# Final Project: Multimodal Market Analyst AI System

Generative AI Intensive Course

## Project Overview

Students will develop a multimodal AI system capable of addressing market-related queries, providing investment insights, analyzing historical market data, generating forecasts, and visualizing financial information. The system comprises collaborative agents coordinated centrally, leveraging real-world financial documents sourced exclusively from **Investor Relations (IR)** publications of **Apple, Microsoft, Google, NVIDIA, and Meta** spanning the years **2020–2024**.

## System Architecture and Agent Roles

The system utilizes a multi-agent framework, clearly partitioned into specialized roles as follows:

### 1. Multimodal Agentic RAG Specialist

**Core Responsibilities:**

- Process multimodal queries (text, financial tables, images, charts, PDFs).
- Retrieve and synthesize relevant financial data explicitly from provided IR documents.
- Generate precise answers accompanied by explicit citations.

**Key Technologies:**

- Embedding Models: CLIP, SentenceTransformers
- Vector Databases: Chroma
- Generative Models: Gemini (optional QLoRA fine-tuning)

**Example Query:**
*"Summarize NVIDIA's recent financial performance based on this earnings presentation."*
**Sample Output:**
*"NVIDIA's Q4 FY24 revenue increased by 18%, driven primarily by strong GPU sales (source: NVIDIA Q4 FY24 Earnings Slides, p. 5)."*

### 2. Data Science and Analytics Agent

**Core Responsibilities:**

- Perform detailed trend analyses and forecasting of market data.
- Create visualizations and predictive models.

- Generate explanatory narratives for analytical findings.

**Key Technologies:**

- Data Analysis: Pandas, scikit-learn
- Forecasting Models: Prophet, ARIMA
- Visualization Tools: Matplotlib, Plotly
- Generative Models: Gemini (for insights generation)

**Example Query:**
*"Analyze Microsoft's stock performance over the past year and forecast its performance next quarter."*

## 3. Web Search and Real-Time Market Agent

**Core Responsibilities:**

- Retrieve current market news, sentiment, and events.
- Summarize up-to-date financial information with citations.

**Key Technologies:**

- Web APIs: SerpAPI, Tavily, NewsAPI
- Web Scraping: BeautifulSoup, newspaper3k
- Summarization APIs: Gemini, Hugging Face

**Example Query:**
*"What recent events are influencing Google's stock price today?"*

## 4. Coordinator Agent

**Core Responsibilities:**

- Decompose multimodal queries into subtasks.
- Manage agent interactions and task coordination.
- Aggregate results into cohesive, cited analyses.

**Key Technologies:**

- Agent Frameworks: LangChain, LangGraph
- Generative Models: Gemini API

## (Optional) 5. Quality Assurance & Ethical AI Reviewer

**Core Responsibilities:**

- Verify factual accuracy and citation integrity.
- Ensure output adherence to ethical guidelines.

**Key Technologies:**

- Moderation: GPT moderation API
- Evaluation Tools: Hugging Face evaluation suite, BERT classifiers

# Student Workflow (Agile Methodology)

## Week 1:

- Dataset preparation (IR documents, 2020–2024).
- Initial multimodal embedding, indexing, and retrieval implementation.
- Implement RAG and Analytics agents fully.

## Week 2:

- Web agent integration (real-time data retrieval).
- Coordinator agent and multi-agent integration.
- Optional fine-tuning of embedding and generative models.
- UI development with Gradio; final deployment and QA checks.

# Deliverables

- Final deployed app (Gradio interface, Hugging Face Spaces)
- Fully documented GitHub repository
- Jira project management documentation
- Final project presentation and demonstration
- Technical report detailing architecture, decisions, and lessons learned

# Learning Outcomes and Professional Alignment

Students will gain practical experience directly aligned with professional roles in financial analytics and generative AI, covering:

- Multimodal retrieval and citation-based knowledge synthesis
- Advanced financial analytics and predictive modeling
- Real-time web scraping and API integration
- Agile methodologies and project management
- Production-ready deployment and interface design

This project directly mirrors the technology, practices, and tasks found in current industry positions.

# Resources

- Workflows and Agents
- Multi-agent Supervisor
- Multi-Vector Retriever for Multimodal RAG
- Passing Multimodal Data to Models
- Multi-agent Systems Concepts
- Returning Sources in RAG
- Adding Citations in RAG Applications