



LLM Agents and Agentic Workflows

FA690 Machine Learning in Finance

Dr. Zonghao Yang

2025 Spring

LLM Agents

FA690 ChatBot

FA690 ChatBot is a customized GPT, ready to answer questions related to FA690 Machine Learning in Finance 24/7 [[Link to FA690 ChatBot](#)]



FA690 ChatBot

By community builder 𐄂

FA690 course assistant with document references and guided learning

When and where do we meet for class?

Where is the instructor's office?

Explain how convolutional neural networks...

What are the applications of CNN in finance?

Ask anything



Key Configuration of FA690 ChatBot

- **Objective:** Its goal is to help students better understand the course by
 - Answering questions about logistics directly, such as syllabus content, requirements, deadlines
 - Guiding exploration of lecture content and technical topics through questions, examples, or references to relevant materials
- **How to respond:** Does the chatbot directly provide the answer or guide the student to discover answers? How to preempt hallucination?
- **Knowledge base:** Course syllabus, lecture notes, project descriptions, etc.
- **Tool use:**
 - Web search ✓
 - Canvas ✓
 - DALL-E image generation ✗
 - Code interpreter & data analysis ✗



From ChatBot to LLM Agents

- An LLM agent is like an AI assistant that can think, decide, and act
 - Set goals
 - Make decisions
 - Use tools or APIs
 - Work in steps or loops
- **FA690 ChatBot** is not a fully-fledged LLM agent yet
- What functions should we expect if **FA690 ChatBot** were an LLM agent?
 - Autonomous Task Execution
 - Goal-Oriented Behavior
 - Reflection & Iteration
 - Memory & Personalization



FA690 Agent

Autonomous Task Execution

- Proactively check deadlines
- Track assignment progress for each student
- Send nudges like: “You haven’t started Assignment 3. Want help?”

Reflection & Iteration

- Notice a student keeps getting questions wrong
- Suggest different study techniques
- Track learning over time and adapt

Goal-Oriented Behavior

Students can give it broad tasks like: “Help me get an A in FA690.”

- Plan a week-by-week study strategy
- Schedule reminders

Memory & Personalization

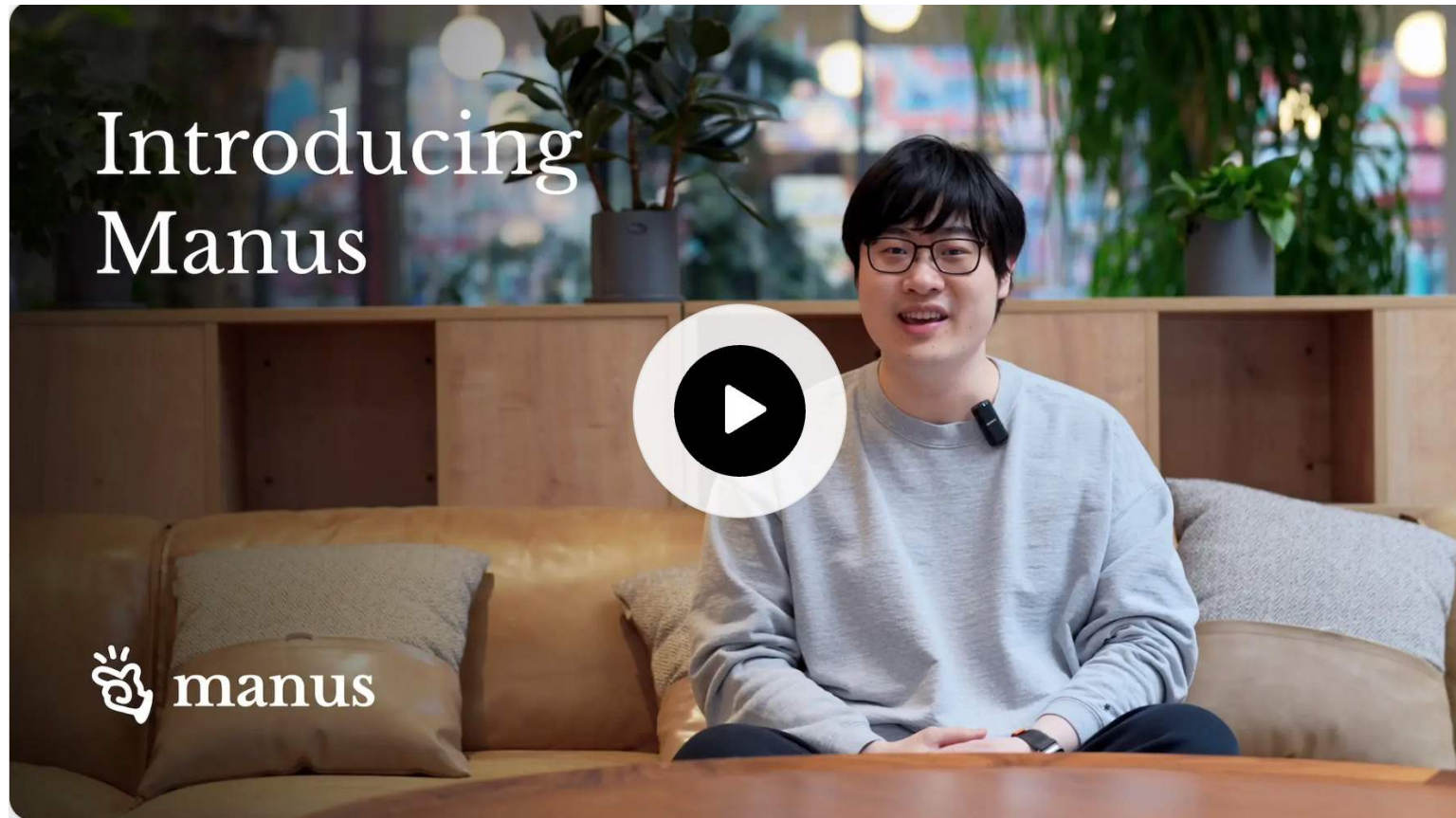
- Knows student preferences, goals, struggles
- Remembers past conversations
- Could even say: “Last week you struggled with generative models. Want to review before the quiz?”



Agentic Workflows



manus The General AI Agent (March 6, 2025)



Source: Manus AI (<https://manus.im/>)

LLM-based Agents

Non-agentic workflow (zero-shot)

Please type out an essay on topic X from start to finish in one go, without using backspace



Agentic workflow

Write an essay outline on topic X

Do you need any web research?

Write a first draft.

Consider what parts need revision or more research.

Revise your draft.

...



Non-Agentive Workflow

- Completes a task in one go without iteration
- No revisions or refinements
- The use of tools and knowledge base

Agentive Workflow

- Breaks tasks into stages (e.g., planning, research, drafting, revising)
- AI iterates based on human guidance (e.g., Feedback Loop)

Truly Autonomous AI Agent

- Fully independent AI agent that determines steps, tools, and iterates without human involvement
- AI adjusts workflow dynamically to achieve the best outcome

Source: AI Agents Fundamentals In 21 Minutes [[Link to YouTube](#)]



OpenAI Agent SDK (March 11, 2025)

“2025 is going to be the year of the agent. It’s the year that [ChatGPT and our developer tools] go from just answering questions to actually doing things for you out in the real world.”

OpenAI Agent SDK Launch Event

Agentic Reasoning Design Patterns

- Reflection
 - Tool use
- } robust technology
-
- Planning
 - Multi-agent collaboration
- } emerging technology



Reflection



Please write code for {task}

```
def do_task(X): ...
```

```
def do_task_v2(X): ...
```

```
def do_task_v3(X): ...
```

Here's code intended for {task}:
`def do_task (x):`
...

Check the code carefully for correctness, style and efficiency,
and give constructive criticism for how to improve it.



Coder Agent
(LLM)

There's a bug on line 5. Fix it by ...

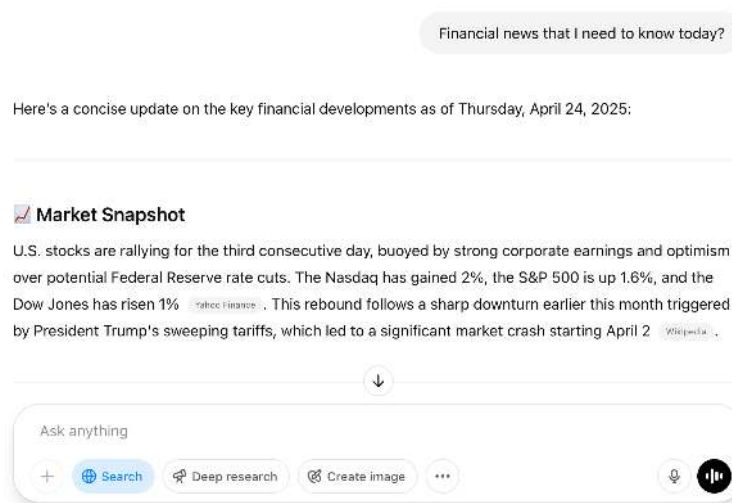
It fails Unit Test 3. Try changing ...



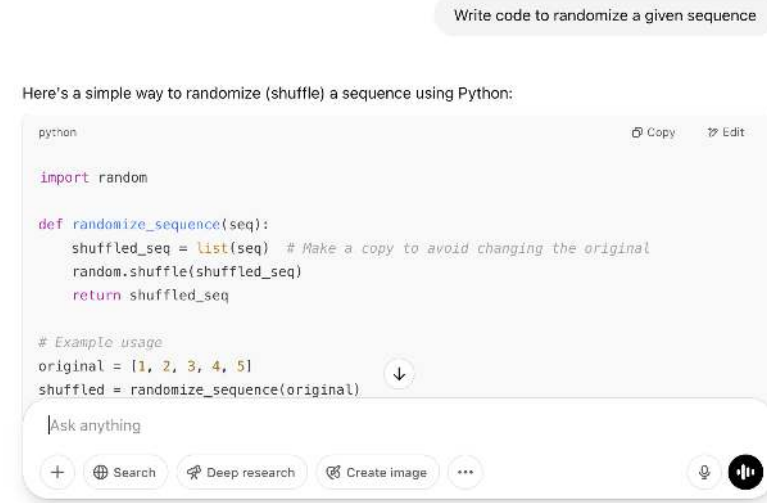
Critic Agent
(LLM)



Tool Use



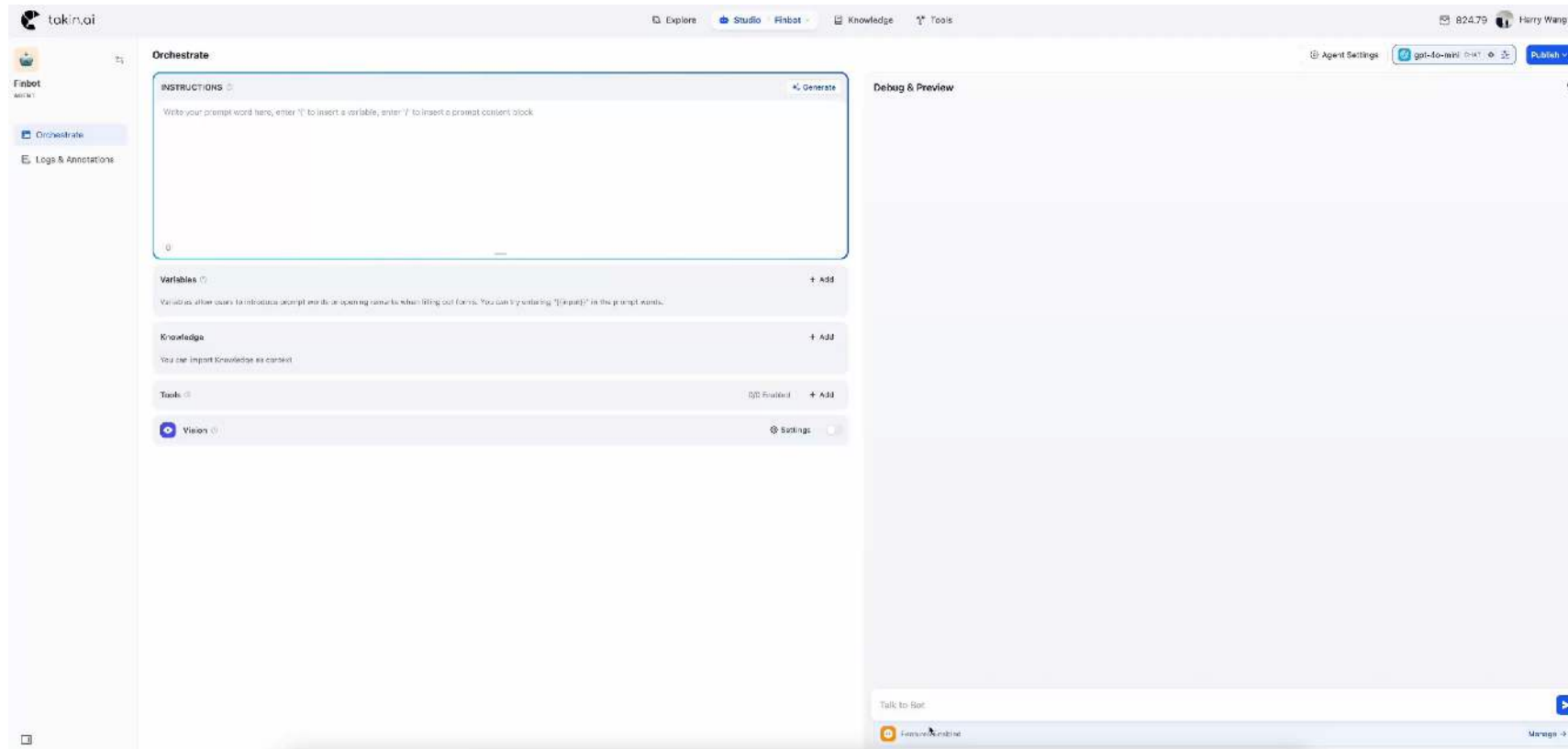
Web search tool



Code execution tool

Analysis	Research	Productivity	Images
- Code Execution - Wolfram Alpha - Bearly Code Interpreter	- Search engine - Web browsing - Wikipedia	- Email - Calendar - Cloud storage	- Image generation (e.g., DALLE) - Image captioning - Object detection

Tool Use Example

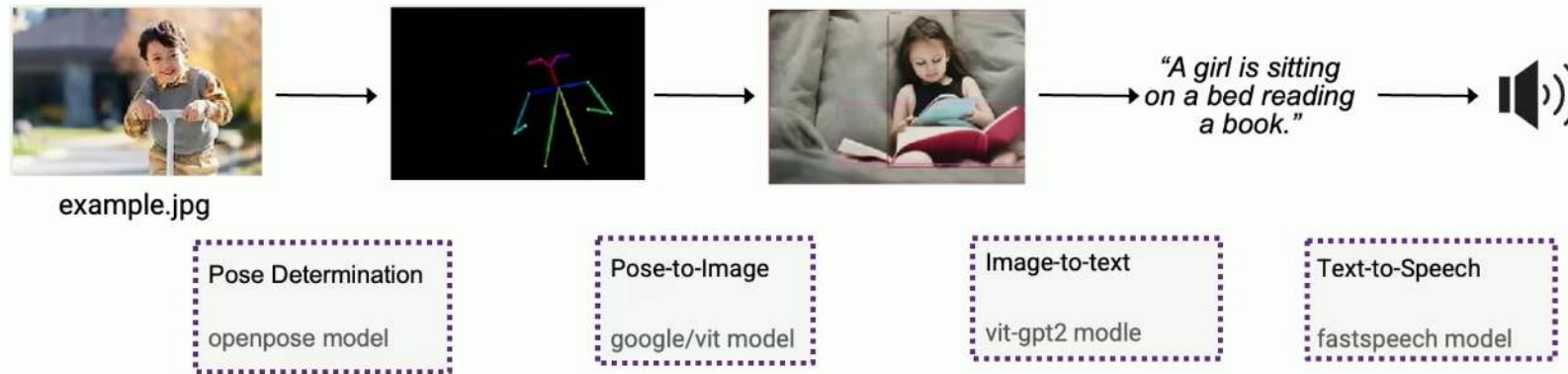


Source: Blog on “AI Agents & Agentic Workflows: The Next Frontier in AI” from Harry Wang



Planning

Request: Please generate an image of a girl reading a book in the same pose as the boy in *example.jpg*. Then, describe the new image with your voice.



Sources:

- “What’s Next for AI Agentic Workflows,” Andrew Ng, March 26, 2024
- Shen, Y., Song, K., Tan, X., Li, D., Lu, W., & Zhuang, Y. (2023). HuggingGPT: Solving AI tasks with ChatGPT and its friends in Hugging Face. *Advances in Neural Information Processing Systems*, 36, 38154-38180.

Multiagent Collaboration



Model	Arithmetic (%) ↑	Grade School Math (%) ↑	Chess (Δ PS) ↑
Single Agent	67.0 ± 4.7	77.0 ± 4.2	91.4 ± 10.6
Single Agent (Reflection)	72.1 ± 4.5	75.0 ± 4.3	102.1 ± 11.9
Multiagent (Majority)	75.0 ± 3.9	81.0 ± 3.9	105.2 ± 5.9
Multiagent (Debate)	81.8 ± 2.3	85.0 ± 3.5	122.9 ± 7.6

Multiagent Debate: Du et al. (2023)

Sources:

- Qian, C., Liu, W., Liu, H., Chen, N., Dang, Y., Li, J., ... & Sun, M. (2023). Chatdev: Communicative agents for software development.
- Du, Y., Li, S., Torralba, A., Tenenbaum, J. B., & Mordatch, I. (2023). Improving factuality and reasoning in language models through multiagent debate. In Forty-first International Conference on Machine Learning.

Predicted Trend from Andrew Ng in Mar 2024

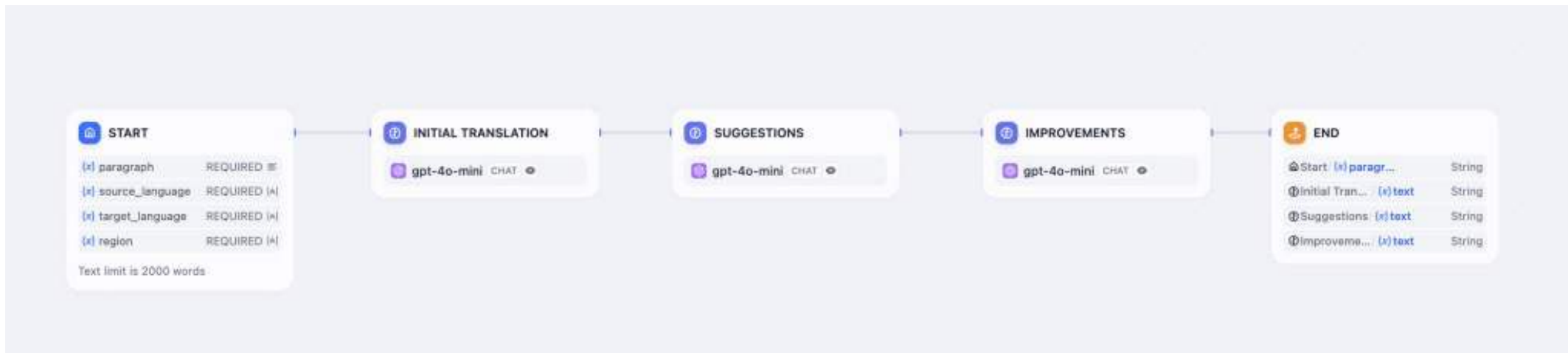
- The set of tasks that AI can do will expand dramatically because of agentic workflows
- We have to get used to delegating tasks to AI agents and patiently wait for a response
- Fast token generation is important. Generating more tokens even from a lower quality LLM can give good results
- If you're looking forward to running GPT-5/Claude 4/Gemini 3 (zero-shot) on your application, you might already be able to get better performance with agentic reasoning on an earlier model



Practical Use Cases

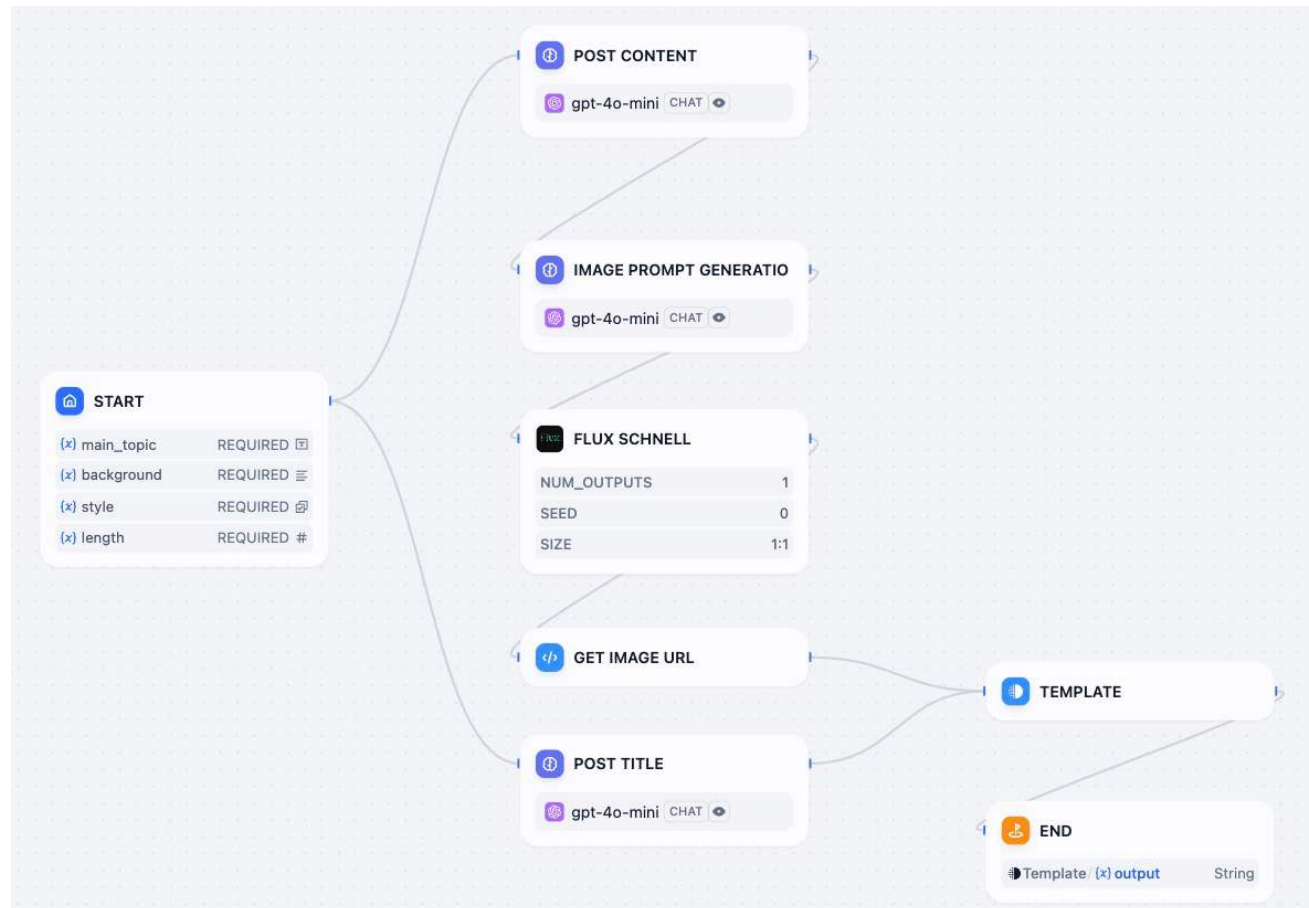
Translation Agents based on No-Code LLM Workflow

Agentic Workflow Tutorial: Remaking Andrew Ng's Translation Agents with No-Code LLM Workflow [\[Link\]](#)



Instagram Post Generator

Agentic Workflow Tutorial: Instagram Post Generator [[Link](#)]



State-of-the-Art: OpenAI Deep Research



An agent that uses reasoning to synthesize large amounts of online information and complete multi-step research tasks for you [[OpenAI Deep Research](#)]

- Why Deep Research is an LLM Agent
 - Requires multiple steps (e.g., gathering data, comparing sources, summarizing findings)
 - Benefits from reasoning (e.g., evaluating source credibility, spotting contradictions)
 - Needs memory and iteration (e.g., refining questions based on early results)
- Example: Stock Analysis in the Age of Generative AI [[Link to Deep Research](#)]



Predict the expected movement of S&P 500 Index (SPX) over the next month as bullish, bearish, or uncertain. Predict as:

- Bullish if you predict a potential increase in the stock price,
- Bearish if you predict a potential decrease,
- Uncertain if the prediction is neutral



State-of-the-Art: Windsurf Cascade



A code agent, equipped with knowledge, tools, and human collaboration, operates in full sync with the developer while also being empowered to act with maximum independence [[Cascade](#)]

- Agentic abilities
 - Suggest and run commands with full contextual awareness
 - Web search
 - Multimodal reasoning: Images and text
- Example: Build a course website for FA690 Machine Learning in Finance



State-of-the-Art: Manus AI



Manus is a general AI agent that bridges minds and actions: it doesn't just think, it delivers results [[Manus AI](#)]

Explore use cases from our official collection.

Learn how Manus handles real-world tasks through step-by-step replays.

Featured Research Life Data Analysis Education Productivity WTF

Trip to Japan in april

Manus integrates comprehensive travel information to create personalized itineraries and produces a custom travel handbook tailored specifically for your Japanese adventure.



Deeply analyze Tesla stocks

Manus delivers in-depth stock analysis with visually compelling dashboards that showcase comprehensive insights into Tesla's market performance and financial outlook.



Interactive course on the momentum theorem

Manus develops engaging video presentations for middle school educators, clearly explaining the momentum theorem through accessible and educational content.



Comparative analysis of insurance policies

Looking to compare insurance options? Manus generates clear, structured comparison tables highlighting key policy information with optimal recommendations tailored to your needs.



B2B supplier sourcing

Manus conducts comprehensive research across extensive networks to identify the most suitable suppliers for your specific requirements. As your dedicated agent, Manus works exclusively in your best interest.



Research on AI products for the clothing industry

Manus conducted in-depth research on AI search products in the clothing industry with comprehensive product analysis and competitive positioning.



List of YC companies

Manus expertly navigated the YC W25 database to identify all qualifying B2B companies, meticulously compiling this valuable information into a structured table.



Online store operation analysis

Upload your Amazon store sales data and Manus delivers actionable insights, detailed visualizations, and customized strategies designed to increase your sales performance.





Final Words on Generative AI

- **GenAI-First Mindset**

- There's no doubt that generative AI increases productivity
- Today's workforce requires you to know how to work with generative AI

- **Do Your Own Due Diligence**

- Generative AI can make mistakes (hallucination)
- You are responsible for the final delivery

- **Stay Open-Minded and Curious**

- Generative AI is a fast-evolving field
- Read and try what's new and trendy



Acknowledgement

The lecture note has benefited from various resources, including those listed below. Please contact Zonghao Yang (zyang99@stevens.edu) with any questions or concerns about the use of these materials.

- “AI Agents & Agentic Workflows: The Next Frontier in AI,” March 12, 2025, Harry J. Wang [[Blog](#)]
- “What’s Next for AI Agentic Workflows,” Andrew Ng, March 26, 2024 [[YouTube](#)]





THANK YOU

Stevens Institute of Technology
1 Castle Point Terrace, Hoboken, NJ 07030