



Tishk
International University

Prompt Engineering

The AI Devolution



AI PE Course 2024-2025

Week7: **Advanced Prompt Engineering Techniques**

Google Classroom: [d5hsxq3](#)

3d Grade IT Students

Lecturer: Mohamamd Salim Al-Othman

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Learning Objectives

By the end of this lecture, students will be able to:

- Understand advanced prompt engineering techniques like chaining, tuning, and ensembles.
- Differentiate between hard and soft prompts.
- Apply few-shot learning to practical use cases.
- Explore real-world applications of these techniques in AI tasks.



Intro to Prompt Chaining for Enhanced LLM Performance

- What is Prompt Chaining?
Sequential prompts used to guide Generative AI Model through a series of tasks or thought processes.
- Benefits of Prompt Chaining and Limitations:
 - Improved accuracy and comprehensiveness of LLM outputs.
 - Enhanced ability to tackle complex tasks by focusing on individual steps.
 - May encounter issues like context loss or response inconsistency.
- Applications of Prompt Chaining:
 - Creative writing: Guiding LLM through story development and character introduction.
 - Code generation: Breaking down complex programming tasks into smaller steps.
 - Question answering: Providing context and sub-questions to enhance understanding.



Prompt Chaining Example:

Task : Generating a comprehensive summary of a scientific paper

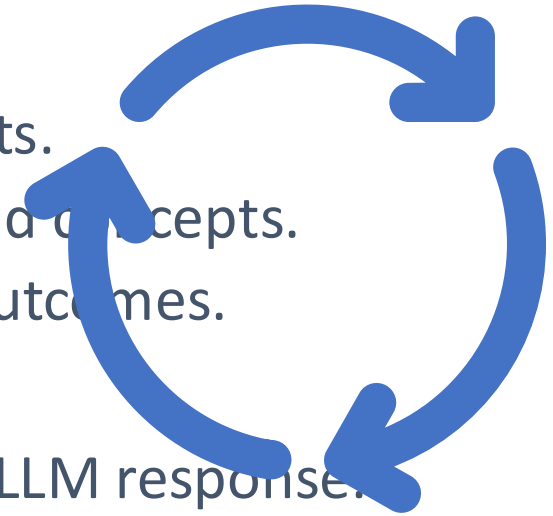
Prompt Chaining:

1. Identify the main topic and key points of the paper.
2. Summarize the introduction, methodology, results, and discussion sections.
3. Highlight the key findings and conclusions of the paper.



Prompt Tuning

- What is Prompt Tuning?
 - Fine-tuning prompts to align with specific tasks or domains.
- Benefits of Prompt Tuning:
 - Improved accuracy, relevance, and creativity of LLM outputs.
 - Enhanced ability to handle domain-specific terminology and concepts.
 - Tailored prompts for specific user intentions and desired outcomes.
- Techniques for Prompt Tuning:
 - Parameter tuning: Adjusting hyperparameters to optimize LLM responses.
 - Word embedding tuning: Replacing words with semantically similar synonyms or paraphrases.
 - Template tuning: Modifying the overall structure and format of the prompt.



Prompt Tuning Example:

Task: Generating a compelling product description for an online store

- Prompt Tuning:

1. Identify the key features and benefits of the product.
2. Use persuasive language to highlight the product's unique selling points.
3. Incorporate relevant keywords to improve search engine optimization (SEO).
4. Tailor the description to the target audience and their interests.



Prompt Ensembles

What are Prompt Ensembles?

Combining multiple prompts into a single prompt to improve LLM performance.

Benefits of Prompt Ensembles:

- Leveraging the strengths of individual prompts to enhance overall performance.
- Providing the LLM with complementary information and perspectives.
- Reducing the risk of overfitting to specific prompts.

Applications of Prompt Ensembles:

- Creative writing: Combining prompts focused on different aspects of the story.
- Question answering: Combining prompts with different question styles and contexts.
- Machine translation: Combining prompts from different language domains.

Example:

Task: Generating a comprehensive and informative answer to a complex question

1. Prompt 1: Focus on providing a factual and accurate overview of the topic.
2. Prompt 2: Explore different perspectives and opinions on the topic.
3. Prompt 3: Address potential counterarguments and provide supporting evidence.
4. Prompt 4: Summarize the key takeaways and implications of the topic.



Prompt Ensembles Example: Creating a Business Plan for a New Coffee Shop

Prompt 1: Market Analysis

- **Prompt:** "Analyze the current market trends in the coffee shop industry, focusing on customer preferences, competition, and growth potential."
- **Purpose:** This prompt aims to gather insights on market conditions and trends, which is crucial for strategic planning.

Prompt 2: Product and Services Description

- **Prompt:** "Describe the range of products and services that a coffee shop can offer, highlighting unique and popular items."
- **Purpose:** To outline the core offerings of the coffee shop, focusing on what will attract customers.

Prompt 3: Marketing and Branding Strategies

- **Prompt:** "Suggest effective marketing and branding strategies for a new coffee shop looking to establish a strong presence in a competitive market."
- **Purpose:** To develop ideas for promoting the coffee shop and building a brand identity.

Ensemble Integration:

By combining these prompts, each focusing on a different key area of business planning, the final business plan for the coffee shop will be comprehensive and detailed.

This approach allows for a nuanced and in-depth exploration of various aspects critical to the success of the coffee shop.



Few-Shot Learning with Prompts

What is Few-Shot Learning with Prompts?

- Training LLMs to perform tasks with minimal amounts of data.

Benefits of Few-Shot Learning with Prompts:

- Enabling LLMs to learn new tasks efficiently and effectively.
- Reducing the need for large amounts of labeled data.
- Expanding the capabilities of LLMs to new domains and applications.

Applications of Few-Shot Learning with Prompts:

- Natural language understanding: Classifying new text categories with limited examples.
- Question answering: Providing answers to new questions based on a few examples.
- Code generation: Generating new code snippets with minimal training data.

Example:

- Task: Classifying new types of flowers based on a limited dataset of labeled flower images

Few-Shot Learning with Prompts:

1. Provide the LLM with detailed descriptions and visual examples of a small set of labeled flower types.
2. Utilize prompt engineering techniques to guide the LLM in identifying key features and patterns in the images.

Few-Shot Learning with Prompts Example

Example prompt:

- "Given this image of a flower, can you identify the following features: petals, sepals, stamen, pistil? What flower type does this image most closely resemble?"

Expected outcome:

- The LLM should be able to classify new types of flowers with a high degree of accuracy, even with a limited dataset of labeled images.

Here are some additional tips for using few-shot learning with prompts for flower classification:

- Use a variety of different flower types in the training dataset.
- Label the images in the training dataset carefully, making sure to include all of the relevant flower types.
- Use a high-quality image dataset.
- Experiment with different prompt engineering techniques.

Interactive Activities

Prompt Tuning Exercise:

- **Example: Original:** "Write about a smartphone."
- **Improved:** "Describe the top 3 features of the latest iPhone for tech enthusiasts."

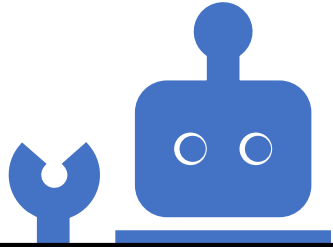
Prompt Chaining Exercise:

- Complete this chain: "Summarize a research paper -> Highlight key findings -> _____."

Group Discussion:

- Brainstorm how few-shot learning can be used in your field of interest?
- How can Few-Shot Learning be applied in education?
- What are the limitations of Prompt Chaining in real-world tasks?

Soft Prompt Vs Hard Prompt



Feature	Hard Prompts	Soft Prompts
Nature	Explicit textual instructions.	Embedded in model parameters.
Creation	Written by users in natural text.	Learned during training.
Usage Example	"Translate this text to French."	Embeddings guide the behavior.

Key Insight:

- **Hard prompts** tell the model *what to do explicitly*.
- **Soft prompts** subtly *guide the model's behavior* through optimized embeddings.

How Hard and Soft Prompts Work!

Hard Prompt:

- Input: "Translate the following text to French: 'Hello, World!'."
- Output: "Bonjour, le monde !".
- Explicit, clear instruction written by human in natural language.

Soft Prompt:

- **Input Embeddings:** $[v_1, v_2, v_3, \dots, v_N]$ (numerical embeddings learned through training).
- No explicit text is provided, but the **optimized embeddings** guide the model to behave as though it was asked to translate.

Lab Instructions or Overview

Tools to Use

- **OpenAI Playground:**
 - Use for testing prompt engineering techniques (e.g., Prompt Chaining, Tuning).
 - Provide a pre-configured account or access credentials if required.
- **Teachable Machine:**
 - Use for Few-Shot Learning tasks (e.g., image classification).
 - Provide a pre-uploaded dataset or guide them on how to upload their own.
- **Google Colab:**
 - Use for coding-based activities like building prompt ensembles or running machine learning experiments.
 - Share pre-written notebooks to save time.

Additional Considerations

In addition to the techniques and applications discussed above, there are a few additional considerations that are important for effective prompt engineering.

These include:

- Task complexity: The complexity of the task at hand will determine the level of detail and specificity required in the prompt. For example, “A simple poem prompt vs. generating a full legal document.”
- Domain knowledge: Prompts should be tailored to the specific domain or application at hand. For example, “Medical terminology in healthcare chatbots.”
- User intent: Understand the purpose behind the task. For instance, a creative writing prompt differs significantly from a technical report prompt.
- Prompt clarity: Prompts should be clear, concise, and unambiguous to avoid misinterpretation. For example, Instead of "**Describe the device,**" specify: "**List three standout features of the iPhone 15.**"

Conclusion

- Soft and hard prompts serve different purposes.
- Few-shot learning expands AI applications.
- Prompt chaining simplifies tasks.

As future IT professionals, you hold the key to unlocking the full potential of AI. By mastering techniques like prompt engineering, you can drive innovation, solve complex problems, and create solutions that impact the real world. Remember, the possibilities are limitless—so start exploring and shaping the future today!



References

LibFewShot: A Comprehensive Library for Few-Shot Learning" discusses the significant advances in few-shot learning, particularly in image classification, and explores techniques like data augmentation and knowledge distillation.

A Critical Study of Few-Shot Learning for Encrypted Traffic" tackles the application of few-shot learning in traffic classification using real-world ISP-level datasets.

Prompt Engineering in Medical Image Segmentation" discusses the use of foundation AI models like GPT-3, BERT, CLIP, and DALL-E in diverse tasks with minimal fine-tuning, focusing on medical image segmentation.

Prompts Matter: Insights and Strategies for Prompt Engineering in"Natural Language Processing and Its Applications in Machine Translation" highlights the role of NLP in supporting machine translation research, emphasizing its multidisciplinary roots.

"explores the optimization of Large Language Models for automated traceability, highlighting the importance of prompt engineering.