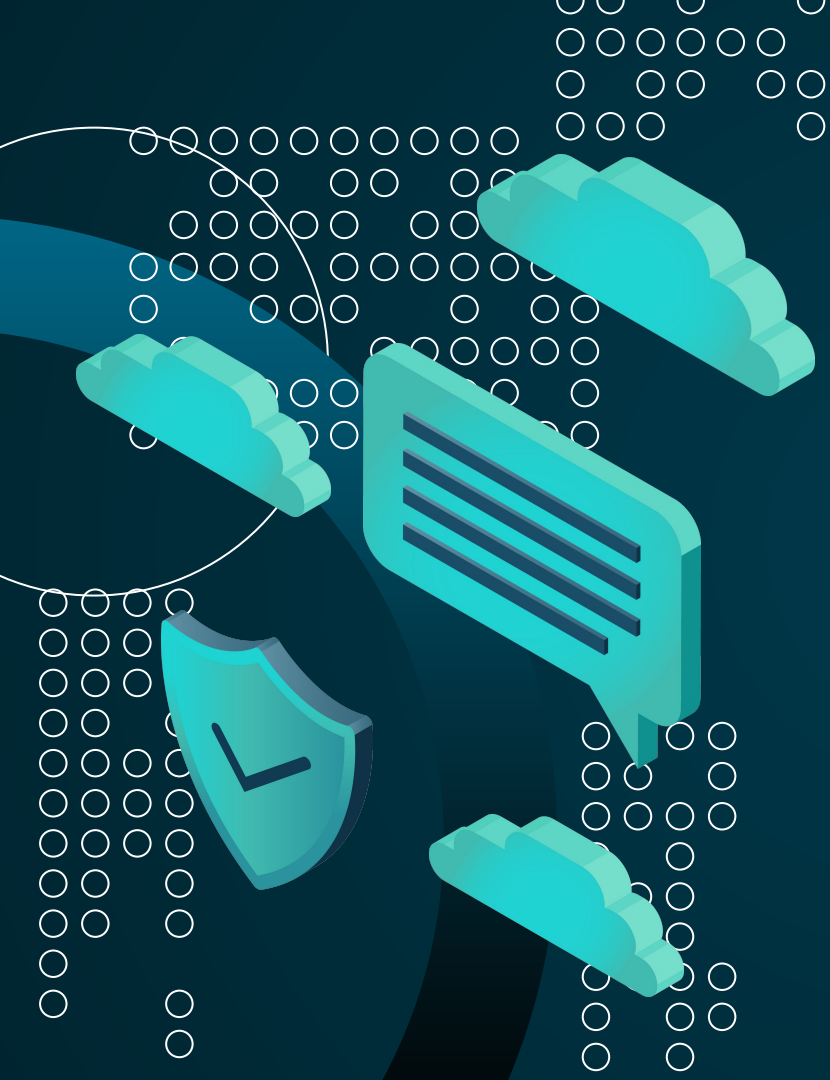
Pain Points : ISD Research Analyst

- Large volumes of unstructured data make manual analysis very **inefficient**.
- Extracting insights from text data manually is **slow and resource-intensive**.
- Manual processing increases the risk of **missing critical intelligence**.
- Threat identification requires rapid response, making **manual methods impractical**.

Triage



AI driven solution **resolves all pain points**



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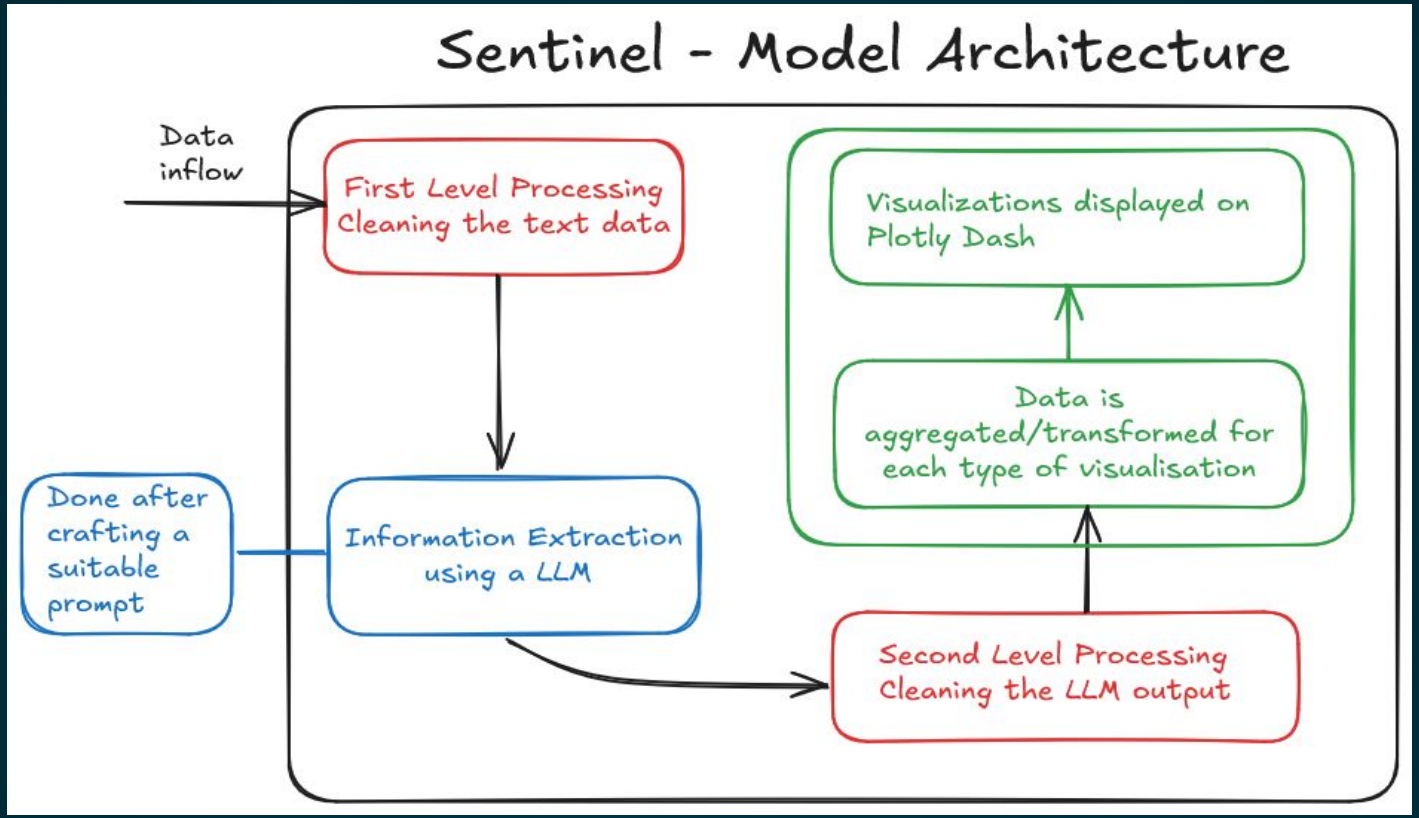
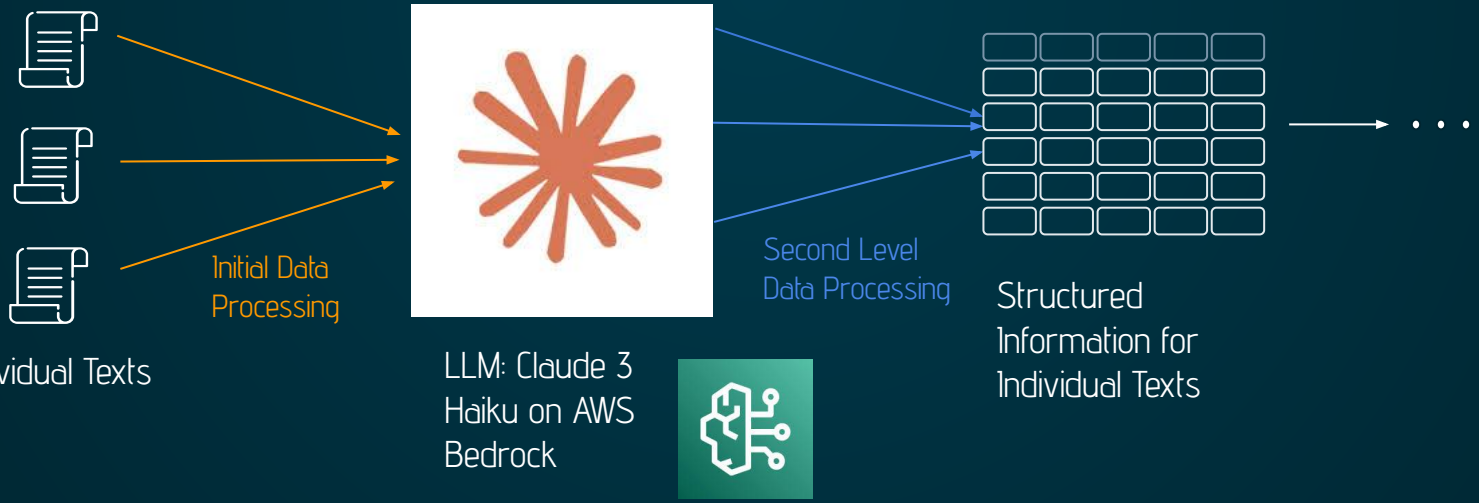
Solution


Sentinel - Model Architecture
Data inflow
First Level Processing Cleaning the text data
Visualizations displayed on Plotly Dash
Data is aggregated/transformed for each type of visualisation
Done after crafting a suitable prompt
Information Extraction using a LLM
Second Level Processing Cleaning the LLM output

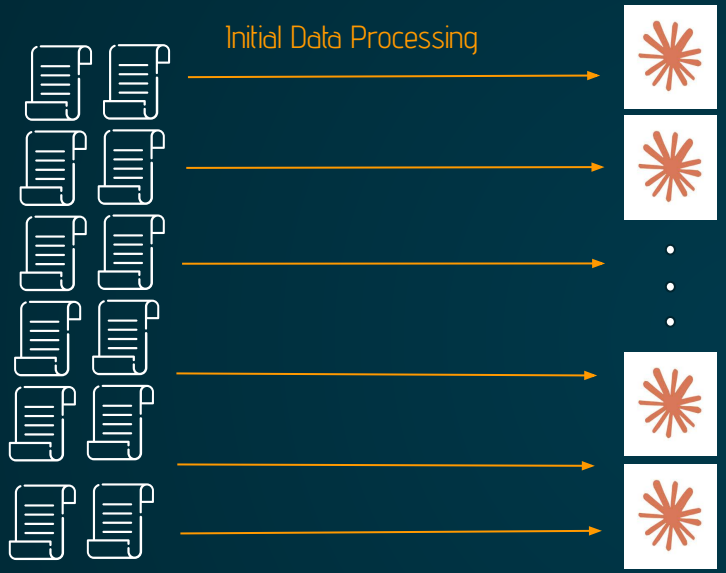
Extract Structured Data Using LLM

Prompt

You are an assistant helping Singapore's Internal Security Department (ISD) in categorizing texts into 0 to 4 critical areas of concern: Espionage, Terrorism and Violent Extremism, Cybersecurity, and Communalism. Return the data in the following JSON format ...



Scalability - Parallel Process



- Sentinel can be scaled
- Process larger amounts of data
- Multiple LLMs running at once

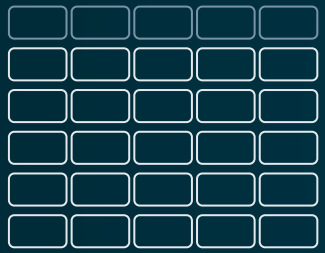
Scalability - Cost

Our costs for running the model during this hackathon on all texts (from AWS Cost Manager)

- Extremely cheap - US$0.55 for running all of the datathon text using LLM on AWS Bedrock
- Scaling with multiple models is cost effective

Aggregation / Transformation

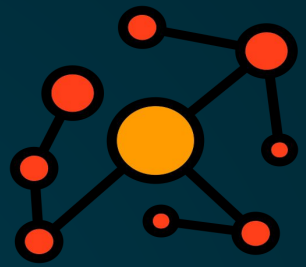
Terrrorism	Communalism	Cybersec	Espionage	Date
T	F	F	F	2022
F	T	T	F	2021
T	F	F	T	2024
F	T	F	T	2024
F	T	T	T	2024



Structured Information for Individual Texts

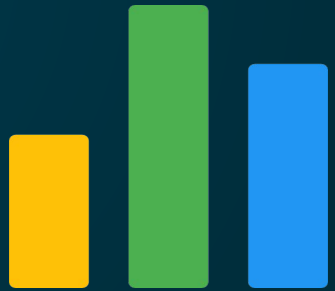
Data Transformation for Visualisations

Breadth First Search



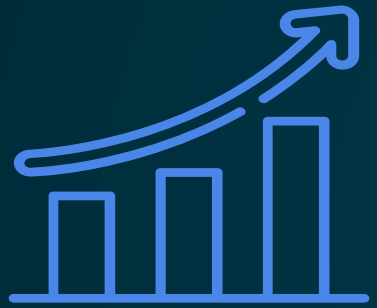
Network Graph

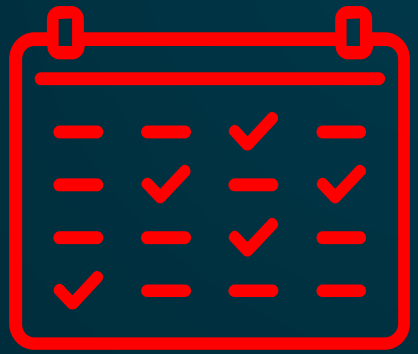
Aggregation



Bar Graph

Visualisations





Visualisation - Plotly Dash

Python framework for building interactive dashboards.

- Traditional Front End Tech Stack: JavaScript (JS), JS Framework (Node, React, etc), HTML, CSS, ...
- Plotly Tech Stack - Only Python
- Dynamic & interactive – supports real-time updates and user inputs.
- Open Source and Free

Visualisation - Cost

Comparison against other commonly used no code dashboarding tools

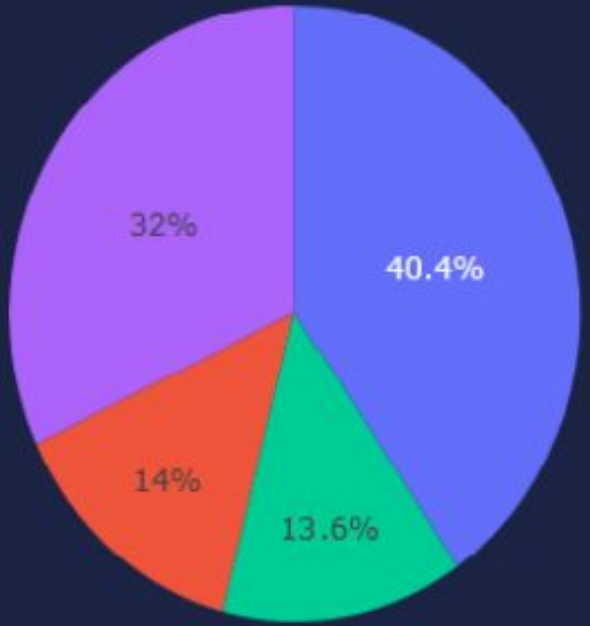
Visualisation Tool	Monthly Cost (US$ Per User)	Annual Cost (US$ Per User)
Plotly Dash	0	0
Tableau Enterprise	75	900
PowerBI Enterprise	24	288

- Plotly Dash is free for many users
- Each unique user requires a product key that needs to be paid for
- Costs will scale for tools like Tableau and PowerBI

Sources :
www.tableau.com/pricing
www.microsoft.com/en-us/power-platform/products/power-bi/pricing

Geospatial Threat Heatmap

Geospatial Threat Heatmap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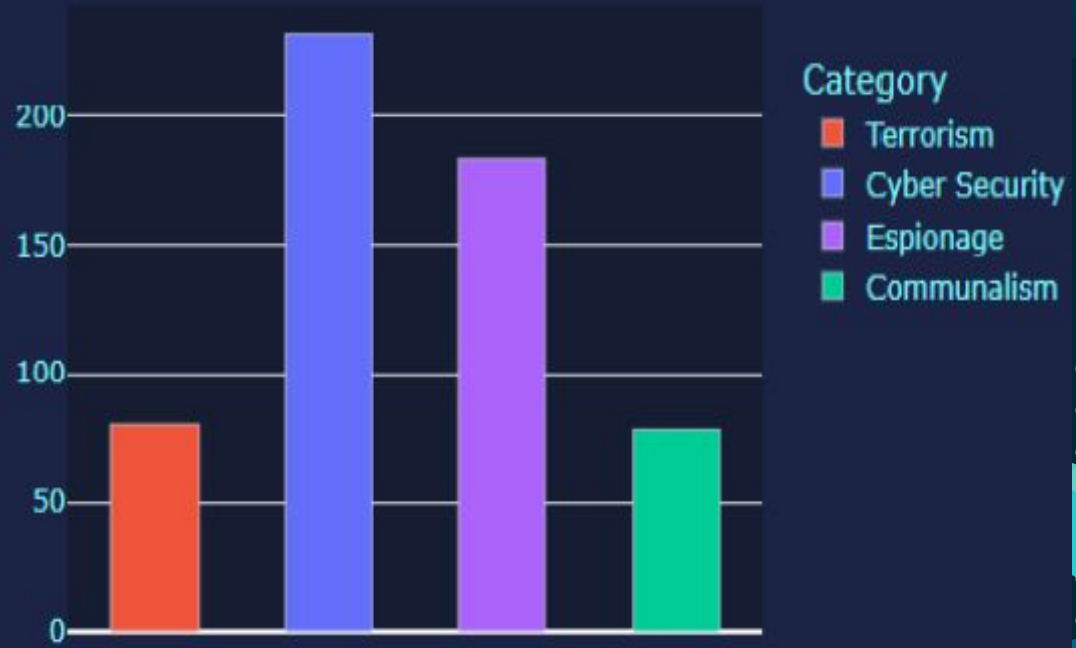
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Category
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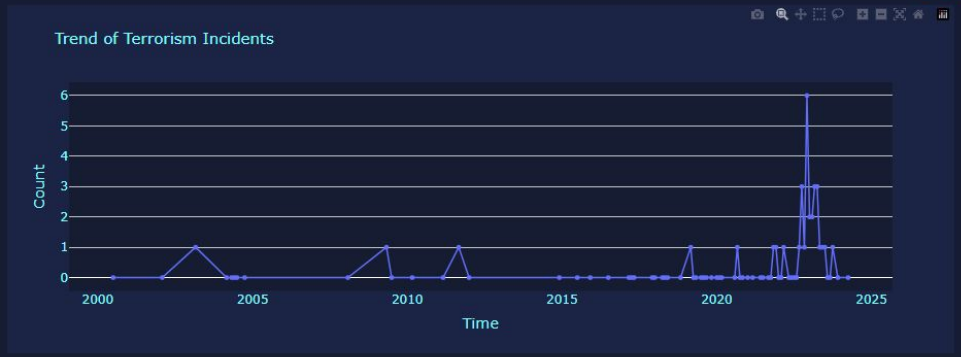
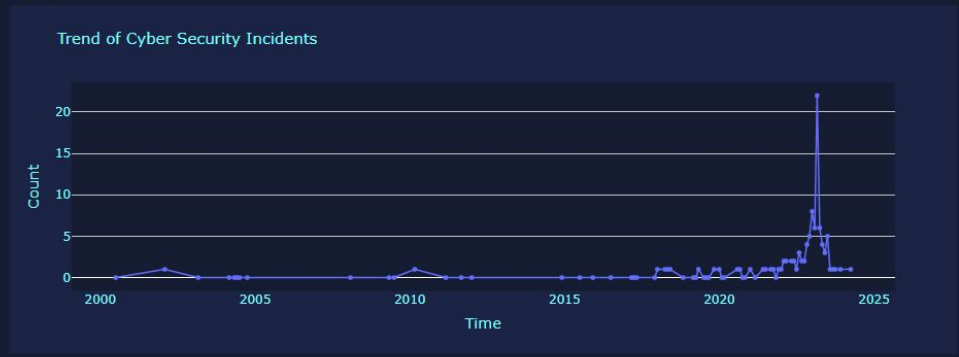
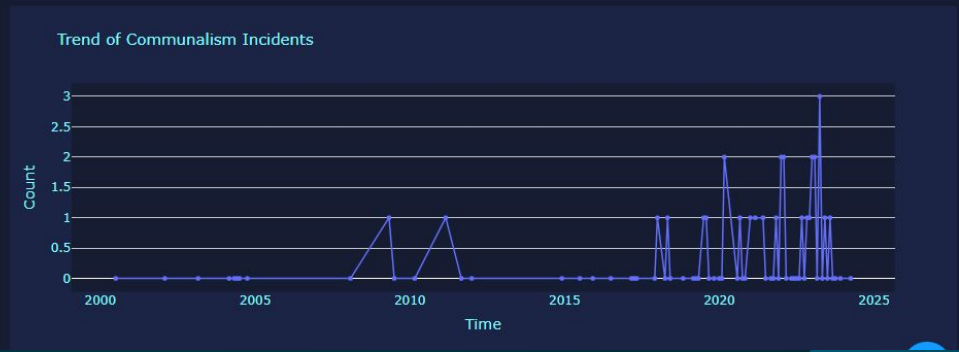
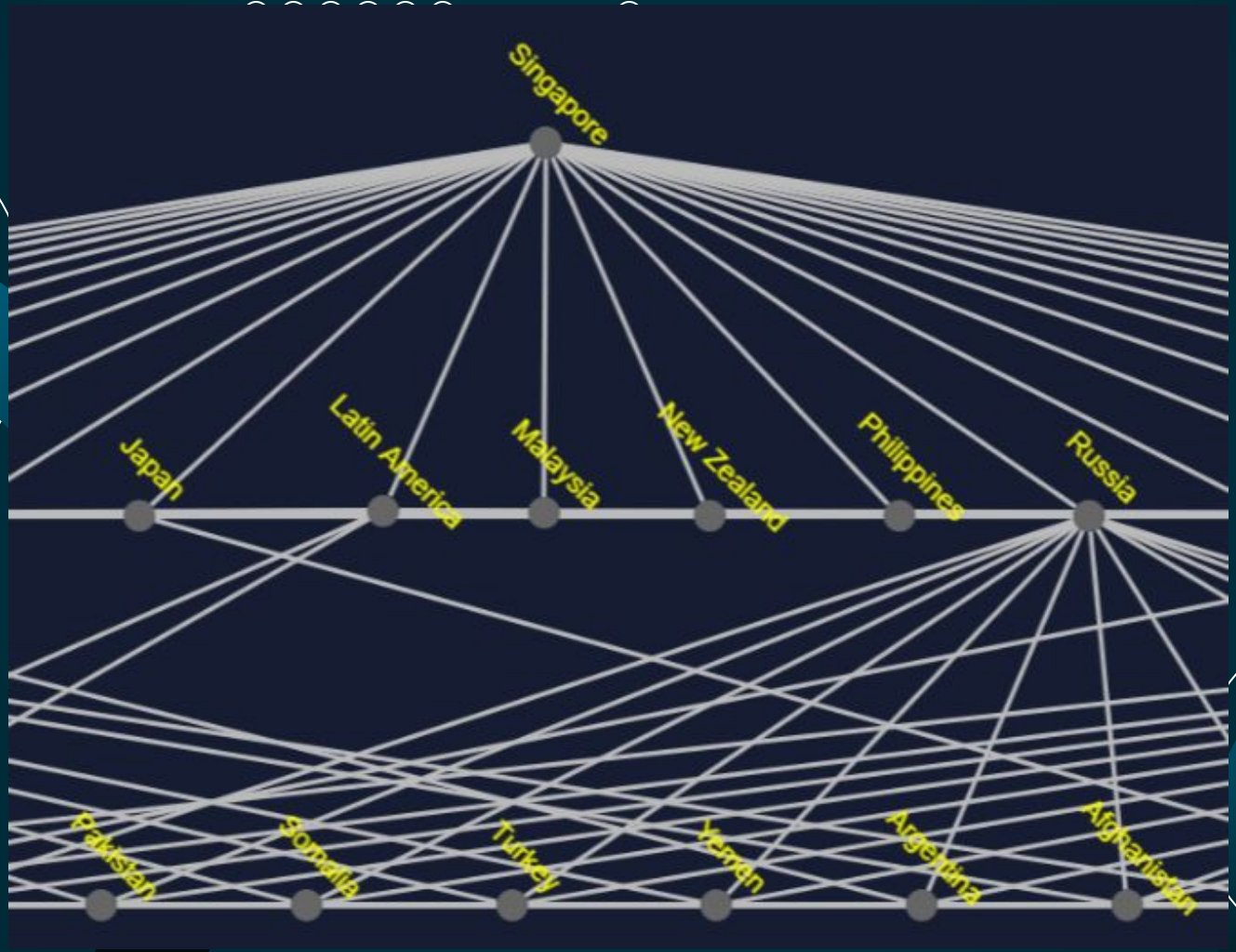
Trend Analysis Over Time

News Leaks





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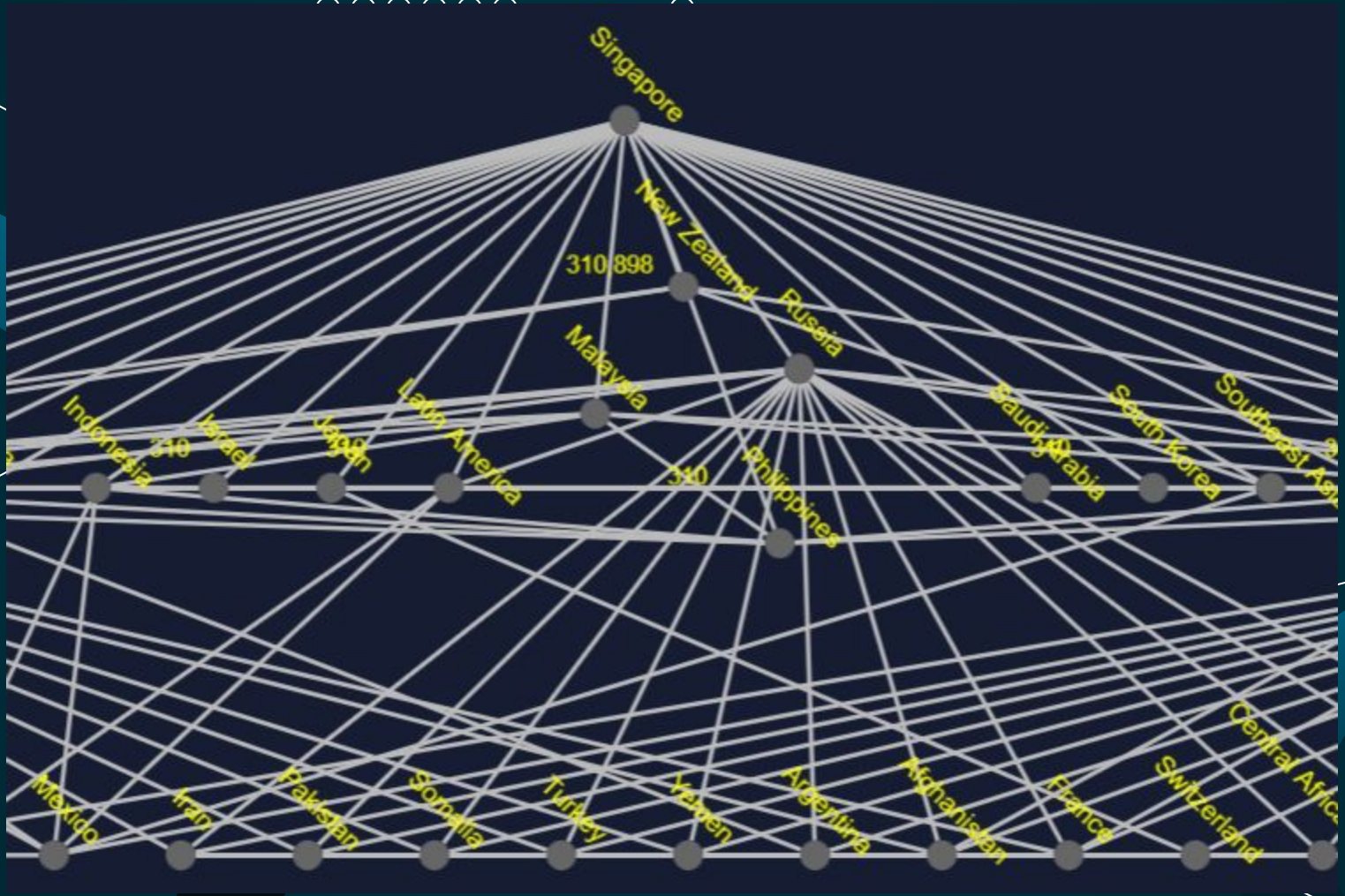
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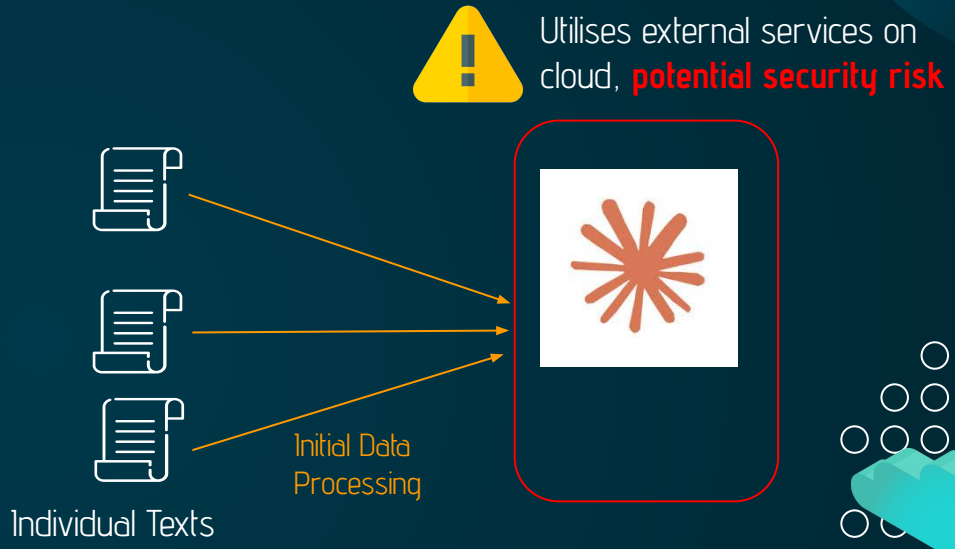
03

Future Improvements

Safety and Security

Part of the pipeline utilises AWS and Anthropic services. This comes with some risks.

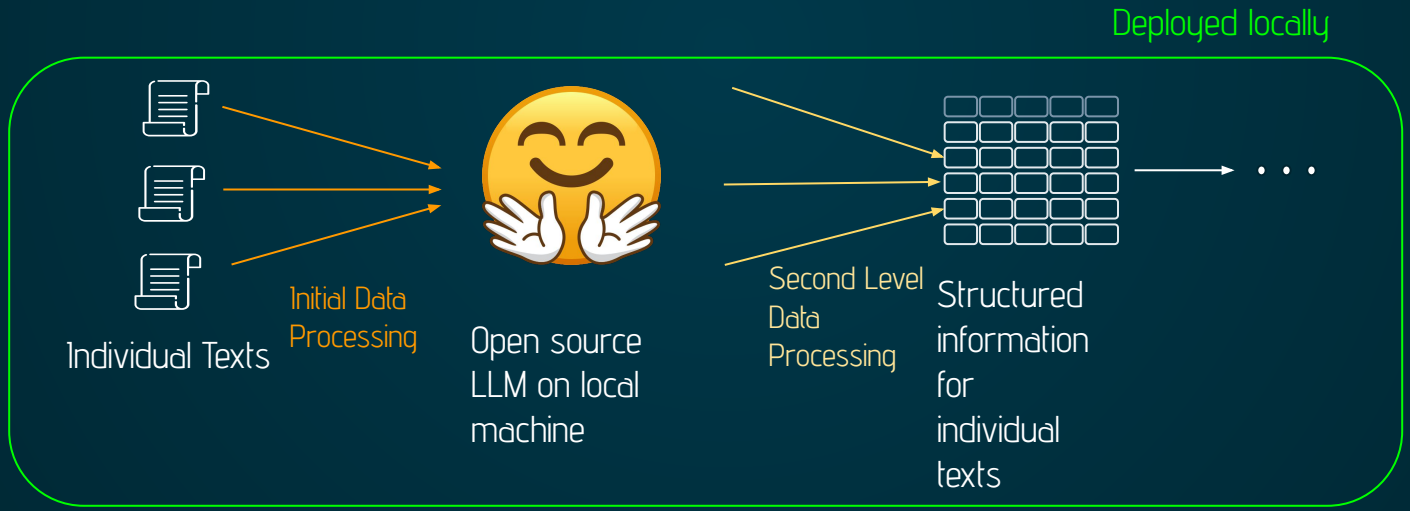
- Anthropic/AWS may utilise sensitive ISD documents for LLM training data.
- Reliance on AWS for service continuity is not ideal. Outages could happen that could disrupt monitoring.



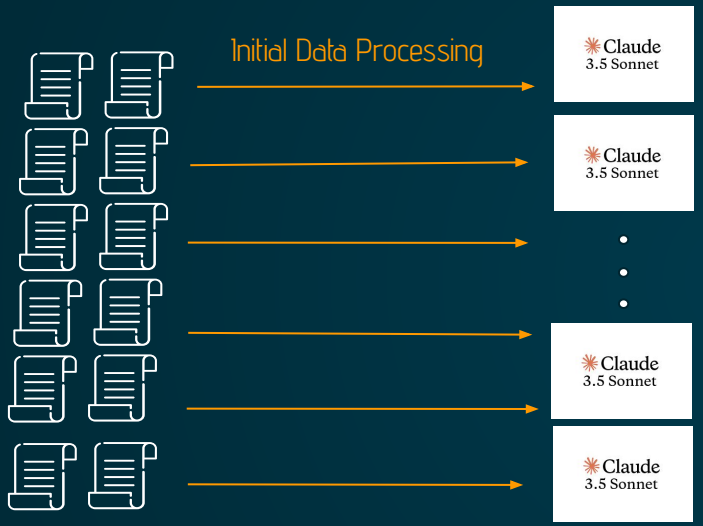
Resolving Safety Security Concerns

Solution? Deploy locally -

- LLMs can be downloaded onto a computer, e.g. Hugging Face
- Cannot use Anthropic models locally (Public endpoints/Not open-source)
- Scripts to process data can run on the same PC
- Plotly Dash can be deployed locally for secure access.

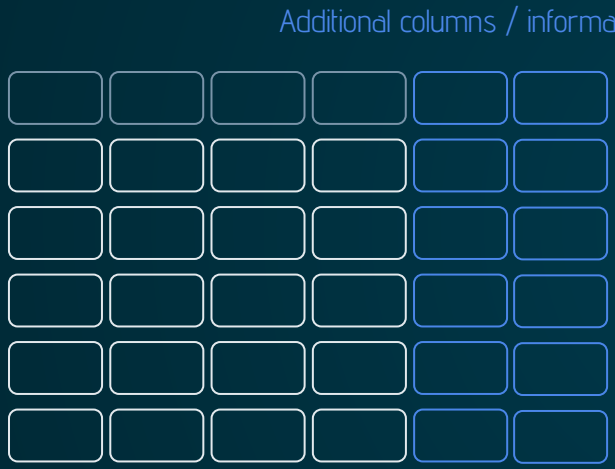


Upgrade LLM



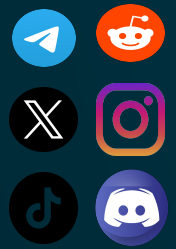
- Could consider more powerful models like Claude 3.5 Sonnet
- Better at extracting data
- Many options available - Hugging Face, DeepSeek R1 etc

Customizability



- Additional information can be requested from the LLM to augment existing analyses
- E.g. Risk score to Singapore - **1 (low)** to **5 (immediate danger)**
- Information can be highlighted in visualisations (e.g. edges on Network Graph) for immediate action.

Expand Data Sources



- Datathon only provided 2 data sources - News Excerpts and WikiLeaks Documents
- Include more news articles from multiple global sources.
- Include official government and company documents.
- Social Media monitoring dashboards to detect potential threats

04

Conclusion

Benefits of Sentinel

- Low Cost - US$0.55 for 1553 texts/documents
- Scalable - Solution can accommodate larger datasets
- Security - Entire pipeline can be ran in an isolated environment
- Reproducibility - All tools are open source, requires only a good understanding of Python

All pain points addressed

1. ~~Large volumes of unstructured data make manual analysis very inefficient~~.
2. ~~Extracting insights from text data manually is slow and resource-intensive~~.
3. ~~Manual processing increases the risk of missing critical intelligence~~.
4. ~~Threat identification requires rapid response, making manual methods impractical~~.

1. Leveraged LLM on AWS to parse large volumes of text, improving efficiency.
2. Enabled ISD Research Analysts to focus on higher-value tasks instead of manual text review.
3. Generated structured data from text and visualise data on a Dashboard enable quick identification of key intelligence.
4. Minimised missed critical insights with comprehensive data extraction.

THANK YOU!

Any questions?

References

1. https://www.mha.gov.sg/isd/keeping-threats-at-bay
2. https://www.mha.gov.sg/isd/be-part-of-isd/career-opportunities
3. Logos : https://www.flaticon.com/
4. www.tableau.com/pricing
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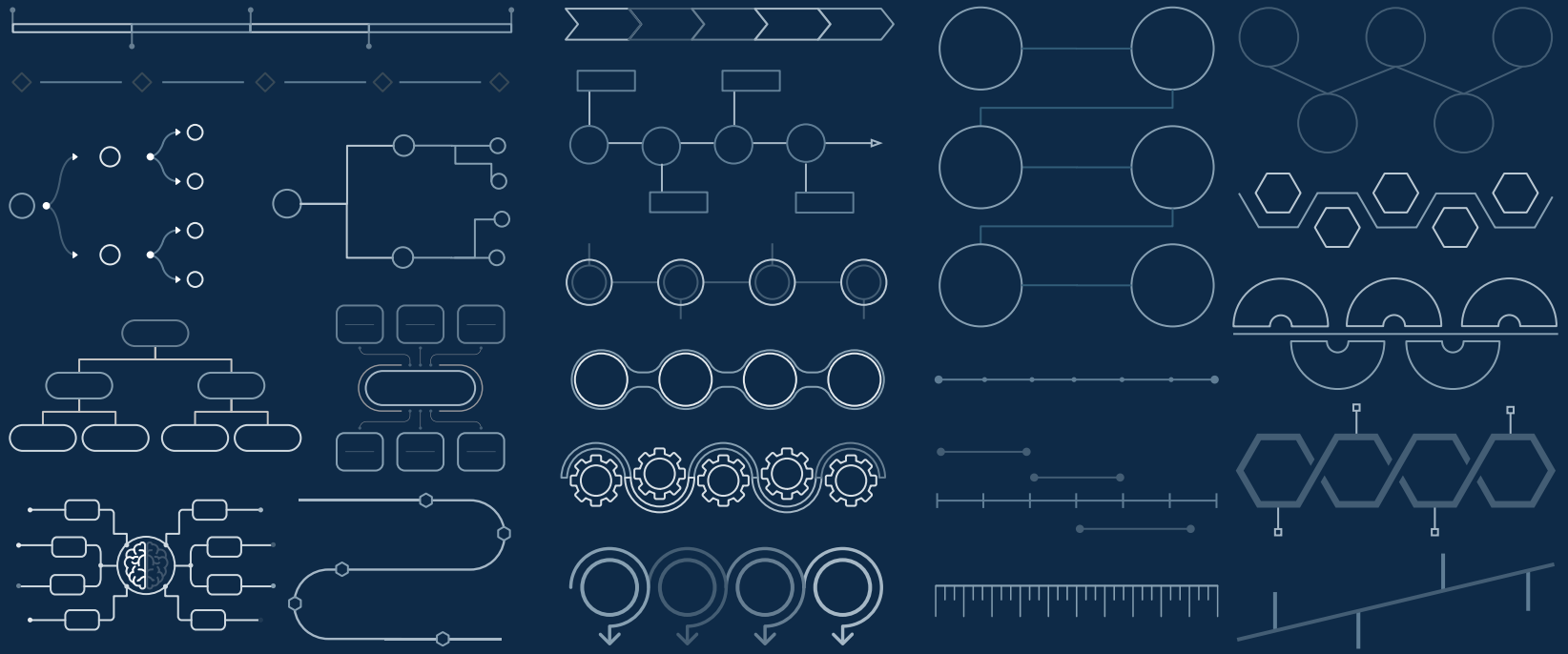

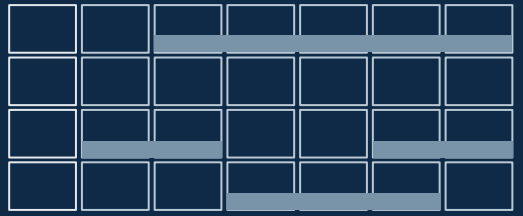

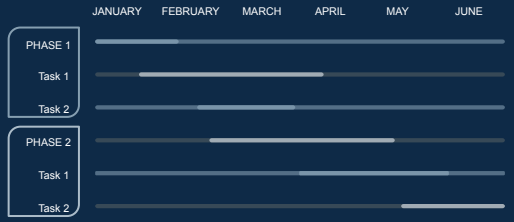
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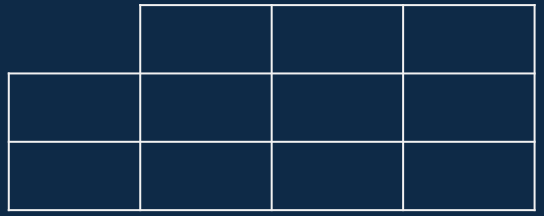

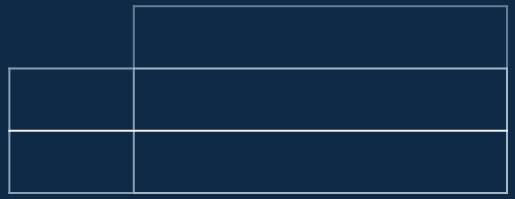

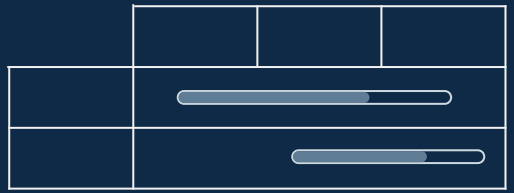

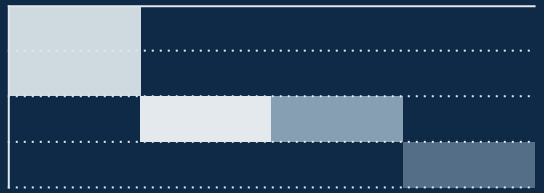

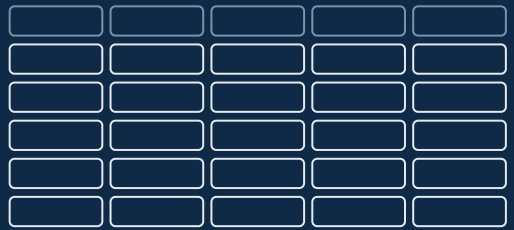

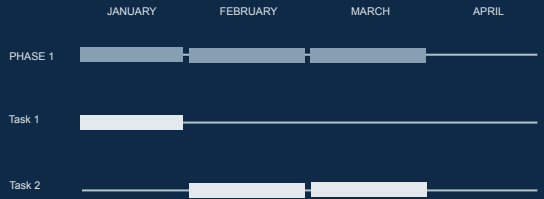
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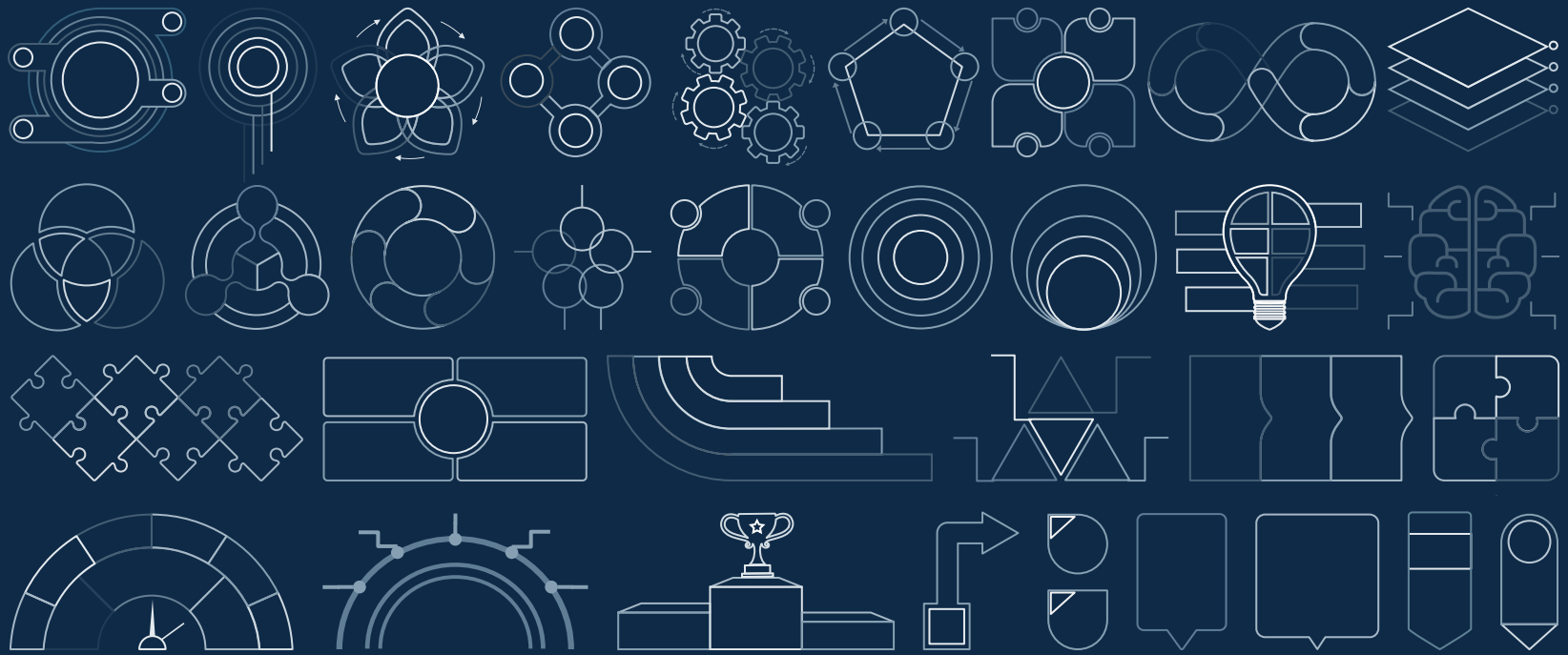

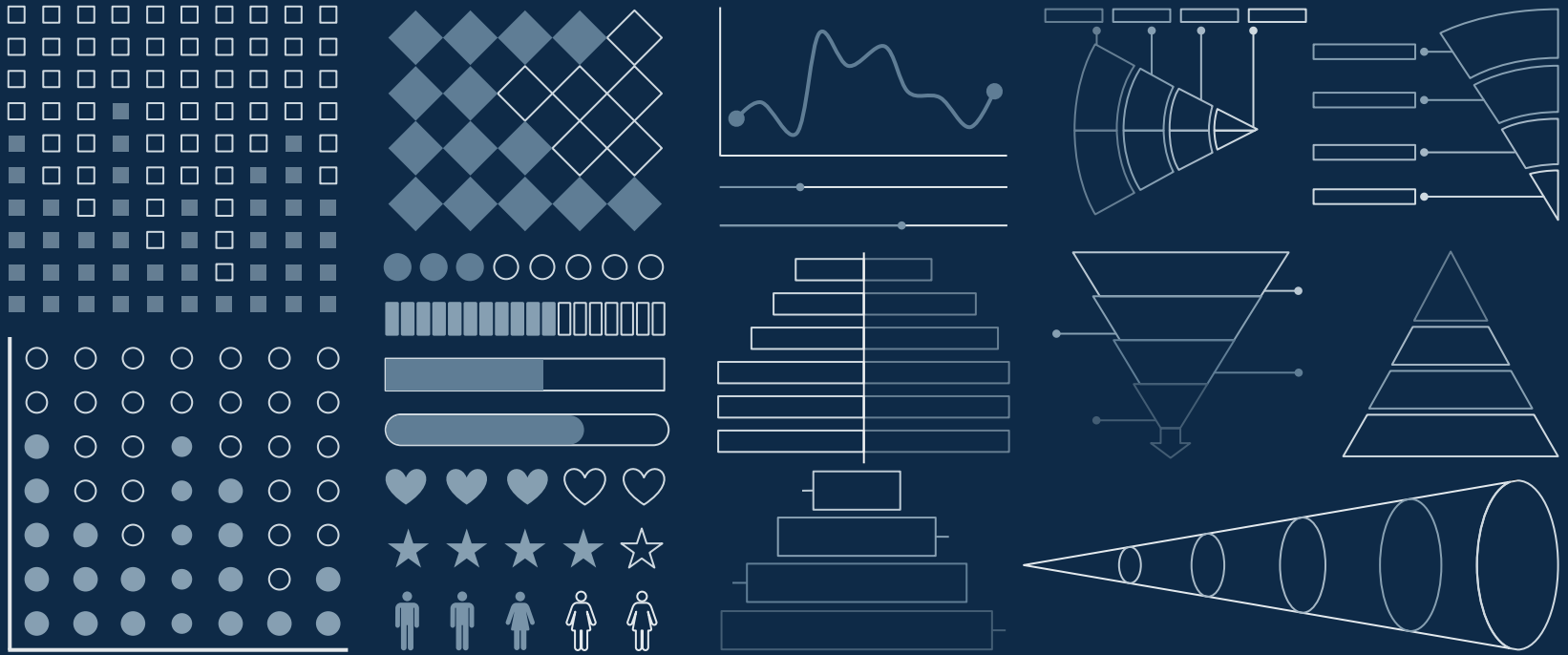

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