PromptSight: Forecasting Emerging Technologies via Iterative Self-Prompting in Large Language Models

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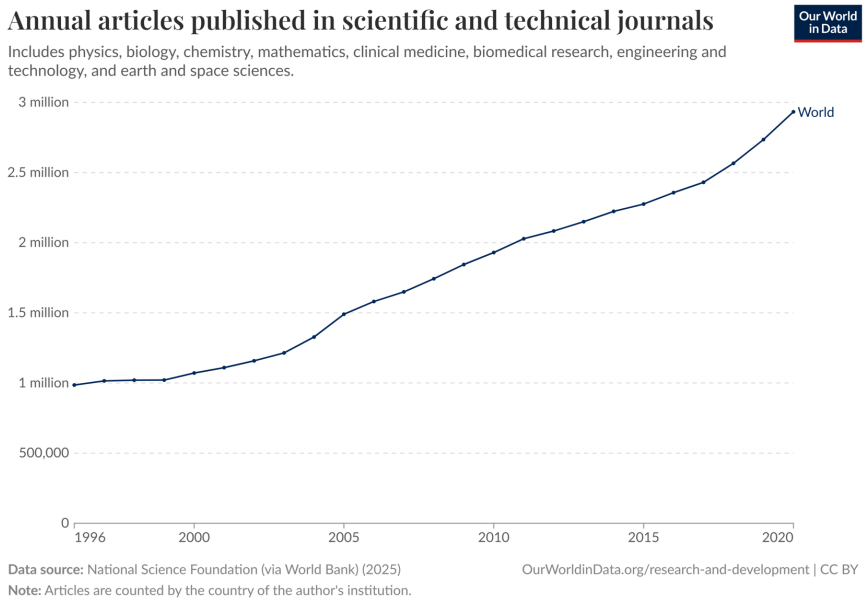
Today

- Technology forecasting and machine learning
- PromptSight: how does it work?
- Results
- Limitations
- Future directions

Technology forecasting and ML - 1

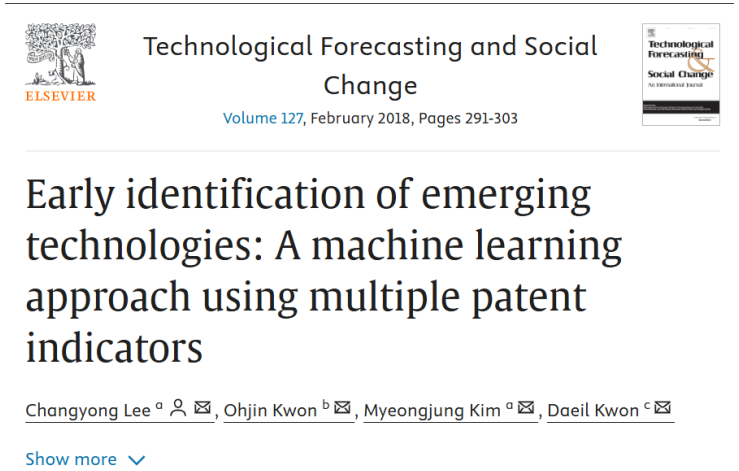
- We focus on **fast-moving technologies** (e.g. LLMs)
  → difficult to execute traditional forecasting methods such as Delphi analysis

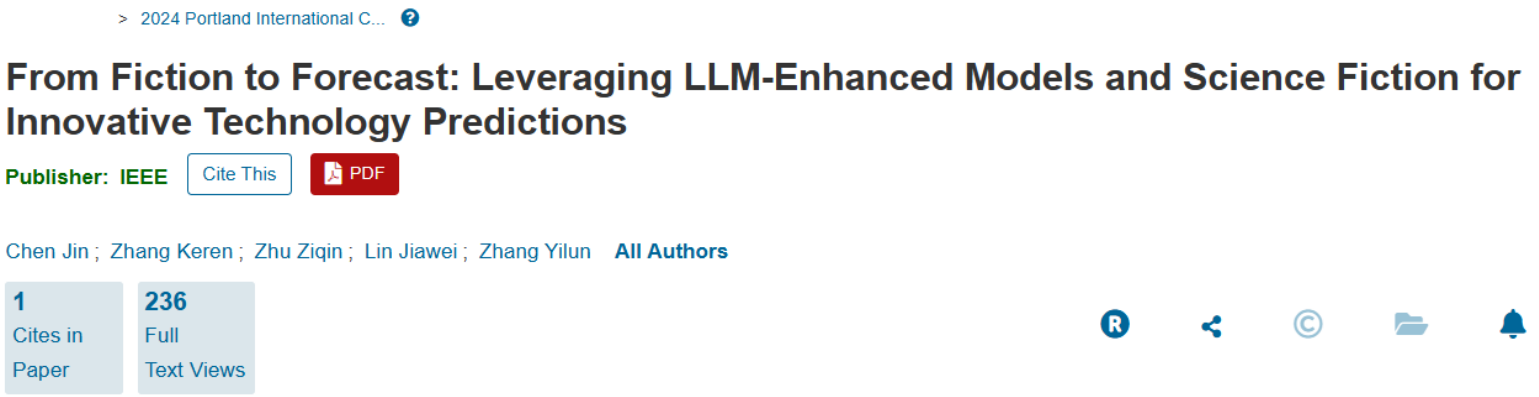
- Large quantities of rapidly evolving information further complicate expert-based reviews



Technology forecasting and ML – 2

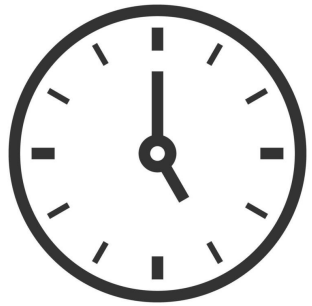
- Recent research aims at processing this information with ML and NLP



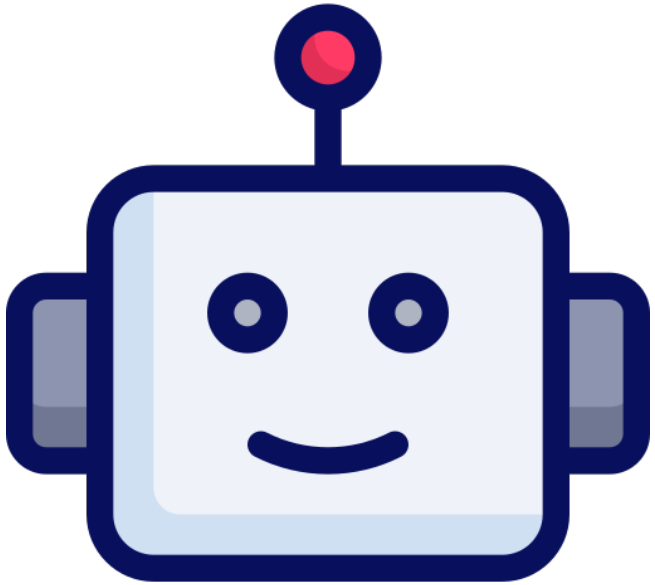


This is nice, but…

- Such methods are **computationally expensive** and **not readily available**
  → need to process a large amount of data



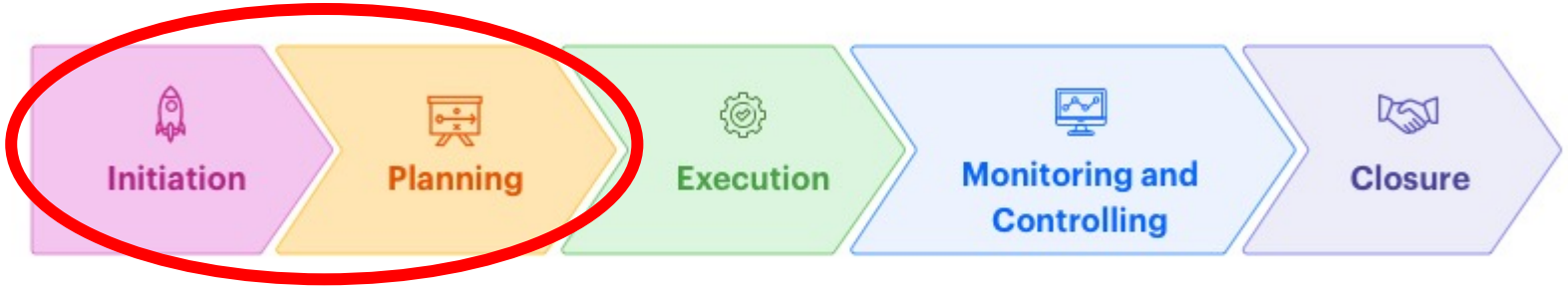
- What if we are in early stages of exploration and want to get an initial idea of the field?



LLM usage is under-explored

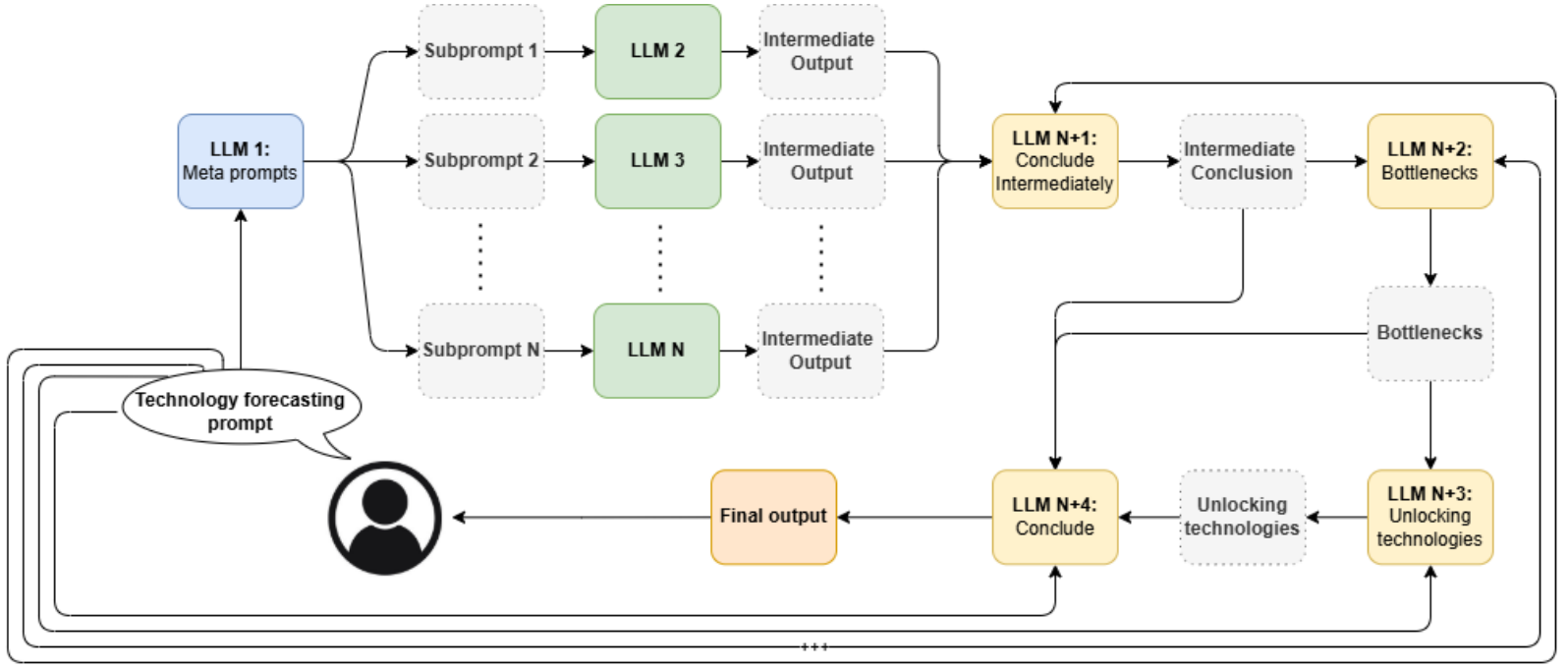
- The performance of LLMs is highly dependent on the **prompting strategy**
- We found that directly prompting a LLM results in a forecast **lacking depth and breadth**

→ **Contribution:** we provide an *agentic AI* framework for technology forecasting



PromptSight

- Prompts are split into **subquestions**
- **Bottlenecks** and **unlocking** technologies are identified
- The final output is a **comprehensive** technology overview



Example – splitting into sub-prompts

- Prompt:

  *What will be the three most important and impactful technologies in the field of **satellite communication** over the next five years?*

- Split into sub-prompts:
  - You are doing a technology forecasting research project. Your task is to identify **current trends and developments** in the field of satellite communication, and provide an overview of the most important technologies that are currently being used.
  - You … task is to research and analyze emerging technologies in the field of satellite communication, and provide a list of **new technologies** that are being developed and have the potential to be impactful in the next five years.
  - You … task is to evaluate and rank the potential impact of different technologies in the field of satellite communication over the next five years, and identify the **top three** most important and **impactful technologies** that will shape the future of the field

Example – intermediate conclusion

- The intermediate conclusion identifies **LEO constellations, High-Throughput Satellites,** and **5G and 6G integration** as the most important emerging technologies

- However, the conclusion lacks **depth** and is not sufficiently **specific**

→ Focus on bottlenecks and unlocking technologies

Example – bottlenecks and unlocking technologies

- Several examples:
  - *LEO constellations:* Interference and congestion → satellite traffic management systems
  - *High-Throughput satellites:* High production costs → Modular and 3D-printed Satellite manufacturing technologies
  - *5G and 6G integration:* Latency and synchronization → Low-Latency Satellite Communication Protocols

Final conclusion

- Enhances the intermediate conclusion with the bottlenecks and unlocking technologies
- More elaborate, comprehensive and specific
- Full example can be found in the paper

But do we improve upon existing methods?

- We make two comparisons now:
  - Compare to a baseline LLM approach, *without* agentic AI → in our paper
  - Compare to an existing Delphi method

Comparison to traditional baseline - 0

- For a proper validation we need to compare to a traditional forecasting method

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Comparison to traditional baseline - 1

- Forecast on AI in healthcare:
  - ***Delphi:*** **Improved diagnostic accuracy**, **enhanced patient care and access**, **operational efficiency**, **educational advancements**, **ethical and data governance challenges**
  - LLM insights not in Delphi: higher focus on *computer vision* and *patient engagement and support*
- Similar findings for AI in journalism / photography

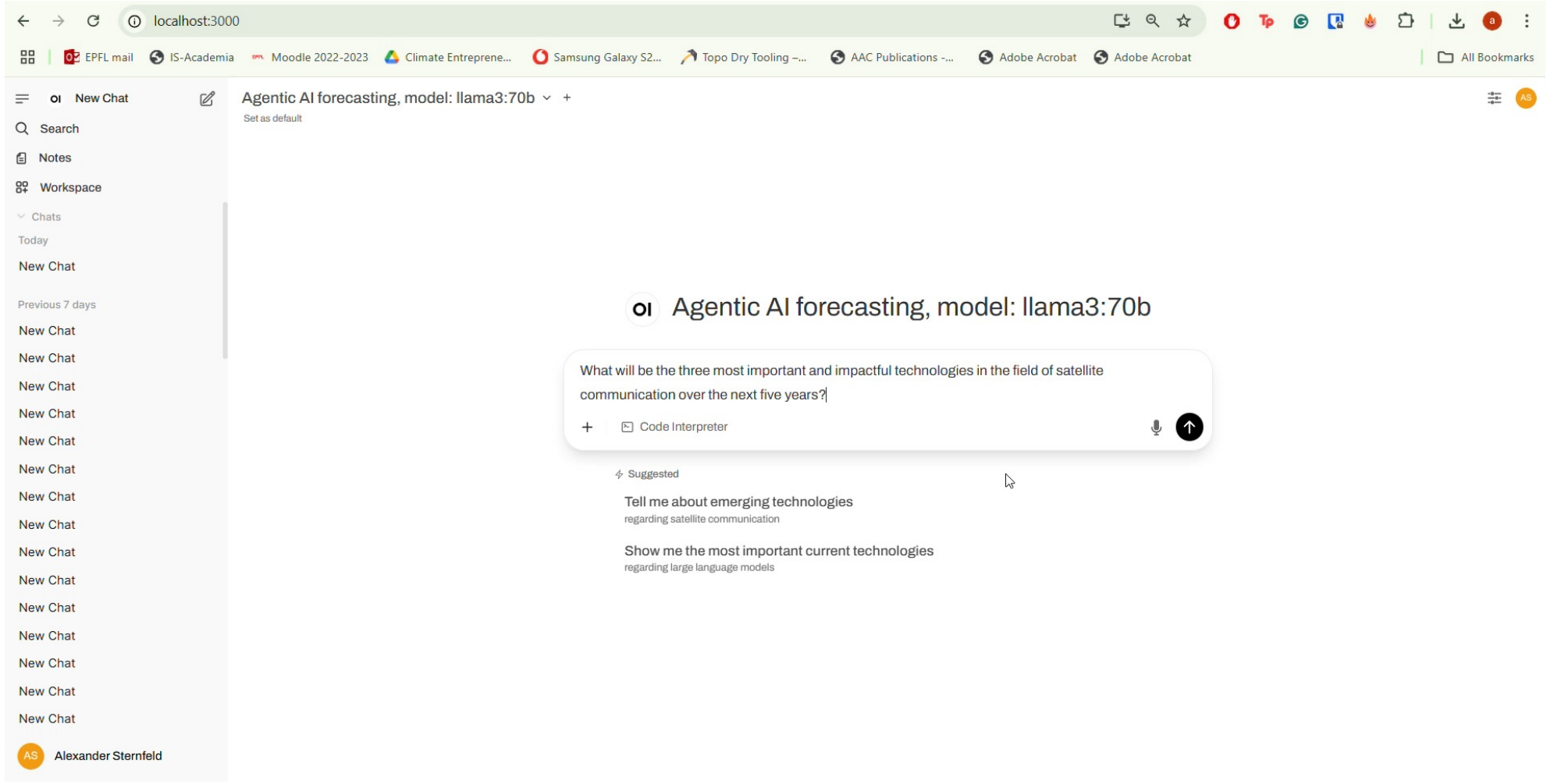
Limitations and going further

- **Hallucinations** and **climate effects**
  - Hallucination is an *inevitable risk*, however, we did not see any signs of it in our experiments.
  - Each run is computationally expensive, but the framework is meant for *high-quality* forecasts, not mass deployment
- **Retrieval-augmented generation** and **semantic triples**
  - We can improve our framework by incorporating RAG through a knowledge base, such as the semantic triple graph we developed.
  - Through this added knowledge, forecasts can become more specific and inform the user on the time and location of new emerging technologies

Future work

- Retrieval augmented generation

Demo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Alexander Sternfeld
Agentic AI forecasting, model: llama3:70b
Set as default
Agentic AI forecasting, model: llama3:70b
What will be the three most important and impactful technologies in the field of satellite communication over the next five years?
Code Interpreter
Suggested
Tell me about emerging technologies
regarding satellite communication
Show me the most important current technologies
regarding large language models

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Full paper

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Abstract

Forecasting emerging technologies is essential for guiding innovation and policy, yet traditional methods often struggle with the fast pace of technological change. Recent advances in machine learning (ML) and large language models (LLMs) are opening up new possibilities for technology forecasting by speeding up the review and summarization of technical expertise. However, the development of effective prompting strategies to fully realize these benefits is still largely underexplored. In this paper, we introduce the novel agentic AI self-prompting framework *PromptSight*, which enables LLMs to autonomously generate and refine prompts through multiple iterations, enhancing forecasting accuracy and granularity. Our results demonstrate that the technologies predicted through our framework are more specific compared to direct generation from an initial prompt. Additionally, we show that iterative prompting yields forecasts that are more structured, coherent, and comprehensive than baseline methods.

Keywords

Large Language Models, Technology Forecasting, Agentic AI, Prompt optimization