LANGUAGE MODEL ADAPTION

What we discuss:

. What is Language Model Adaption

. Techniques

What is Language Model Adaption:

Language model adaptation is a process in NLP where we adjust an existing language model to perform better on a new, specific type of text or context.

✅ **Before Adaptation:**
Q: *Summarize this contract.*
A: *This contract is about an agreement between two parties.*

✅ **After Adaptation:**
Q: *Summarize this contract.*
A: *This contract defines the roles and payment terms between Company A and Company B, including service timelines, breach clauses, and confidentiality rules.*

How Language Model Adaption is Done:

- 🗐 **Collect Legal Data:**
They gather many **contracts, agreements, and case studies**.

- 🧠 **Fine-Tune the Model:**
They train the AI model again using this **legal data** so the model learns the style, terms, and structure of legal language.

- 💡 **Adapted Model Result:**
Now, the model can quickly **summarize long legal documents** into simple and clear language.

Importance of Language Model Adaption:

This is important when the data used to train the model is different from the data where the model will actually be used.

Situation:
A language model is trained on **general English books and websites**.
But the company wants to use it for **medical question answering**.

Problem:
The model was not trained on **medical terms** like "hypertension," or "CT scan," so its answers might be wrong or too simple.

Solution: Adaptation
The model is adapted (fine-tuned) using **medical textbooks, research papers, and patient reports**.
Now it understands medical terms and gives correct, detailed answers.

☑ **Before Adaptation:**
Q: *What is hypertension?*
A: *Hypertension is high blood pressure.*

☑ **After Adaptation:**
Q: *What is hypertension?*
A: *Hypertension is a condition where the blood pressure in the arteries is higher than normal, increasing the risk of heart disease, stroke, and kidney problems.*

💡 **Why Adaptation is Important:**
Because the model was trained on general data, but the real use is for **medical data** — adaptation helps it perform well in the new situation.

TECHNIQUES USED IN MODEL ADAPTION:

1. Model Interpolation (Mixture Models)
2. Topic-Dependent Models
3. Self-Adaptive Models (Trigger Models)
4. Unsupervised Adaptation
5. Using Web Data

Language Model Adaptation Technique

1. Model Interpolation (Mixture Models)

- Combines two or more language models.
- One model might be trained on general text, another on specialized text.
- The final prediction is a weighted mix of all models.
- Helps the model adapt to new domains without forgetting old knowledge.

2. Topic-Dependent Models

- Language models are trained separately for each topic.
- The system first identifies the topic (e.g., sports, medical) and then uses the model trained for that topic.
- Improves prediction accuracy in topic-specific language

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3. Self-Adaptive Models (Trigger Models)

- The model adapts itself during prediction.
- When certain "trigger" words appear, the model changes its behavior.
- Example: If the word "hospital" appears, the model focuses more on medical vocabulary.

4. Unsupervised Adaptation

- The model learns from new data without human-labeled examples.
- It automatically adjusts to the style, vocabulary, and structure of new input.
- Useful when labeled data is not available.

5. Using Web Data

- Large amounts of real-world text from the web are used to adapt models.
- Covers different writing styles, topics, and languages.
- Helps improve generalization and performance in real applications.