Lecture 42: Structured Output Converter

Introduction:

- When AI is integrated into applications, the output should not always be plain text.
- Applications often expect **structured data** such as JSON, lists, or objects instead of free text.
- The **Structured Output Converter** in Spring AI helps transform raw AI output into structured formats that applications can directly use.

Why Structured Output?

- Human-like text responses are fine for conversations.
- For AI engineering, applications need **data in a defined structure**.
- Example formats:
    - JSON
    - List
    - Maps
    - Java Beans / Objects
- This ensures smooth communication between your application and the AI model.

Types of Converters:

- **Bean Output Converter**
    - Maps AI output into an existing **Java Bean/Object.**
    - Useful when you already have defined classes with variables.
- **List Output Converter**
    - Converts AI output into a **list of values**.
- **Map Output Converter**
    - Converts AI output into a **key-value map**
- These converters allow different structured outputs depending on application needs.

How it works?

- **Raw Input** → Sent to AI model through **PromptTemplate.**
- **PromptTemplate** → Combines user input with format instructions.
- **ChatModel** → Generates raw text output from AI.
- **StructuredOutputConverter** → Applies chosen converter:
    - BeanOutputConverter
    - ListOutputConverter
    - MapOutputConverter
- **Final Output** → Returned in structured format for the application.

Key Points:

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- Structured output converters ensure AI results are **directly usable by applications**.
- Requires **defining the expected format** so the LLM knows what structure to follow.
- Converters available: **Bean, List, and Map**
- Works by aligning **LLM output format** with the **converter logic**.

Summary:

- Structured Output Converter transforms raw text from AI into structured data
- Helps applications work with predictable formats (JSON, lists, beans, maps).
- Spring AI provides ready-made converters like **BeanOutputConverter**, **ListOutputConverter**, and **MapOutputConverter**.
- Ensures better **integration between AI and enterprise applications**.