DAY 5: CAPSTONE AND APPLICATION

Streamlit Application, and Industry Impact

Day 5 Agenda

Today, we synthesize the entire course into a Capstone project, review key learnings, and discuss real-world industrial impact.

- **Deployment Tools** Streamlit and NiceGUI for rapid Python application frontends
- **Industry Specific Use Cases** Analyzing high-value applications
- **Course Key Takeaways** Synthesis of core learnings from Days 1 through 4
- **Capstone Project & Presentation** Demonstrating the end-to-end Agentic RAG system

Deployment Tooling: Streamlit & NiceGUI

Streamlit: Rapid Python Dashboards

The standard for data scientists needing to quickly demonstrate their work without writing HTML/CSS/JS.

- **Speed:** Turn Python scripts into interactive web apps in minutes.
- **Simplicity:** Very low barrier to entry; uses a linear script structure.
- **Use Case:** Capstone project demos, internal dashboards, fast POCs.

NiceGUI: Custom UI with Python

A modern, lightweight framework for building web UIs using Python, offering more flexibility than Streamlit.

- **Design**: Enables better control over layout and component aesthetics.
- **Structure:** Supports persistent state and is ideal for complex, stateful LLM applications.
- **Use Case:** Full-featured internal tools, simple frontends for agents.

Industry Specific Use Cases

Health Care

1. Clinical Documentation Automation

The Problem: Doctors spend excessive time documenting care instead of delivering care, leading to burnout and reduced patient throughput.

How It Works

- GenAI listens to ambient doctor–patient conversation.
- Identifies symptoms, diagnoses, and medications (Entity Extraction).
- Generates structured SOAP notes & discharge summaries.
- Clinician reviews and signs off (Human-in-the-loop).

The GenAI Advantage

Why Now? Unlike older dictation tools, LLMs understand *context*, not just keywords. They map free-form speech directly to standard clinical terminology.

Business Outcomes

- Improved clinician satisfaction.
- Fewer errors caused by "copy-paste" notes.

2. Diagnostic Support (Multi-Modal)

The Problem: Medical imaging produces massive data volumes; interpretation is time-intensive, variable, and prone to fatigue-based errors.

Vision + Language

GenAI analyzes medical images (X-ray, CT, MRI, Pathology) and cross-references findings with patient history.

- Vision models identify patterns (lesions, anomalies).
- GenAI explains findings in natural language.
- Auto-generates draft radiology report.

Executive Summary

Clarification: GenAI does NOT replace doctors. It acts as a diagnostic *Co-Pilot* to highlight risks.

Business Outcomes

- Faster turnaround time for critical reports.
- Reduced diagnostic variability between shifts.
- Better utilization of scarce radiologist time.

3. Patient Care & Engagement

The Problem: Patients struggle to understand care plans and access support, leading to poor adherence—especially across language barriers.

Personalized Care at Scale

GenAI operates 24/7 across chat, voice, and mobile to simplify complex medical info.

- **Education:** Generates personalized materials based on patient literacy levels.
- **Triage:** Symptom checkers use reasoning to route cases (ER vs. Clinic).
- **Adherence:** Agents send nudges and follow-ups.

The Shift: Script vs. Intent

Traditional Chatbots	Followed rigid scripts. Failed at edge cases. Frustrating.
GenAI Agents	Understand intent, emotion, and context. Multi-lingual by default.

Reduced Call Center Load & Improved Outcomes

4. Clinical Decision Support (CDS)

The Problem: Medical evidence changes rapidly. Clinicians struggle to synthesize thousands of new papers while treating patients.

Evidence-Based Reasoning

GenAI reads and synthesizes medical literature to provide explainable recommendations.

- Reviews patient data (Labs, Notes, History).
- Searches current guidelines and medical papers (RAG).
- Generates ranked treatment options with "Why".

Critical: GenAI *supports* decisions—it does not make final clinical judgments. The human is the decision maker.

Business Outcomes

- Faster decision-making in complex cases.
- Reduced cognitive overload for clinicians.
- Better alignment with hospital standard operating procedures.

Human Resource

1. Talent Acquisition: Intelligent Hiring

The Problem: Recruiters drown in thousands of resumes, job descriptions are biased or generic, and screening is a manual bottleneck.

Smart Screening

GenAI reads resumes for **context**, understanding skills and career progression rather than just keyword matching. Ranks by role fit.

JD Creation

Generates optimized Job Descriptions tailored to market demand.

Candidate AI

24/7 Chatbots answer candidate queries. Video analysis tools summarize interview responses for sentiment and skill alignment.

Faster Time-to-Hire

Consistent & Fair Screening

Focus on People, Not Paper

2. Employee Engagement: Continuous Listening

The Problem: Annual surveys are reactive. Managers lack real-time insight into sentiment, and L&D is often "one-size-fits-all."

Real-Time Sentiment Analysis

GenAI analyzes open-text feedback and survey data to detect morale trends and burnout risks.

- Surfaces issues **early** before attrition occurs.
- Identifies patterns across teams/departments.

Personalized Growth

AI Career Coaches: Virtual advisors that suggest roles, mentors, and stretch assignments.

- **Dynamic L&D:** Creates custom learning paths based on current skills and future career goals.

Higher Retention

Proactive Development

Equitable Career Guidance

3. HR Operations: From Confusion to Clarity

The Problem: Complex, scattered policies lead to repetitive questions. Onboarding is document-heavy, slow, and prone to errors.

Policy RAG

Retrieval-Augmented Generation ingests handbooks and compliance docs to ensure answers are **accurate** and up-to-date.

Employee Chatbots

Employees ask natural questions ("What is the parental leave policy?") and get instant, clear explanations instead of PDF links.

Auto-Onboarding

Automatically generates contracts, offer letters, and checklists. Guides new hires through steps without HR intervention.

Reduced HR Ticket Volume

Faster Onboarding

Compliant Communication

4. Performance & Analytics: Strategic Planning

The Problem: Reviews are subjective and long. Leaders lack visibility into skills gaps, and bias in compensation is hard to detect manually.

Review Summarization

Condenses lengthy feedback into key strengths/weaknesses. Highlights patterns across the org.

Skills Gap Analysis

Maps current workforce skills against future strategic requirements to predict hiring needs.

Bias Detection

Analyzes performance reviews for language bias.

Flags disparities in ratings and compensation across demographics to ensure equity.

Result: Fairer, Data-Driven Decisions

Objective Management

Workforce Planning

Reduced Bias

Software Services

1. Software Development

The Problem: Time is lost to boilerplate, manual reviews, and outdated documentation, while tribal knowledge remains locked in senior engineers' heads.

Gen-Code & Review

Generates boilerplate, tests, and stubs. Analyzes PRs for bugs, security, and best practices with explainable suggestions.

Live Documentation

Auto-generates API docs, READMEs, and change summaries directly from code and PR history. Stays continuously updated.

Legacy Modernization

Ingests monoliths (COBOL/Java) to suggest refactoring paths and generate modern, cloud-native equivalent code.

Faster Development Cycles | Rapid Engineer Onboarding | Reduced Tech Debt

2. Testing & QA: Proactive Quality

The Problem: Manual test creation fails to scale with feature velocity. Bug triage is inconsistent, and coverage gaps increase production risk.

Automated Test Generation

Reads user stories and code to generate unit, integration, and edge-case tests.

Dynamically creates realistic synthetic test data for complex scenarios.

Intelligent Triage

Analyzes bug reports to predict severity and root cause, routing issues to the correct team automatically.

Higher Test Coverage | **Accelerated Release Cycles** | **Lower Production Defects**

3. DevOps & Security: Autonomous Reliability

The Problem: Exploding log volumes create noise, security alerts overwhelm SOC teams, and incident response remains a manual, high-pressure process.

Log Anomaly Detection

Identifies unusual patterns across logs and metrics. Explains root causes in plain language, correlating signals across distributed systems.

Vulnerability Scanning

Analyzes configs and dependencies. Prioritizes threats based on actual business risk, not just generic severity scores.

Agentic Automation

Autonomous agents take action: isolating compromised services, rolling back failed deployments, and notifying SREs with context.

Reduced MTTR

Enhanced System Reliability

Lower Security Exposure

Banking & Finance

1. Fraud Detection & Prevention

The Problem: Traditional rules-based systems are static, yield high false positives that frustrate customers, and fail to keep pace with adaptive fraudsters.

Check Forgery

Multi-modal analysis detects subtle inconsistencies in signatures and layouts while cross-referencing behavioral history.

KYC Automation

Reads IDs and selfies together to validate identity consistency across channels and flag anomalies instantly.

Call Analysis

Analyzes service call transcripts for stress, coercion, or fraud scripts to flag high-risk interactions.

Reduced Fraud Losses | **Lower False Positives** | **Better Customer Trust**

2. Personalized Banking

The Problem: Customers demand 24/7 support for complex financial products, but human-led service scaling creates unsustainable operational costs.

Banking Assistants

Understand intent to handle FAQs and transactions, escalating complex cases with full context to humans.

Tailored Advice

Analyzes spending patterns and goals to generate personalized financial recommendations in plain language.

Auto-Loan Flow

Reads applications and income documents to provide instant status and reduce underwriting workload.

Sentiment Pulse

Monitors feedback across channels to identify dissatisfaction early and trigger proactive outreach.

Higher Customer Satisfaction | Lower Servicing Costs | Improved Retention

3. Risk: Continuous Assurance

The Problem: Regulatory volatility and document-heavy compliance processes increase operational risk and create reporting bottlenecks.

Reg-Doc Analysis

Automatically reads new policies, maps changes to internal controls, and highlights gaps or required actions.

AML Screening

Identifies complex laundering patterns across counterparties to reduce manual review burden.

Faster Regulatory Response

Lower Compliance Costs

Reduced Regulatory Risk

4. Ops: Decision Intelligence

The Problem: Analysts are overwhelmed by fragmented data, spending more time on summarization than high-value strategic decision-making.

Statement Analysis

Summarizes earnings reports and balance sheets to extract key risks and insights for faster decisions.

Contract Extraction

Extracts clauses, obligations, and key dates from legal documents to structure data for downstream systems.

Investment Research Generation

Synthesizes market data, news, and reports into research summaries to support portfolio and advisory teams with real-time intelligence.

Faster Insights

Reduced Operational Friction

Better Investment Decisions

Retail & Marketing

BUSINESS IMPACT
Higher conversion rates and optimized marketing ROI through relevant customer journeys.

Personalization & Marketing

The Challenge

Traditional segmentation is static. Marketing teams struggle to scale content across hyper-personalized touchpoints.

GenAI Solution

- **Unstructured Data Recs:** Analysis of reviews, queries, and images to predict contextual intent.
- **Dynamic Ad Copy:** Automated generation of messages that adapt tone and focus in real-time.
- **Visual Search:** Multi-modal patterns allowing image-to-catalog matching.

BUSINESS IMPACT
Reduced support operational costs and accelerated resolution times with improved CSAT scores.

Intelligent Customer Support

The Challenge

Exploding support volumes and fragmented product information across manuals lead to slow, reactive service.

GenAI Solution

- **Shopping Assistants:** Intelligent buying guides that recommend products based on use-case.
- **Automated Q&A:** Instant RAG-based extraction from manuals, FAQs, and technical specs.
- **Image Inquiry:** Analyzing user-uploaded photos for compatibility checks and visual bug triage.

Summary & Key Takeaways

Key Takeaways (Days 1 & 2)

Day 1

Foundations & Architecture

LLMs are Next-Word Predictors (Transformer NN). The power is in scale. Decision point: Enterprise (GPT) vs. Open Source (Llama).

Prompt Engineering

Control LLM output using clear Personas, Tasks, and Constraints (JSON). Tune output using Temperature/Top-P.

Day 2

Tool Calling Agent

Agents move from passive generation to active problem solving via Tool Usage (Function Calling) and calling databases.

Advanced RAG

Naive RAG fails in production. Solution: Hybrid Search, Re-Ranking, Query Translation, and Multi-Modal indexing for complex data.

Course Synthesis: Key Takeaways (Days 3 & 4)

Day 3

Frameworks (Orchestration)

Use LangGraph for complex agents requiring control flow, state management, and loops (production standard).

Multi-Agent Patterns

Choose architecture based on task: Single-step, ReAct (looping), Planner-Executor, or Supervisor-Worker (AutoGen).

Day 4

LLMOps & Observability

Tracing (LangSmith) is essential for debugging non-deterministic LLM behavior, tracking costs, and ensuring compliance.

Fine-Tuning & PEFT

Fine-Tuning is for *behavior* and *tone* (not facts). Use PEFT/LoRA to reduce hardware cost. Use SFT (skills) then DPO (alignment).

Capstone

Demonstrating End-to-End Agentic Capability

Thank You