

## Unit 5.2: Large Language Models

Utrecht Summer School: Programming with Python 2025

2025-07-11



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# Table of Contents

- 1 What is an LLM
- 2 Ethics
- 3 HuggingChat
- 4 Colab
- 5 Local LLMs
- 6 Conclusions

# Stupid is as stupid does

- What do you think is the next word that I will...?



# Stupid is as stupid does

- What do you think is the next word that I will WRITE?



# Stupid is as stupid does

- What do you think is the next word that I will WRITE?
- What do you think is the next word that I will SAY?



# Stupid is as stupid does

- What do you think is the next word that I will WRITE?
- What do you think is the next word that I will SAY?
- How did you guess?



# LLMs as coding agents

```
a = [2, 4, 5]
```



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# LLMs as coding agents

```
a = [2, 4, 5]  
# Compute the mean of the list
```





# LLMs as coding agents

```
a = [2, 4, 5]  
# Compute the mean of the list  
Can the LLM auto-complete?
```



# LLMs as bug fixers

```
# Create a dictionary with elements in the name of a person
name_parts = {"given name": "Consolacion", "surname": "Valenzuela"}
# Add a middle name
name_parts.append("middle name": "Celestina")
```

# LLMs as bug fixers

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# Create a dictionary with elements in the name of a person
name_parts = {"given name": "Consolacion", "surname": "Valenzuela"}
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```

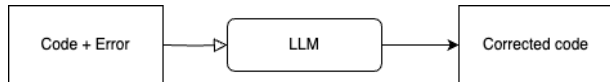
```
File "<stdin>", line 1
    name_parts.append("middle name": "Celestina")
                        ^
SyntaxError: invalid syntax
>>>
```

# LLMs as bug fixers

```
# Create a dictionary with elements in the name of a person
name_parts = {"given name": "Consolacion", "surname": "Valenzuela"}
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```
File "<stdin>", line 1
    name_parts.append("middle name": "Celestina")
                                ^
```

```
SyntaxError: invalid syntax
>>>
```



# Training data



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## OpenAI must face part of Intercept lawsuit over AI training

By Blake Brittain

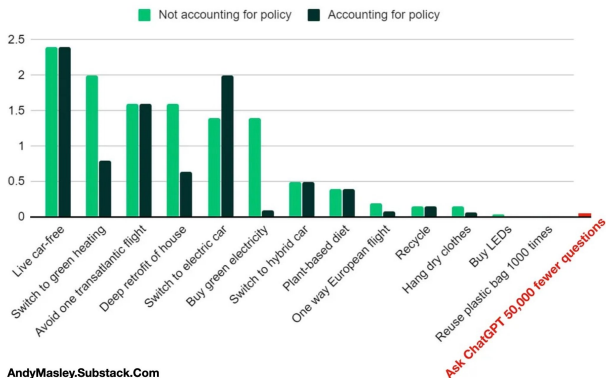
February 20, 2025 9:45 PM GMT+1 · Updated 4 days ago



OpenAI logo is seen in this illustration taken May 20, 2024. REUTERS/Dado Ruvic/Illustration [Purchase Licensing Rights](#)

# Environment

**Figure 4.** Tonnes of CO<sub>2</sub> avoided by selected personal lifestyle decisions accounting for government policy



AndyMasley.Substack.Com  
Original climate graph taken from Founders Pledge

1

<sup>1</sup>Source (January 2025):  
<https://open.substack.com/pub/andymasley/p/individual-ai-use-is-not-bad-for>

# Labor conditions



"When it gets to the day before payday, they close the account and say that you violated a policy," Kanyugi said.

Employees say they have no recourse or even a way to complain.

The company told 60 Minutes that any work done "in line with our community guidelines was paid out." In March, as workers started complaining publicly, Remotasks abruptly shut down in Kenya, locking all workers out of their accounts.

## The mental toll of AI training

Workers say some of the projects for Meta and OpenAI also caused them mental harm. Wambalo was assigned to train AI to recognize and weed out pornography, hate speech and excessive violence from social media. He had to sift through the worst of the worst content online for hours on end.

"I looked at people being slaughtered," Wambalo said. "People engaging in sexual activity with animals. People abusing children physically, sexually. People committing suicide."

Berhane Gebrekidan thought she'd been hired for a translation job, but she said what she ended up doing was reviewing content featuring dismembered bodies and drone attack victims.

2

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<sup>2</sup>Source (November 2024):

<https://www.cbsnews.com/news/ai-work-kenya-exploitation-60-minutes/>

# Effect on cognition

## Results

---

Cultural modulation of neural mechanisms asserts that technological interactions significantly influence brain development and cognitive abilities. The use of artificial intelligence chatbots like ChatGPT for cognitive offloading may lead to underemployment of specific cognitive faculties, inhibiting their full maturation. This phenomenon is particularly relevant in the context of executive functions, where reliance on artificial intelligence for problem-solving can reduce cognitive effort and lead to long-term cognitive changes.<sup>13</sup>

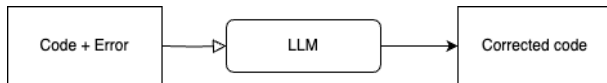
3

---

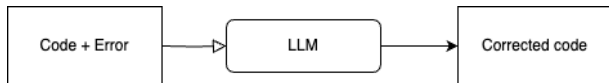
<sup>3</sup>Source (June 2024): Dubey et al. Redefining Cognitive Domains in the Era of ChatGPT: A Comprehensive Analysis of Artificial Intelligence's Influence and Future Implications. Med Res Arch. 2024 Jun;12(6):5383. doi: 10.18103/mra.v12i6.5383



# Uploading restricted data



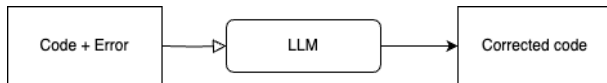
# Uploading restricted data



- What if error contains sensitive information?



# Uploading restricted data



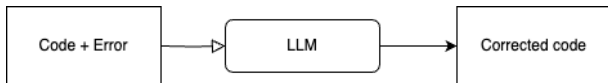
- What if error contains sensitive information?

```
import pandas as pd

def print_selected_municipalities():
    df = pd.read_csv('data/dutch_municipalities.csv', sep=';')
    for income, munic, prov in df[['avg_household_income_2012', 'municipality', 'province']].values:
        if int(income) > 40000:
            print(munic, ': ', prov)
```



# Uploading restricted data



- What if error contains sensitive information?

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import pandas as pd
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def print_selected_municipalities():  
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```

```
ValueError                                Traceback (most recent call last)  
Cell In[9], line 1  
----> 1 print_selected_municipalities()  
  
Cell In[8], line 6, in print_selected_municipalities()  
      4 df = pd.read_csv('data/dutch_municipalities.csv', sep=';')  
      5 for income, munic, prov in df[['avg_household_income_2012', 'municipality', 'province']].values:  
----> 6     if int(income) > 40000:  
      7         print(munic, ':', prov)  
  
ValueError: cannot convert float NaN to integer
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# Uploading restricted data

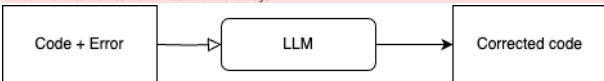
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ValueError: cannot convert float NaN to integer
```



# Uploading restricted data

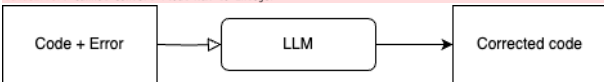
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```

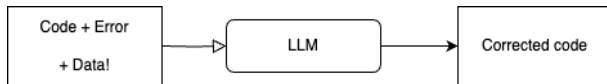


- Corrected code is useless / does not work

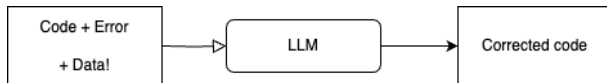




# Uploading restricted data



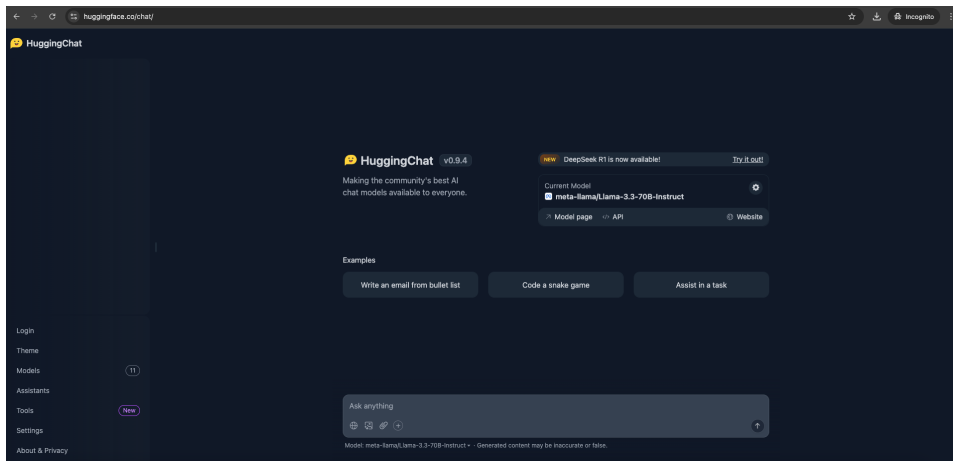
# Uploading restricted data



- May be illegal!



# HuggingChat



# Switch models

×

Models

meta-llama/Llama-3.3-70B-Instruct

Active

Qwen/Qwen2.5-72B-Instruct

CohereForAI/c4ai-command-r-plus-08-2024

deepseek-ai/DeepSeek-R1-Distill-Qwen-32B

nvidia/Llama-3.1-Nemotron-70B-Instruct-HF

Qwen/QwQ-32B-Preview

Qwen/Qwen2.5-Coder-32B-Instruct

meta-llama/Llama-3.2-11B-Vision-Instruct

NousResearch/Hermes-3-Llama-3.1-8B

mistralai/Mistral-Nemo-Instruct-2407

microsoft/Phi-3.5-mini-instruct

Assistants

My Assistants

**meta-llama/Llama-3.3-70B-Instruct**

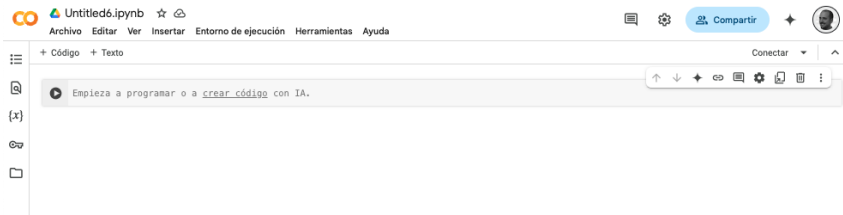
Ideal for everyday use. A fast and extremely capable model matching closed source models' capabilities. Now with the latest Llama 3.3 weights!

↗ Model page ↗ Model website ↗ API Playground 🔗 Copy direct link to model

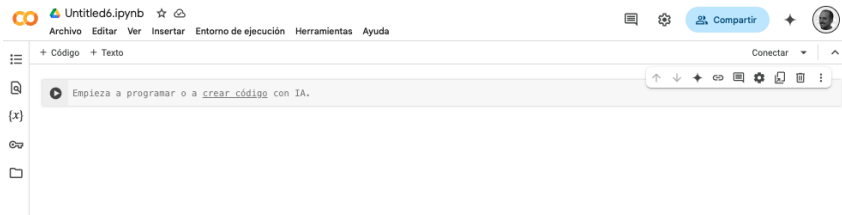
💬 New chat

**System Prompt**

# Generative AI on Google Colab



# Generative AI on Google Colab



# Model cards

The screenshot shows the Hugging Face interface for the **Mistral-Nemo-Instruct-2407** model. At the top, there's a navigation bar with links to Models, Datasets, Spaces, Posts, Docs, Enterprise, Pricing, and a Login/Sign Up button. Below the navigation bar, the model name is prominently displayed with its ID and a 'Like' button. A row of tags indicates the model's capabilities: Text Generation, Transformers, Safetensors, 5 languages, mistral, conversational, text-generation-inference, Inference Endpoints, and License: apache-2.0. A 'Model card' tab is selected, showing a section where users must agree to share contact information to access the model. To the right, a graph shows the number of downloads (231,897) over the last month. Below the graph, there are sections for 'Safetensors' (Model size: 12.2B params, Tensor type: BF16) and 'Inference Providers' (Nebius AI Studio). At the bottom, a text input field is provided for users to interact with the model, with a 'Send' button and links to 'View Code' and 'Open Playground'.

**Hugging Face** Search models, datasets, users...

**Mistral-Nemo-Instruct-2407** Like 1.4K Follow Mistral AI 5.6k

Text Generation Transformers Safetensors 5 languages mistral conversational text-generation-inference Inference Endpoints License: apache-2.0

Model card Files and versions Community

You need to agree to share your contact information to access this model

If you want to learn more about how we process your personal data, please read our [Privacy Policy](#).

Login or Sign Up to review the conditions and access this model content.

**Model Card for Mistral-Nemo-Instruct-2407**

The Mistral-Nemo-Instruct-2407 Large Language Model (LLM) is an instruct fine-tuned version of the **Mistral-Nemo-Base-2407**. Trained jointly by Mistral AI and NVIDIA, it significantly outperforms existing models smaller or similar in size.

For more details about this model please refer to our release [blog post](#).

**Key features**

- Released under the **Apache 2 License**
- Pre-trained and instructed versions
- Trained with a **128k context window**

Downloads last month: **231,897**

**Safetensors** Model size: 12.2B params Tensor type: BF16

**Inference Providers** Nebius AI Studio

Text Generation Examples

Input a message to start chatting with mistralai/Mistral-Nemo-Instruct-2407.

Your sentence here... Send

[View Code](#) [Open Playground](#)



# Model cards

The screenshot shows the Hugging Face interface for the **Mistral-Nemo-Instruct-2407** model. At the top, the navigation bar includes the Hugging Face logo, a search bar, and links for Models, Datasets, Spaces, Posts, Docs, Enterprise, Pricing, Login, and Sign Up. The model's name is prominently displayed with its ID and a 'Like' button. Below this, there are tabs for Text Generation, Transformers, Safetensors, and Languages. The 'Model card' tab is selected, showing a detailed description of the model, its training process, and its key features. A 'Model card for Mistral-Nemo-Instruct-2407' section is visible, followed by a 'Key features' list. To the right, there is a 'Downloads last month' graph showing 231,897 downloads, and a 'Safetensors' section with a download button. The 'Inference Providers' section lists 'Nebius AI Studio' as the provider. At the bottom, there is a 'Send' button for the chat interface.

**Hugging Face** Search models, datasets, users...

**Mistral-Nemo-Instruct-2407** Like 1.4K Follow Mistral AI 5.6k

Text Generation Transformers Safetensors 5 languages mistral conversational text-generation-inference Inference Endpoints License: apache-2.0

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Your sentence here... Send

View Code Open Playground

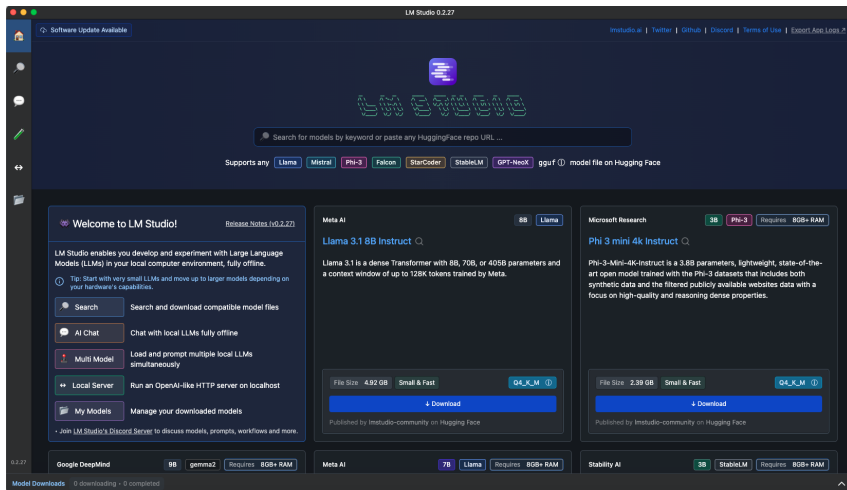
No model card for Gemini!



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# Using an LLM locally (no server)



# Time for a demo

But before we do that...

- Choose your poison carefully / Know what you choose



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# Time for a demo

But before we do that...

- Choose your poison carefully / Know what you choose
- Do not share private data



# Time for a demo

But before we do that...

- Choose your poison carefully / Know what you choose
- Do not share private data
- Consider if you really need this

