Alright — I’ll design a **6-week LangChain Capstone Plan** that pushes you to build **high-complexity, portfolio-ready applications** using *everything* you’ve learned:

* Components, Models, Prompts, Structured Output & Output Parsers
* Chains & Runnables
* Document Loaders, Text Splitters, Vector Stores, Retrievers
* RAG
* Tools, Tool Calling, Agents

Each week = **1 big project** (except Week 6, which is integration + polish).  
Projects will be realistic, resume-worthy, and demonstrate advanced skills.

**📅 Week-by-Week Capstone Plan**

**Week 1 — Multi-Source Research Assistant with Adaptive Retrieval**

**Goal:** Build an AI that can research a topic by pulling information from multiple heterogeneous data sources and adapt retrieval dynamically.

**Features:**

* Document loaders for **PDF, CSV, API JSON, and HTML**.
* Custom **TextSplitter** that chunks differently per source type.
* Vector store + retriever that uses **hybrid search** (dense + keyword).
* Adaptive retrieval logic: changes k and chunk size based on query type.
* Chain that summarizes and produces **structured JSON** with citations.

**Skills Used:** Loaders, Splitters, Vector Stores, MultiQueryRetriever, Structured Output, Chains.

**Week 2 — Legal & Technical Document AI Analyst with Multi-Agent Workflow**

**Goal:** An AI system that can analyze contracts *and* technical specs, using different agent personalities for each domain.

**Features:**

* Two specialized agents:
  + **Legal Analyst Agent** → trained with legal docs.
  + **Technical Analyst Agent** → trained with manuals/specs.
* Router agent that sends queries to the right specialist.
* Tool calling to:
  + Search vector DB.
  + Retrieve related laws/spec clauses.
  + Retrieve technical diagrams or code snippets.
* RunnableSequence to handle multi-step reasoning.

**Skills Used:** Agents, Tool Calling, Vector DB, Retrieval, Branching Runnables.

**Week 3 — AI Knowledge Management System with Auto-Updating RAG**

**Goal:** Build a knowledge base that constantly ingests, embeds, and updates itself from live sources.

**Features:**

* Loaders for RSS feeds, Google Drive, and APIs.
* Background task that checks for new/updated docs and refreshes embeddings.
* Versioned vector store (stores embedding history per doc).
* RAG chain with **temporal prioritization** (recent docs weigh more).
* Output parser that returns **bullet-point factual summaries**.

**Skills Used:** Advanced Retrieval, Document Loaders, Chains, Structured Output.

**Week 4 — Codebase Q&A Assistant with Multi-Modal Support**

**Goal:** Build an assistant that can answer questions about a codebase *and* related documentation.

**Features:**

* Loaders for Markdown, source code files, and API docs.
* Custom splitter that preserves function/class integrity in chunks.
* Multi-vector store setup:
  + One for code embeddings.
  + One for doc embeddings.
* Retriever chain that queries both stores and merges results.
* Tool calling to:
  + Run code in sandbox.
  + Search code references.
  + Generate refactoring suggestions.

**Skills Used:** Multi-Retriever RAG, Tools, Structured Output, Chains.

**Week 5 — Business Intelligence Agent with API & DB Integration**

**Goal:** Build an agent that can answer complex business questions by pulling from both live APIs and structured databases.

**Features:**

* SQL database loader & retriever.
* API loader (e.g., financial data from Yahoo Finance API).
* Tool calling to:
  + Run SQL queries.
  + Call APIs.
  + Combine and visualize results (e.g., via matplotlib).
* RunnableParallel to fetch and process multiple data streams.
* Output parser that produces:
  + Charts.
  + Tabular data.
  + Written insights.

**Skills Used:** Tool Calling, Agents, Runnables, Multi-Modal Output.

**Week 6 — Final Integration & Polishing: Universal AI Assistant**

**Goal:** Combine all your previous projects into a single **Universal LangChain AI Assistant**.

**Features:**

* Unified interface with:
  + Research mode (Week 1).
  + Specialist analysis mode (Week 2).
  + Knowledge base mode (Week 3).
  + Code assistant mode (Week 4).
  + BI mode (Week 5).
* Agent router that chooses the right pipeline.
* Shared vector store infrastructure with metadata filters.
* Fully documented & deployed on **Streamlit or FastAPI**.
* Add **memory** for conversational continuity across modes.

**Skills Used:** Everything you’ve studied.

**📈 Skill Growth Over 6 Weeks**

* **Weeks 1–2:** Master complex retrieval & multi-agent setups.
* **Weeks 3–4:** Handle automation, knowledge base updating, multi-modal search.
* **Weeks 5–6:** Integrate APIs, databases, multi-modal outputs, and system orchestration.

If you want, I can now make **a detailed execution sheet** for each week with:

* Required LangChain classes/functions.
* Pseudocode for key components.
* Suggested APIs & datasets.
* Success criteria for portfolio readiness.

That way, you’ll know exactly what to build each week without guesswork.