# DHUM 25A43 - 01

# Investigating with AI

## Welcome

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# Discord

- #sciencespo-DHUM25A43
- **https://discord.gg/DDbh5AyHYH**

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# The Course

# What is this course about?

**Data Science for Social Sciences**: Applying data science techniques to social science research.

- **Data Search and Collection**: Searching, gathering, and transforming diverse datasets to create corpora and heterogeneous data collections.
- **Exploratory Data Analysis**: Exploring textual content, categories, temporal evolution, extracting names, topics, and their relationships.
- **Qualitative and Quantitative Results**: Combining qualitative insights with quantitative analysis and visual representation of findings.
- **Result Communication**: Presenting outcomes through interactive documents and websites.

# Digital investigations with AI for social sciences

- **Powerful LLMs**: Revolutionizing data analysis, interpretation, and automation.
- **Impact on Data Science**: Enhancing efficiency, accuracy, and scalability of workflows.
- **Code Generation with LLM**: Quickly develop data analysis pipelines
- **Use of LLMs as an Autonomous Data Analysis Tool**: extract patterns, trends, and insights from raw data. Analysis of large datasets or documents
- **Accessible Methods**: Simplifying complex data processes with user-friendly tools.

# Course Organization

- **Project-Oriented Approach**: Focus on applying concepts through real-world projects.
- **Workshop-Style Sessions**: Interactive, hands-on learning environment.
- **Collaborative Work**: Students work in groups to tackle selected themes and datasets.
- **Practical Focus**: Emphasis on skills development through guided exercises and demos.
- **Professor Assistance**: Direct support and feedback during project work.

# Session Structure

**Theoretical Introduction**: Present existing methods (no advanced math or equations) and new AI-assisted approaches.

**Technical Demo**: Showcase practical applications of the methods introduced.

**Practical Student Work**:

- Groups of 3-4 students collaborate on selected themes and datasets.
- Hands-on project development with guidance from professors.

# Course Evaluation

- group note (80%)
- public presentation
- individual : (20%)
- critical reflexion on your work and experience with IA
- write a personal SWOT report on your work with AI and propositions

# Course outline - timeline

## We have 12 classes, 2h each

## We'll cover

- Background on Web and API
- Data: how to collect and process
- Machine Learning : training models for prediction
- NLP : analyzing text to extract information
- AI & LLMs
- Agents : combining LLMs for agency

# Tools

- **discord** for conversations
- **google drive** for documents
  - course material
    - ./slides
    - ./data
    - ./colab
  - student projects
    - ./projects
- **Google colab** notebooks for work

All course material is available in google drive and on the discord channel

# Course Project

# Project Presentation

## Themes

- Climate change, energy
- AI - robotics
- Brain–computer interface
- Other issues...
- Data sources : media, social media, web, scientific publications, specific websites (COP, IMDB, wikipedia, Kaggle datasets)

**Comment 1** : These topics focus on future-oriented challenges and opportunities

**Comment 2** : The issues are very broad; we need to refine them into precise research questions or subtopics to ensure project feasibility and a reasonable dataset size.

# Project Organization

- Find and Formulate Research Questions
- Initial Validation of Projects - Feasibility Check, Relevance
- **Goal: Create a Website**: Design an engaging platform to showcase your report.
- **Creative Formats**: Present findings as a report or in unique forms, such as a movie script or other innovative approaches.
- Publish the website
- Organization: 3 to 4, groups with complementary skills
- Evaluation, expectations
- Primary exposé after a few classes
- Last class: final exposé in front of class and experts

# Project

Start thinking about your project

Share your project definition

Create your team

# Getting to know you

# Please fill out this form

We'd like to know a bit more about you

So that we can adapt the course to meet your expectations

All questions are optional (except your email)

https://forms.gle/1ksP3qtAk2F5N2gT8

# State of AI

# A Thorough Recap of 2024

## Things we learned about LLMs in 2024

by Simon Willison.

A lot has happened in the world of Large Language Models over the course of 2024. Here's a review of things we figured out about the field in the past twelve months, plus my attempt at identifying key themes and pivotal moments.

# Over 120 new models released in 2024!

## Released Models 2024

- Open Source Models: 55
- API Only Models: 63

## 2024 AI Timeline

*a Hugging Face Space*

# Chatbot Arena: LLMs vs LLMs

Where LLMs compete https://lmarena.ai/?leaderboard

Total #models: 194. Total #votes: 2,557,144. Last updated: 2025-01-20.

Creative Writing: #models: 190 (98%) #votes: 385,176 (15%)

# 2024

70 models from 18 organizations are now **performing** better than GPT4

- GPT-4 level models run on a laptop (not mine tho)
- Multimodal vision is common, audio and video are starting to emerge
- Prices have dropped => less energy
- EU AI act

# Benchmarks

- The Massive Multitask Language Understanding (**MMLU**) : range of exam questions on academic subjects.
- **BIG-bench** : Beyond the Imitation Game
- **GPQA Diamond**: harder still, google proof,
  - PhDs domain experts reach 74% accuracy
- **LiveBench**: avoid contamination

and many others

- **Humanity's Last Exam**
- **CultureVLM**
- ...

It's becoming harder to find tasks that are difficult enough for the LLMs.

Connections — The New York Times

# AI vs Humans (March 2023)

## How Smart is ChatGPT?

GPT 4.0 has made impressive strides over GPT 3.5 but continues to struggle in certain subjects.

According to OpenAI, the essays that GPT-4 produced for these tests were graded by "qualified third-party contractors".

GPT attempted 10 programming contests 100 times each, but was unable to consistently find solutions to the more complex problems.

# Augmented LLMs

It's no longer just about the model

- 🔍 Web browsing
- 📚 File upload - projects - knowledge base
- 🧠 Dynamic memory
- 👁️ Streaming
- 🖐️ Function calling
- 👄 speech
- 🤓 voice

# 2025 ?

**weekly updates**

- Models: DeepSeek-R1, OpenAI o3
- Stargate project ?!
- China vs US
- Massive deployment of AI in all Google and Microsoft services
- Platform evolutions : Anthropic, OpenAI, Gemini, ...
    - more features, connections, memory, protocols

# 2025 ?

Ethan Mollick : Which AI to Use Now: An Updated Opinionated Guide

Comparison table showing different AI services, their capabilities, and recommended use cases.

# Emergence

or algorithms of the LLM.

- the **wetness of water** isn't found in individual water molecules.

**Weak Emergence**: sophisticated but fundamentally different from human intelligence

- The observed abilities can still be **explained** by the underlying mechanisms,
- But their appearance is unexpected and simply difficult to predict.
- ~ modeling **traffic patterns** using the behavior of individual cars.

# Emergence - Jason Wei - OpenAI

## 137 emergent abilities of large language models — Jason Wei

As the size of the model increases, we see sudden improvements in its performance on certain tasks

for instance 3 digit addition

gradually increase size of model

- errors, errors, ..., errors, ...

and then suddenly

- correct

# LLMs you can use

- Gemini (Colab)
- Gemini (aistudio.google.com)
- chatGPT (with memory)
- DeepSeek
- Claude.ai, (create a project)
- Gemini
- LLama
- ...

# Google Colab

# Google Colab

Like google docs but also for executing code

Shareable, collaborative work

**A notebook is a series of executable cells**

- code (python)
- text with Markdown

https://colab.research.google.com/

# Text with Markdown

## What you write

```
Simple Syntax

# Header 1

**this is bold**, not bold

[a link](https://sciencespo.fr)
```

## What you get !

Simple Syntax

# Header 1

this is **bold**, not bold

a link

# Demo

# Movie Analysis

The dataset is available in the shared folder in google drive (csv file, google spreadsheet)

It contains information of a 1000 movies

- title
- description
- ranking (imdb, Meta)
- duration
- genres
- actors, director
- revenue

# Demo

1. create a new notebook
2. upload the csv file
3. ask Gemini to
    a. load the data
    b. analyze the data
    c. suggest & explain
    d. extract information from the movie description
    e. save the new data
4. share the notebook

Example of analysis notebook:

https://colab.research.google.com/drive/1KWmqZRSg7O2gJEWtY8NroUYX68TLkEL9#scrollTo=yoLD0yLL0Phc

# Next time

# Colab and AI

## In Colab

- Load a dataset
- prompt Gemini on what questions you can ask on this dataset
- prompt Gemini to create the code to answer your questions

# Create your Project

- Create your team
- Define your project
- Share your project definition
- Announce on the discord channel #sciencespo-dhum25a43 and we will create the related drive folders and subchannels

# Need help ?

1. **Ask an LLM**
2. **We are available on discord**
    a. if possible, please post in the course channel #sciencespo-dhum25a43 not in private messages, so all can contribute