Automating the junior analyst

Cyber security report generation with classic AI

by Sergey Polzunov

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Effective reporting is difficult

Requirements

- **Efficiency**: there is a demand for extensive communication towards both internal and external stakeholders, placing a significant burden on the security teams to produce a wide range of reports.
- **Quality**: inconsistent quality hinders understand within an organization. With reports varying in accuracy and clarity, it is difficult for stakeholders to make informed decisions promptly.
- **Customisation**: crafting reports to meet the specific needs of various stakeholders manually requires time and effort.

The problem with efficiency

- **Efficiency**: it is difficult to scale up the report production:
  - while creative in-depth research work enjoys a dedicated time budget, simpler reports are often neglected and left to junior analysts to do
  - the reporting features in the security platforms are simplistic: mostly multi-page text-area forms or WYSIWYG editors *(bonus points if you can insert pictures or tables!)*

The problem with quality

- **Quality**: the teams develop internal guidelines and templates but there are associated costs:
  - template management is painful – the templates are treated as artifacts and are stored in Google Docs, OneDrive, Confluence, or in endless email threads with Word documents *(bonus points if you use git!)*
  - there are no built-in control checks to make sure all required data is included in the final text
  - stylistic and formatting constraints are not applied automatically, leaving space for inconsistencies.

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The problem with customisation

- **Customisation**: the final form of the report depends on the target audience *and* on the input data available:
  - the multiple variants of the same report are either produced from a clean slate or require some creative frankenstein-ing of various other templates into one
  - writer’s block is still an issue when starting from scratch
  - the templates are rigid and must be adjusted manually if the shape of input data changes

Let’s automate it!

- **Efficiency**: using code to generate the reports
- **Quality** and **Customisation**: introducing “reports-as-code” templating:
  - A template is specification tree written in a custom declarative DSL
  - A template defines the document structure and the data needed to populate the document, without prescribing the exact words / phrases to be used
  - The same template can be used to produce multiple variants of the report or produce the report from different shapes of input data:
    - the “compilation” step of combining the **template**, the **configuration**, and the **input data** defines the final form of the document.

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! Full automation is unachievable – somebody always needs to perform the last editing step and sign off on the final product

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Where is AI here?

Classic and modern AI from a bird's-eye view

- Symbolic AI
  - Rule-based systems that relied on predefined rules and logic, making them suitable for deterministic well-defined tasks and problems.
  - Excels in the domains where the knowledge can be structured and codified into a clean input data. No learning ability.
- ML models
  - Utilise machine learning algorithms to enable systems to learn complex patterns, relationships, and behaviours from data. Training requires vast amounts of training data.

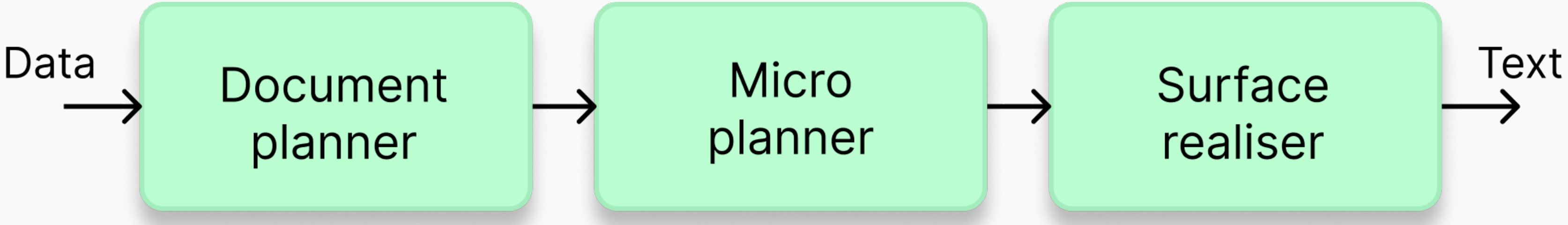
Why not just throw a LLM at it?

Using LLMs as end-to-end solution relies on LLM as both *a knowledge base* and *a comprehension engine*:

- there are issues with the embedded knowledge base:
    - limited domain expertise
    - over-reliance on training data, with all its built-in biases
- there are issues with the comprehension engine:
    - limited context understanding ability
    - absence of transparency, explainability and auditability (cyber security becoming more regulated!) that hinders QA efforts and erodes trust

Natural Language Generation pipeline

Natural Language Generation pipeline



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- defines the document structure based on configuration and available data

- selects properties and data points from the input data
- defines the aggregations of the data points to be expressed together

-generates the final text from a spec
-performs syntactical, morphological and orthographic realisation (SimpleNLG, Grammatical Framework, etc)

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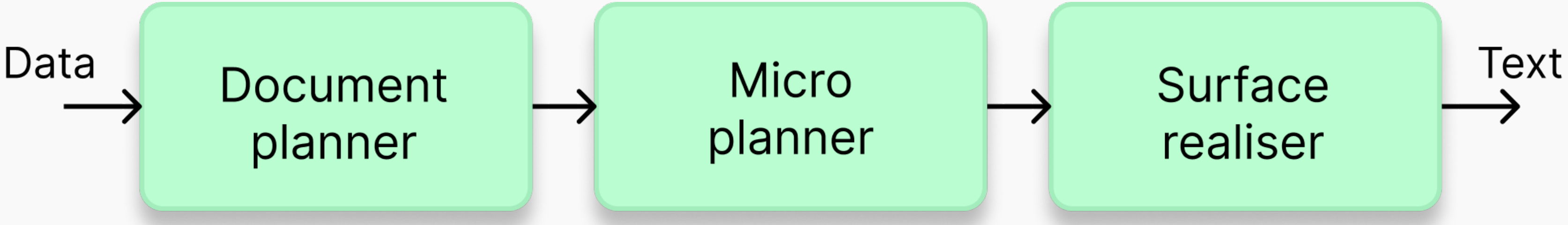

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Surface realiser

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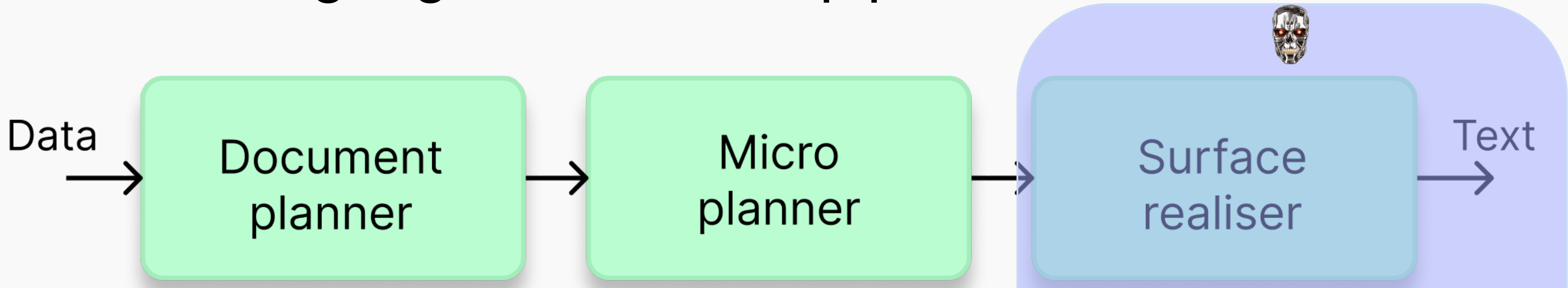
Threat actor X
- associated TTPs
- **associated campaigns**
- associated victims

Threat actor X
- **created by: Vendor V**
- **aliases: Alias1, Alias2**

Associated **Campaign A**
- **first seen: Oct 2, 2023**

Threat actor X was described by **Vendor V.** The actor is also known as "**Alias1**" and "**Alias2**". The actor is associated with **Campaign A,** first observed on **Oct 2, 2023.**

Natural Language Generation pipeline with ML



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Narrow scope allows for specialised ML models:

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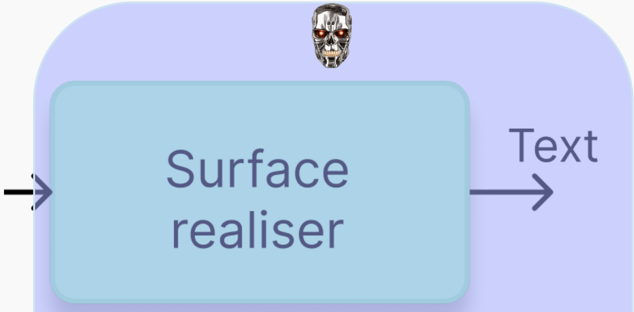
- BART language model (2018): converting a partial set of unordered non-inflected tokens into a full set of ordered inflected tokens



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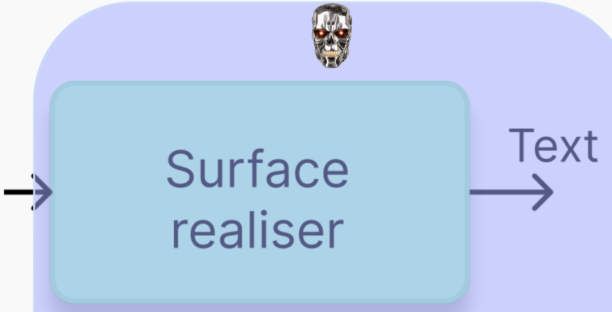
or a **constrained** use of LLMs (GPT, LLaMA, etc).

The model just needs to know English language.

The final editing step is the smallest.



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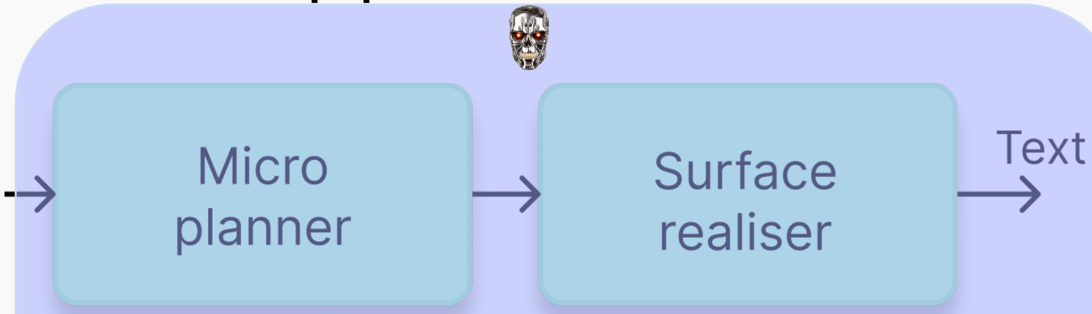
Wider scope requires the model to "understand":

- summarisation
- rephrasing

Less control:

- it is difficult to impose restrictions on the output
- the result text is less predictable
- larger editing step



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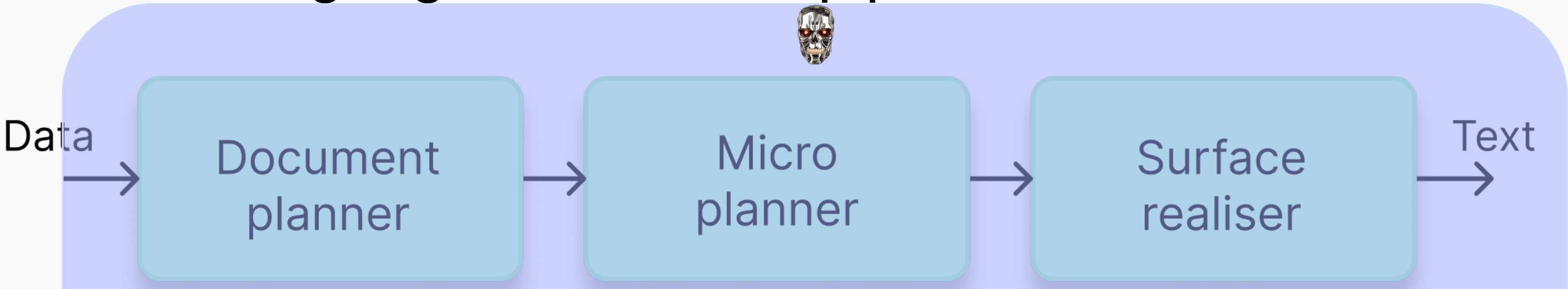

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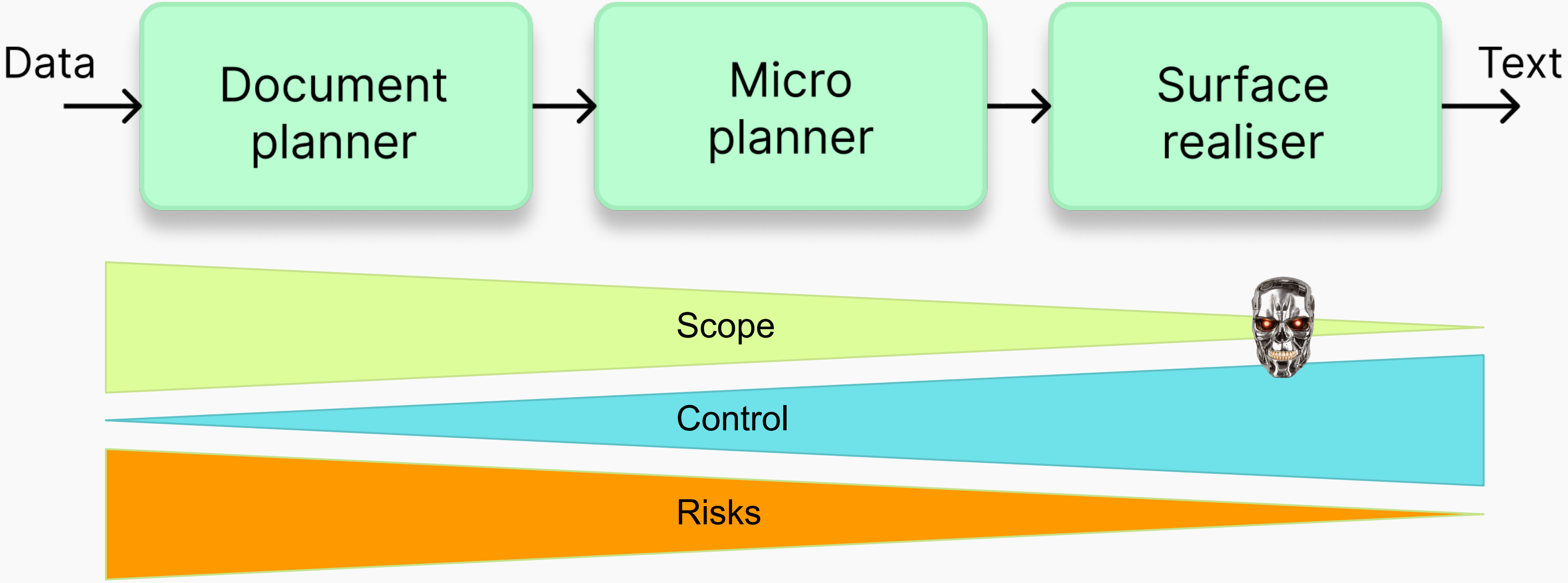
Let's throw LLM at it!

Lowest level of control, the highest risk, largest editing step.

The right amount of ML in NLG



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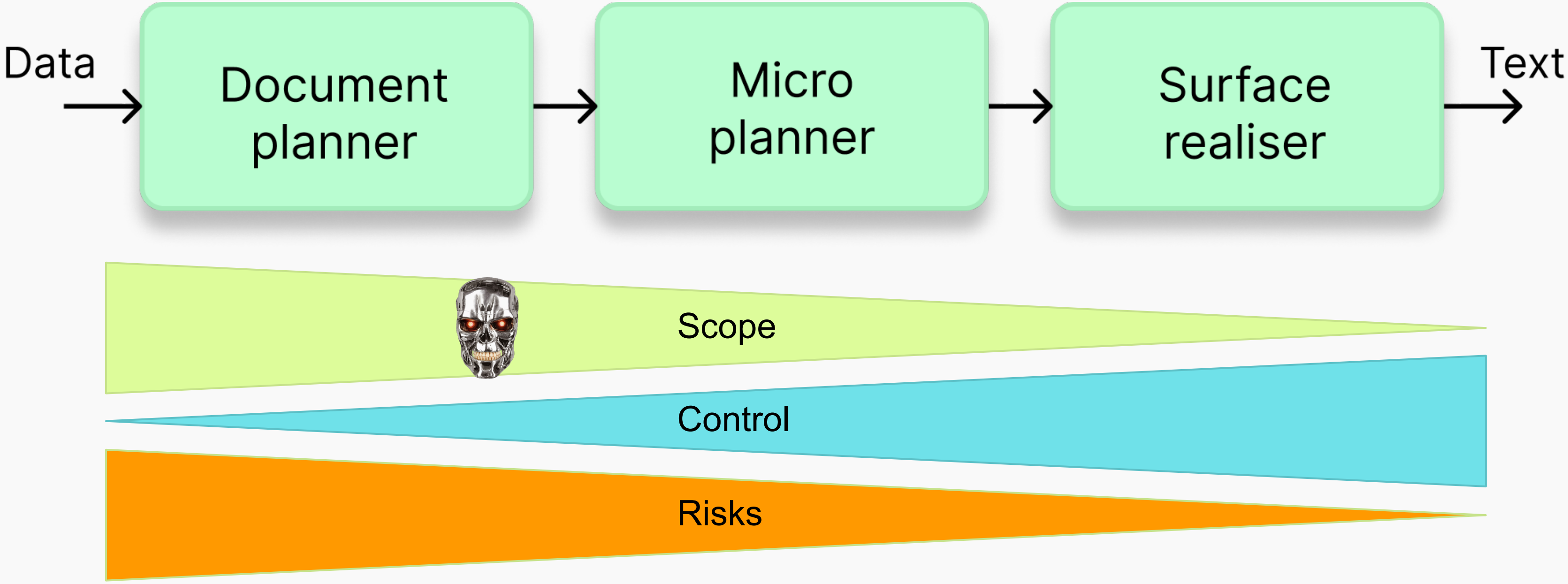

Conclusions

- **Re-evaluate existing tech:**
    - classic rule-based systems have a lot to offer and can be nicely combined with the creativity of the modern ML models
- **Define how much ML is right for you:**
    - be mindful of the risks that come with deploying ML models (and LLMs) in production in mission critical workflows
- **Sometimes less is more:**
    - LLMs are powerful and easy to integrate with, but there are smaller ML models that might fit your use cases better, are easier to manage and can be run on-prem
- **Be on top of your reporting game!**
    - NIS2 brings additional pressure to have the communications streamlined

Thank you!

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https://blackstork.io