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AI Using AI – The Art of Automated Prompt

Current and Future Developments in LLM-powered Prompt Engineering

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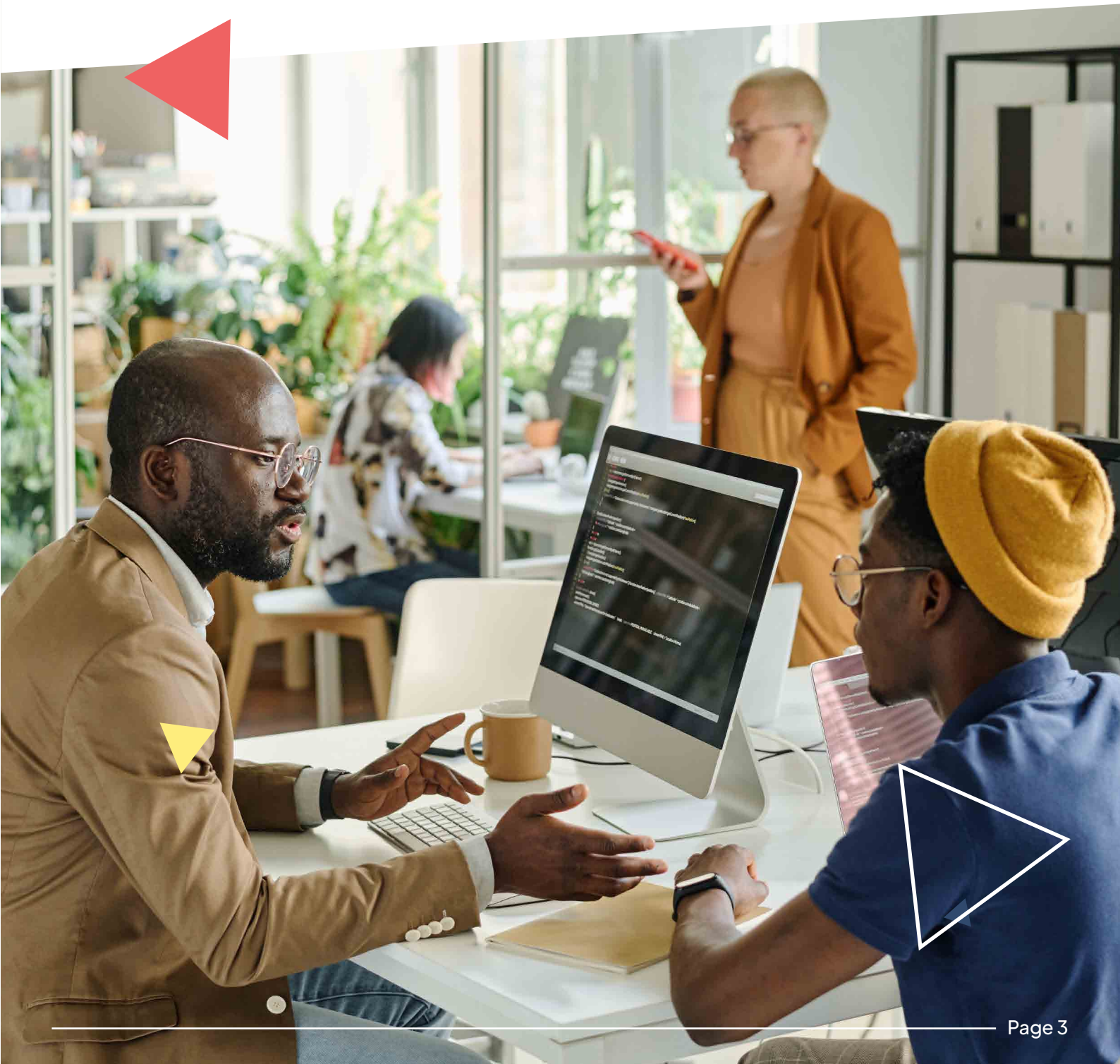
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Executive Summary

Large language models (LLMs) have successfully demonstrated their ability to comprehend instructions in natural languages. However, the performance of the LLM is significantly dependent on the quality of the human prompt. An effective prompt is essential for obtaining an appropriate response from the LLM.

This has led to more research and development in the area of automated prompts for LLMs.

This whitepaper discusses some of the current and future developments in the domain of automated prompts – designed for generating and selecting automatic instructions.



The Art of Automated Prompts

Be it a "simple" zero-shot prompt or a more "complex" chain of thoughts, LLMs use various prompting techniques, most of which humans create. In addition to text responses, LLMs are also using prompts to generate new images and videos. An automated prompt typically comprises the following:

- Humans provide descriptive instruction in simple language
- AI generates a prompt for the instruction

For instance, consider a simple prompt to “generate the image of a beach.” Instead of directly using this prompt with an LLM, an automated prompt can be to “generate a prompt to generate the image of a beach.” We tested this prompt on the Google Gemini tool. Here are some of the “more descriptive” prompts that we got from Gemini which can give a much better response from any LLM:

- A photorealistic image of a secluded cove beach with white sand, turquoise water, and a dramatic, clear sky at sunset
- A panoramic view of a golden coast beach with gentle waves lapping at the shore, a few surfers riding the waves under a bright, cloudless sky
- A peaceful image of a deserted beach at dawn, with the first rays of light painting the clear sky in soft hues of pink and orange, and footprints leading into the water
- A vibrant scene of a tropical beach paradise, with crystal-clear turquoise water, white sand, swaying palm trees, and a bright, cloudless sky painted in shades of azure and cerulean

Let’s discuss some of the latest techniques in automated prompts currently being developed.



Automated Prompt Engineering (APE)

Despite their high success rate, simple language prompts do not always produce the desired output even when LLMs are prompted with alternative instructions. Humans have to experiment with a variety of prompts to obtain the desired behavior. Often, they have limited knowledge of how compatible instructions work with a particular model.

With Automated Prompt Engineering (APE), LLMs can automatically generate instructions for a task by providing multiple instruction candidates.

What is APE? Designed for automated generation and selection of instructions, this technique adopts a formal approach to the program, which is optimized by presenting a diverse pool of instruction candidates (as suggested by the LLM). The goal of the APE technique is to maximize a selected score candidate. To evaluate the quality of the selected candidate, the LLM assesses the zero-shot performance of another LLM.

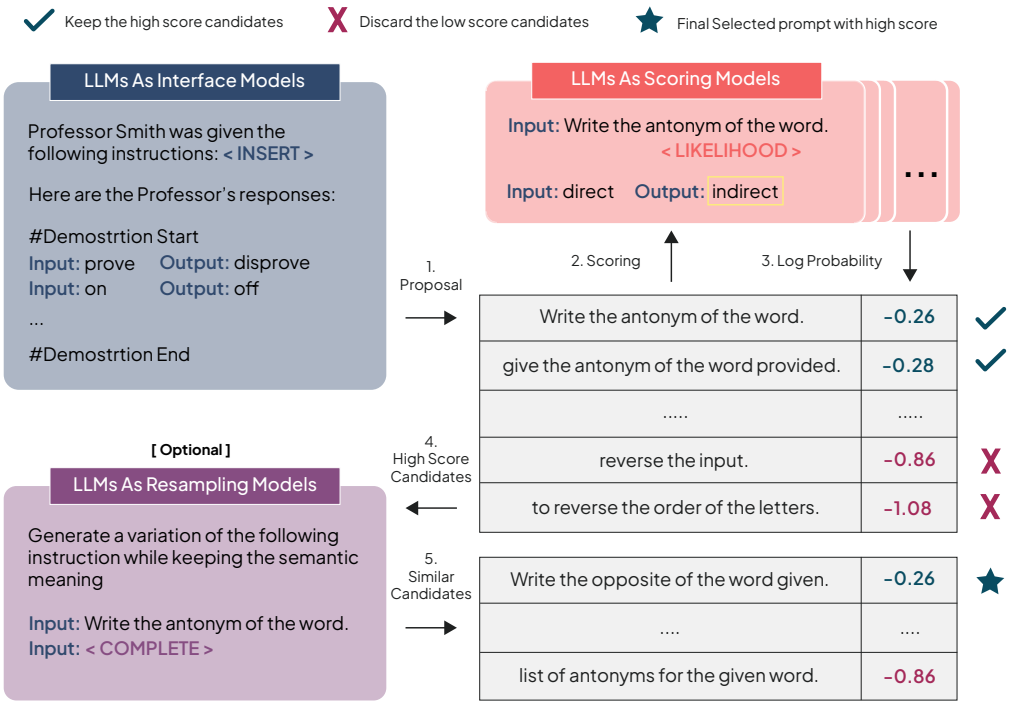


Image Source

This illustration demonstrates how automatic prompts outperform previous LLMs and perform better than instructions provided by human users. APE-driven prompts can also improve the performance of few-shot learning by appending them to existing learning prompts in context. Besides, this technique enables "truthful" and "informative" models by identifying superior zero-shot "chain of thoughts" prompts.

Graph of Thoughts (GoT)

Previous approaches like the "chain of thoughts" or "tree of thoughts" produced solutions that focused simply on the sequence of human thoughts. However, these approaches faced challenges with scenarios that require complex reasoning and problem-solving abilities. Particularly, this involved tasks requiring multiple inferencing and integrating different pieces of information.

The Graph of Thoughts (GoT) framework overcomes these LLM challenges. It is more closely linked with how humans break down and resolve problems. At the fundamental level, GoT can conceptualize the LLM output as a flexible graph structure. Each LLM "thought" represents an individual unit of information (or the graph node). Connected nodes represent their interdependency.

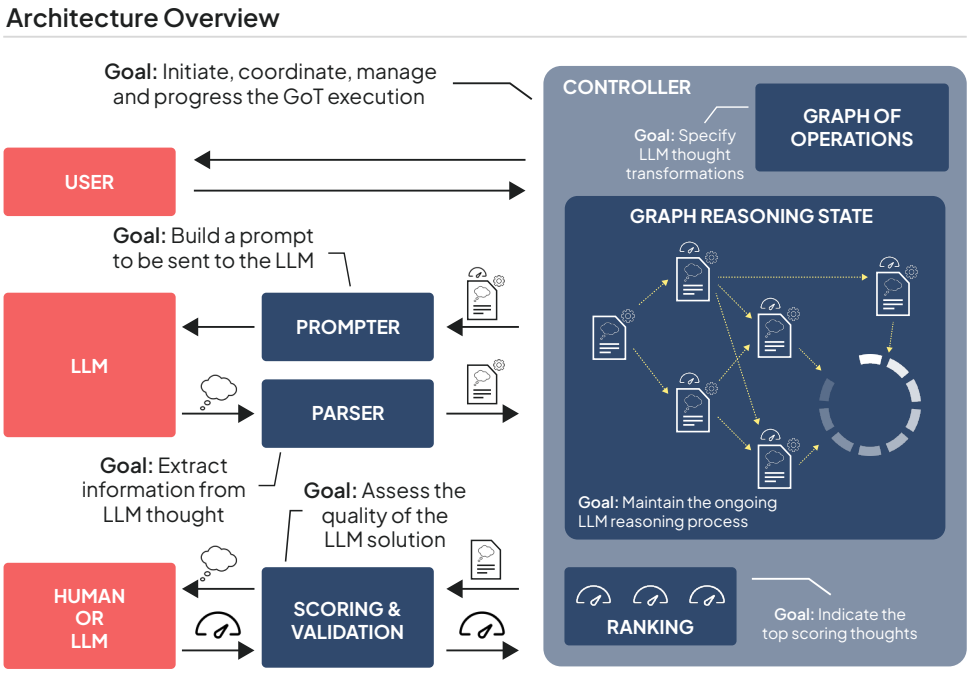


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In combination with Google's ReAct framework, the GoT framework can produce a complex web of tasks in tune with how humans think cognitively. Here's an example to understand this better:

Consider how humans think when planning their next vacation. Here's how it flows:

1. Think of the various tasks to perform like booking the flight, hotel, and rentals. Additionally, think of associated parameters like hotel reviews, credit card benefits, and places to visit.
2. This "thought" process follows a graph-based workflow where earlier decisions (or outputs) can alter the later decisions. Humans can also change the sequence completely or add a new task (for example, add a new place to visit).

Pseudo Languages

Among other trends in automated prompts, we are seeing the rise of pseudo languages that automatically provide instructions to LLMs to perform a task. Here are a couple of examples:

1. SudoLang

SudoLang is a powerful pseudocode-based language for LLMs that can create programs using natural informal language. With the release of GPT-4, pseudocode languages have become more powerful. SudoLang is simple and intuitive for creating automatic prompts in GPT-4.

Here's its typical command structure:

- Ask(question) – this command poses a question for GPT-4 LLMs to answer
- Explain(topic) – this command requests an explanation from GPT-4 LLMs on a particular topic
- Suggest(idea) – this command asks GPT-4 LLMs to provide suggestions related to a particular idea
- List(items) – this command requests GPT-4 LLMs to list items related to a particular subject

2. Jargon

Jargon is another interesting LLM-based pseudocode language used for prompt engineering. Using simple natural language, every instruction in Jargon is a line of text to be intelligently interpreted and executed by the LLM.

To be accurate, Jargon uses the procedure and the entire session – including the conversation history – as well as the knowledge set of the LLM. Here's a simple example of the Jargon procedure to produce the sum of two numbers:

```
ChatGPT: Please input a number:
Me: 11
ChatGPT: Please input another number:
Me: 111
ChatGPT: The sum of the two numbers is 122.
```

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Here's a more complex example:

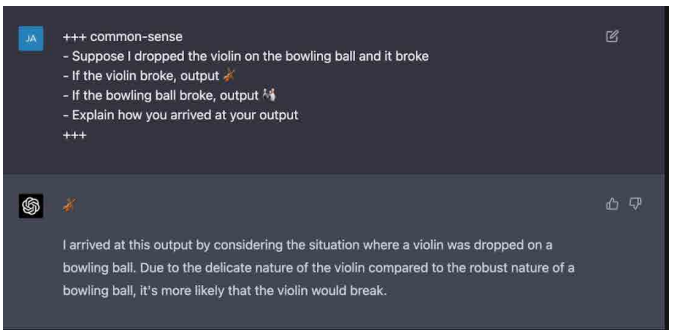
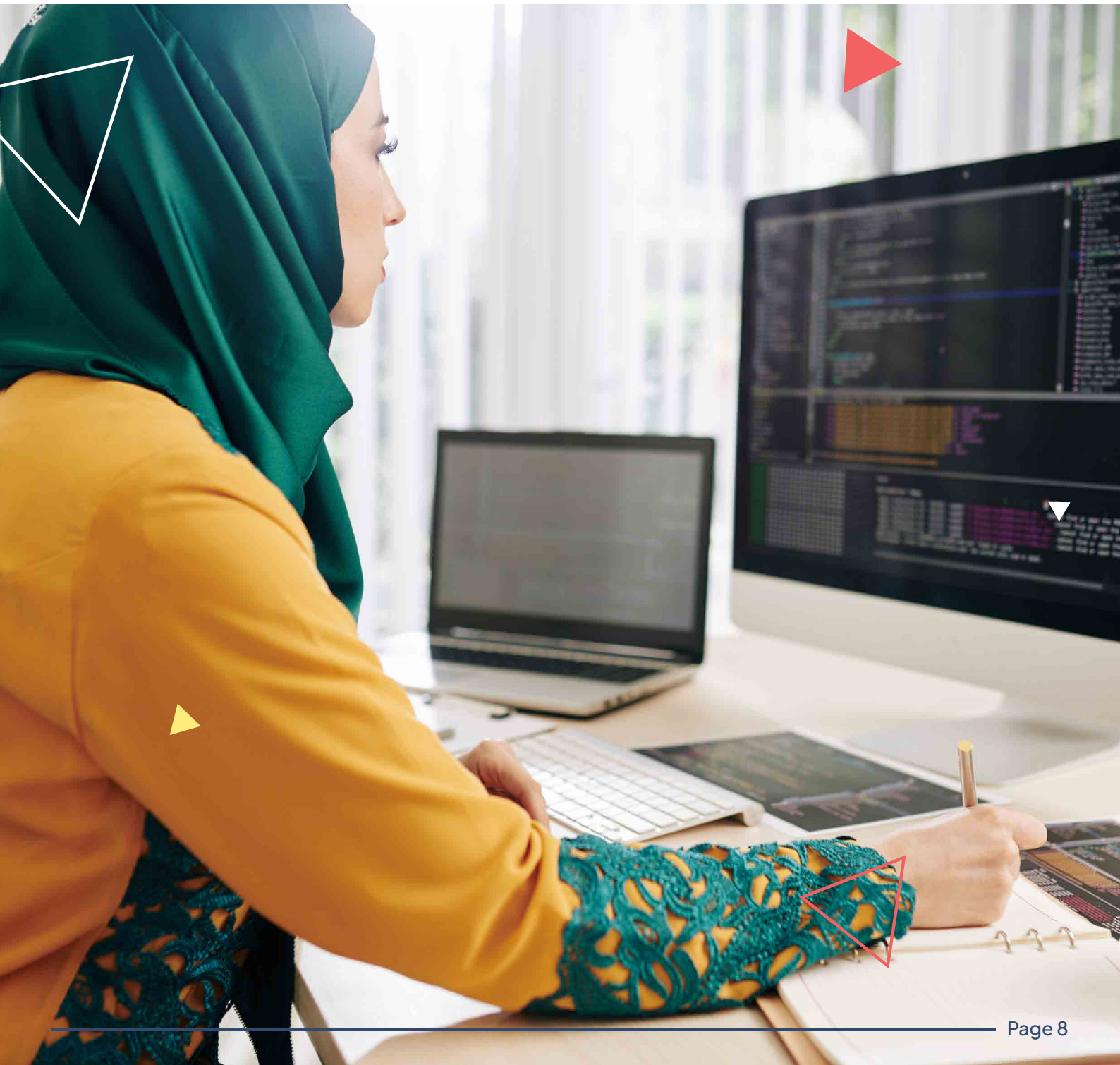


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High-Level Languages

Besides pseudocode language, the LLM development environment is witnessing the emergence of high-level language frameworks like LangChain, llamaindex. Among the popular toolkits for prompt engineering, LangChain focuses on chains, agents, and memory-handling tools.

Very soon, we will see the emergence of more sophisticated high-level language frameworks that would use a native construct to ask specific questions to the LLM. Like any compiler or interpreter, these high-level language frameworks would translate natural language to well-defined prompts among their characteristics, these high-level languages would use natural languages, without any strict syntax or formatting requirements.

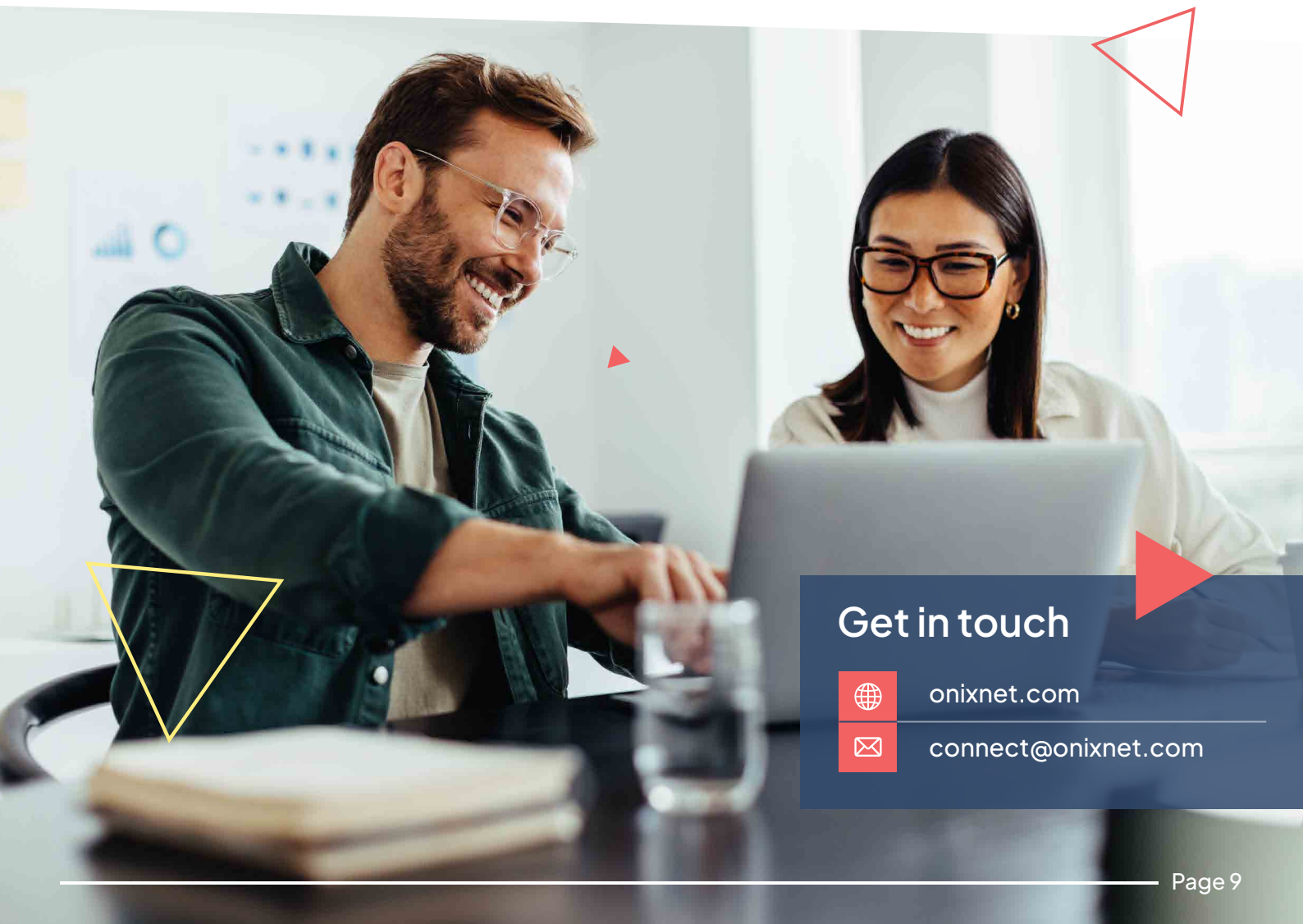


The Future Has Arrived

Onix empowers businesses to harness the transformative power of AI, data, and the cloud to drive unparalleled growth and innovation. Our Google Cloud expertise and proven track record in implementing AI and machine learning solutions enable our customers to streamline operations, unlock valuable insights, and deliver exceptional experiences to their customers.

We work closely with businesses to understand their unique challenges and goals, then tailor solutions that maximize efficiency, reduce costs, and drive revenue. By leveraging cutting-edge technologies like natural language processing, computer vision, and predictive analytics, we empower organizations to make data-driven decisions, automate repetitive tasks, and gain a competitive edge in their respective industries.

Partnering with Onix is more than just adopting technology; it's about embracing a future where data-driven insights fuel innovation and business transformation. Contact us today to discover how we can help you achieve your goals and stay ahead of the curve in today's competitive landscape.



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