

The background features a series of concentric, overlapping arcs in shades of blue, teal, orange, and red, creating a sense of depth and movement. Scattered throughout are small, solid-colored dots in blue, red, and orange, some of which are positioned along the arcs. The overall aesthetic is modern and artistic.

Revolutionizing Modern Research with ChatGPT and Generative AI

Steven Van Vaerenbergh
October 24th, 2023
3rd COMCHA School
Facultad de Ciencias
Universidad de Oviedo

About me

Steven Van Vaerenbergh

Associate professor at

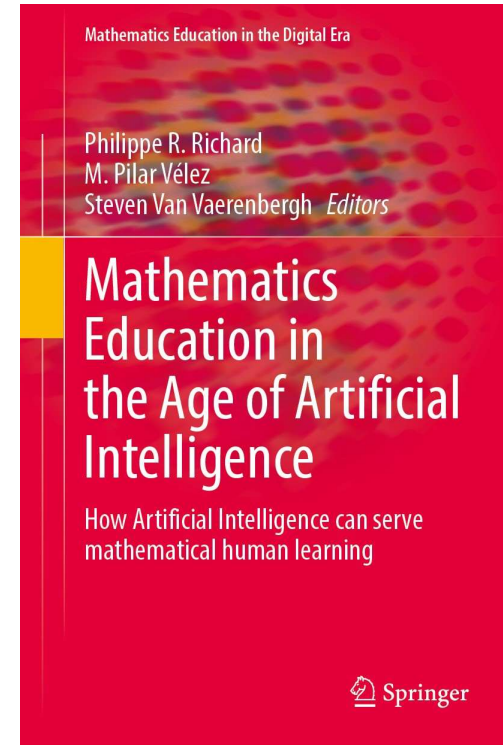


Research fields:

- > Signal processing
 - > Machine learning
 - > Mathematics education



@steven2358



Part 1:

It's the year 2023

A detailed pencil sketch of a hexacopter drone, featuring a central body with six arms, each ending in a propeller. The drawing is surrounded by various other sketches, including a spherical object on a stand and a circular mechanism with a central vertical axis. The sketches are drawn on aged, yellowed paper with some handwritten notes in Italian.

August 2023

Sketches reveal Leonardo da Vinci designed a hexacopter drone



January 2023

First world championship of giant tortoise racing



March 2023

The pope goes Balenciaga

Images generated by Midjourney v5



1. Author's own.
2. https://www.reddit.com/r/midjourney/comments/13ndq6i/viral_selfies_of_history_part_2/
3. https://www.reddit.com/r/midjourney/comments/12ewexx/the_high_octane_world_of_giant_tortoise_racing/
4. https://www.reddit.com/r/midjourney/comments/120vhdc/the_pope_drip/

How did we get to this point?

A very brief history of Generative AI



A very brief history of Generative AI (1)

First chatbots and content generators

- 1960: **ELIZA**, a chatbot that simulates a conversation using predefined text patterns.
- 1973: **AARON**, a system that draws scenes and human figures using rules.
- 1983: **EMI**, a system that creates new musical compositions in the style of existing ones.
- 1996: **RACTER**, a system that generates random (though absurd) texts based on a grammar and a vocabulary.

Generative AI based on deep learning

- 2014: **GAN**, a model that generates realistic images from noise or labels.
- 2016: **WaveNet**, a model that generates natural sounds, such as voices or music, from audio.
- 2017: **Transformer**, an architecture that uses attention to enhance natural language processing (NLP) and generate fluid and coherent texts.
- 2018-2019: **GPT** and **GPT-2**, language models that generate texts on any topic from a sentence.

A very brief history of Generative AI (2)

Generative AI Revolution

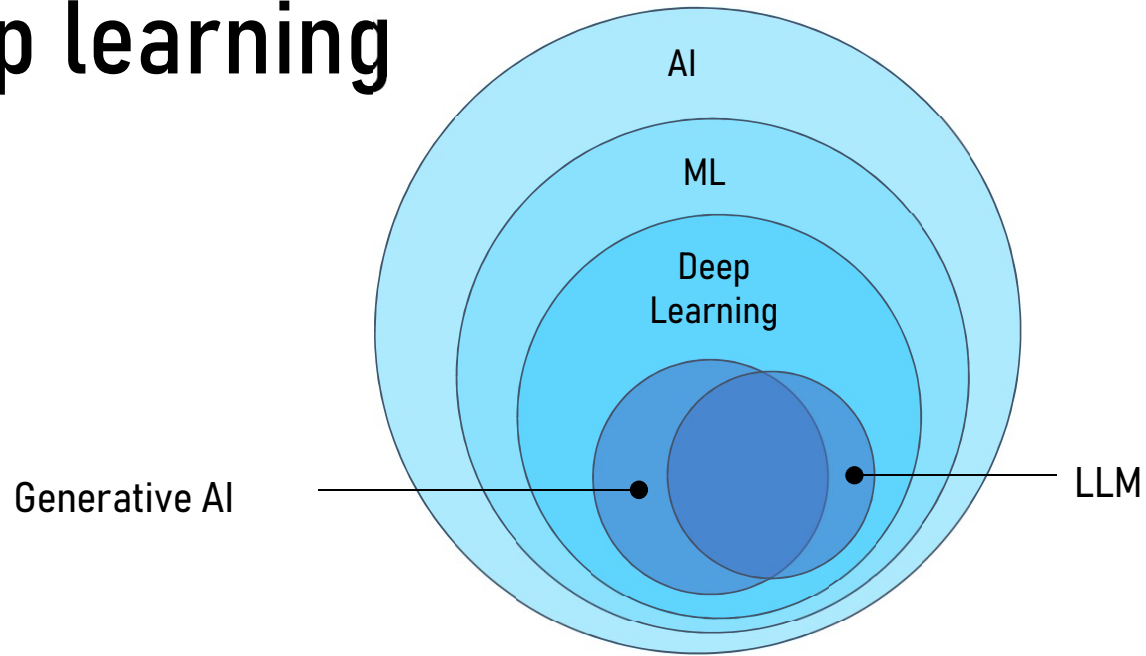
- 2020: **GPT-3**, a language model that produces quality texts on any topic. (OpenAI)
- 2021: **Codex**, a model based on GPT-3 that generates source code from texts. (OpenAI)
- 2022: **DALL·E 2**, an improved version of DALL·E that produces realistic and accurate images from texts. (OpenAI)
- 2022: **Stable Diffusion**, an open-source model that generates images from texts, based on a latent diffusion model. (Stability AI)
- 2022: **ChatGPT**, a chat system based on the GPT-3.5 language model. (OpenAI)
- 2023: **Bing Chat**, an intelligent chat system integrated with the Edge web browser. (Microsoft)
- 2023: **GPT-4**, a larger and more powerful model than GPT-3. (OpenAI)
- 2023: **Llama 2**, an open source large language model. (Meta)
- 2023: A report from Goldman-Sachs on the **economic and social impact** of generative AI, estimating it could affect 300 million jobs and increase global GDP by 7%.

What is Generative AI?

- Generative AI is a type of artificial intelligence technology that can automatically create unique and original content, including text, code, images, audio, and video.



Modern Generative AI is a subfield of deep learning



- Modern generative AI uses ML algorithms that are trained on large amounts of data, using Large Language Models (LLM)
- Includes a random component: The same input leads to different variations of the output.

ChatGPT

chat.openai.com/?model=gpt-4

Model: GPT-4

ST

What are large language models?

T

Large language models are a type of artificial intelligence model that are designed to understand and generate human language. These models are based on machine learning algorithms that have been trained on a vast amount of text data.

A significant subtype of these models is generative models, of which GPT (Generative Pretrained Transformer), is an example. GPT-4, the model you're interacting with now, is one such model.

In essence, these models learn to predict the next word in a sentence by analyzing the words that came before it.

☐ Stop generating

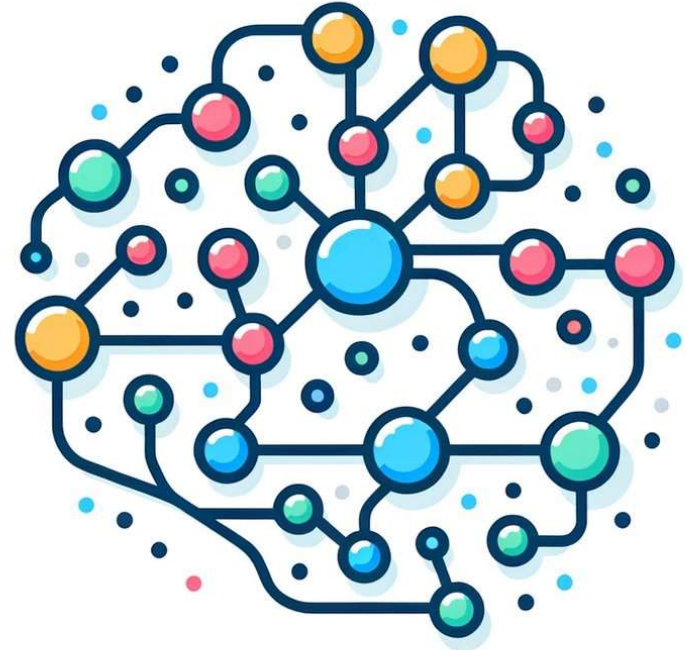
Send a message

ChatGPT may produce inaccurate information about people, places, or facts. [ChatGPT May 24 Version](#)

Revolutionizing Modern Research with ChatGPT and Generative AI - Steven Van Vaerenbergh

<https://youtu.be/6lyqHzrs9mc>

How do LLMs work?



Tokens

- Text is divided into pieces (tokens)

GPT-3 Codex

I want to know how this text is decomposed into tokens. One token generally corresponds to ~4 characters of text for common English text. This translates to roughly 3/4 of a word. E.g. 100 tokens ~= 75 words.

Clear Show example

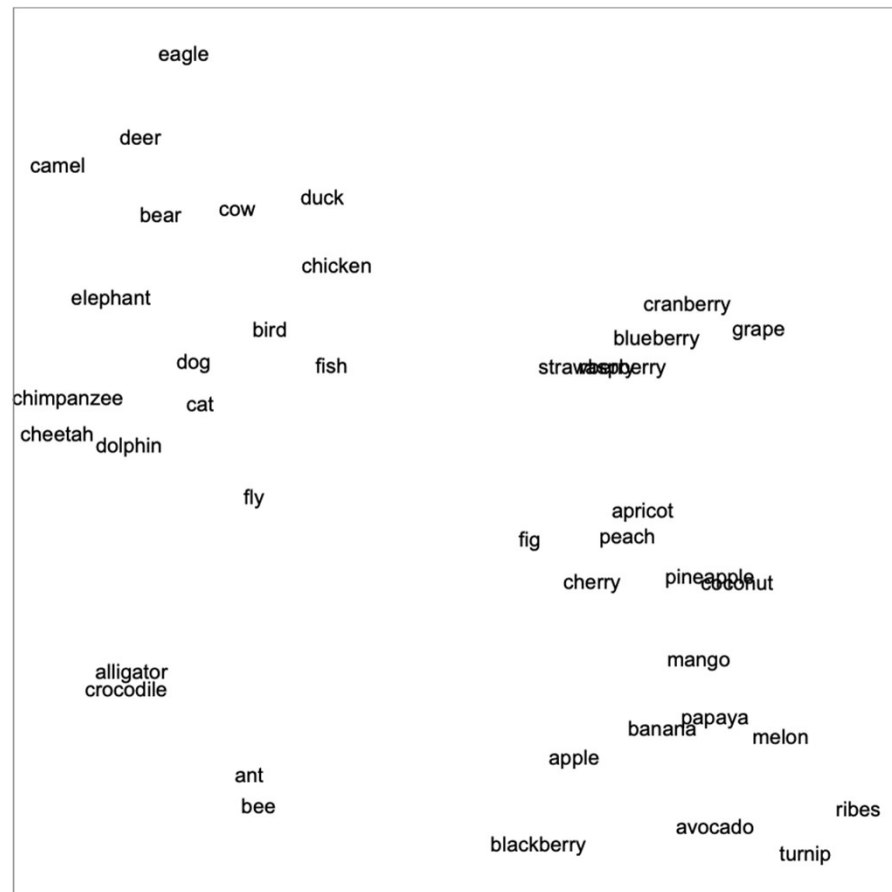
Tokens	Characters
50	208

I want to know how this text is decomposed into tokens. One token generally corresponds to ~4 characters of text for common English text. This translates to roughly 3/4 of a word. E.g. 100 tokens ~= 75 words.

<https://platform.openai.com/tokenizer>

Embeddings

- Each token is mapped to a vector.
- GPT-3: embeddings of up to 12288 dimensions (Davinci model).
- “Close meanings” ~ small distance between embeddings

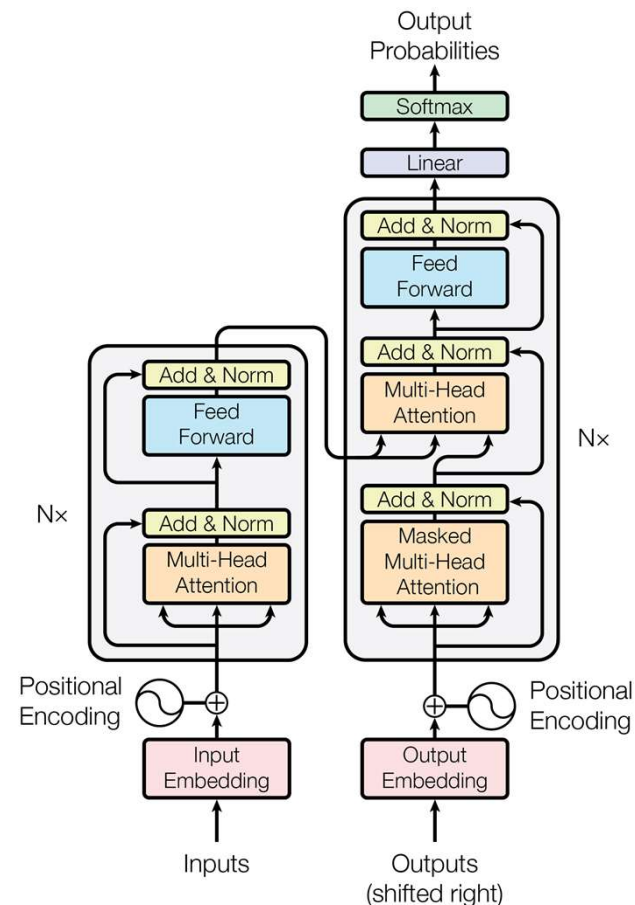


Example from <https://writings.stephenwolfram.com/2023/02/what-is-chatgpt-doing-and-why-does-it-work/>

Transformer

- A deep learning model that solves **sequence-to-sequence** tasks, with long-term dependencies.
- Highly **parallelizable** (\gg RNN).
- Uses **self-attention** to weigh the importance of each part of the input.
- Contains an encoder and a decoder, which are composed of multiple layers of sub-modules, such as **multi-head attention**, *feed-forward networks*, and *layer normalization*.

Vaswani, A., Shazeer, N., Parmar, N., Uszkoreit, J., Jones, L., Gomez, A. N., ... & Polosukhin, I. (2017). Attention is all you need. *Advances in neural information processing systems*, 30.

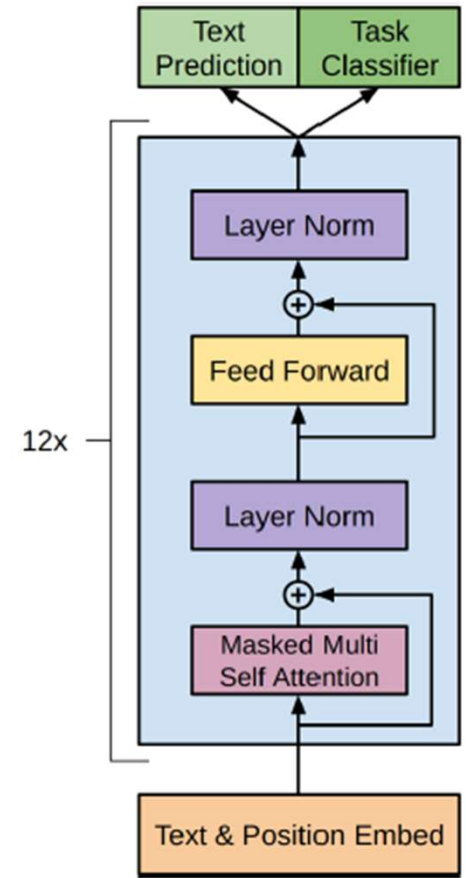


Transformer architecture

GPT

- “Generative Pretrained Transformer”
- GPT uses only the **decoder** part of the transformer, and has multiple layers of it.
- Foundation model: 1) **Pretrained** on a large corpus of unstructured text data in an unsupervised manner.
- 2) Afterwards: **fine-tuned** for specific tasks with small, supervised datasets.
- Supports few-shot and zero-shot learning.

Many similar models: Bloom, LLaMa 2, Bard, Gopher, Vicuna, ...



Arquitectura de GPT-1

Radford, A., Narasimhan, K., Salimans, T., & Sutskever, I. (2018). Improving language understanding by generative pre-training.

Text prediction

- LLMs (Large Language Models) like GPT are text predictors.
- They try to predict the next word (token), recursively.
- They associate a probability with each word (token).

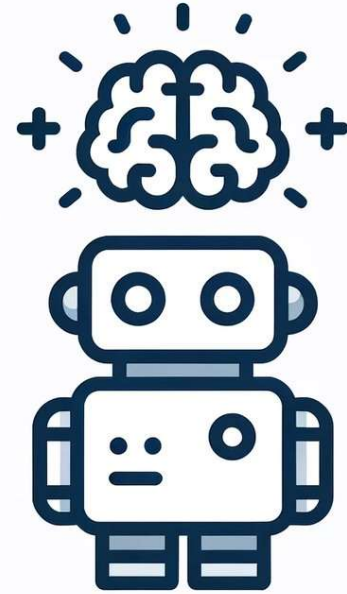
The best thing about AI is its ability to

learn	4.5%
predict	3.5%
make	3.2%
understand	3.1%
do	2.9%

Ejemplo de
<https://writings.stephenwolfram.com/2023/02/what-is-chatgpt-doing-and-why-does-it-work/>

- Choosing the most probable one generates poor results.
- A random choice is made among the most probable ones.

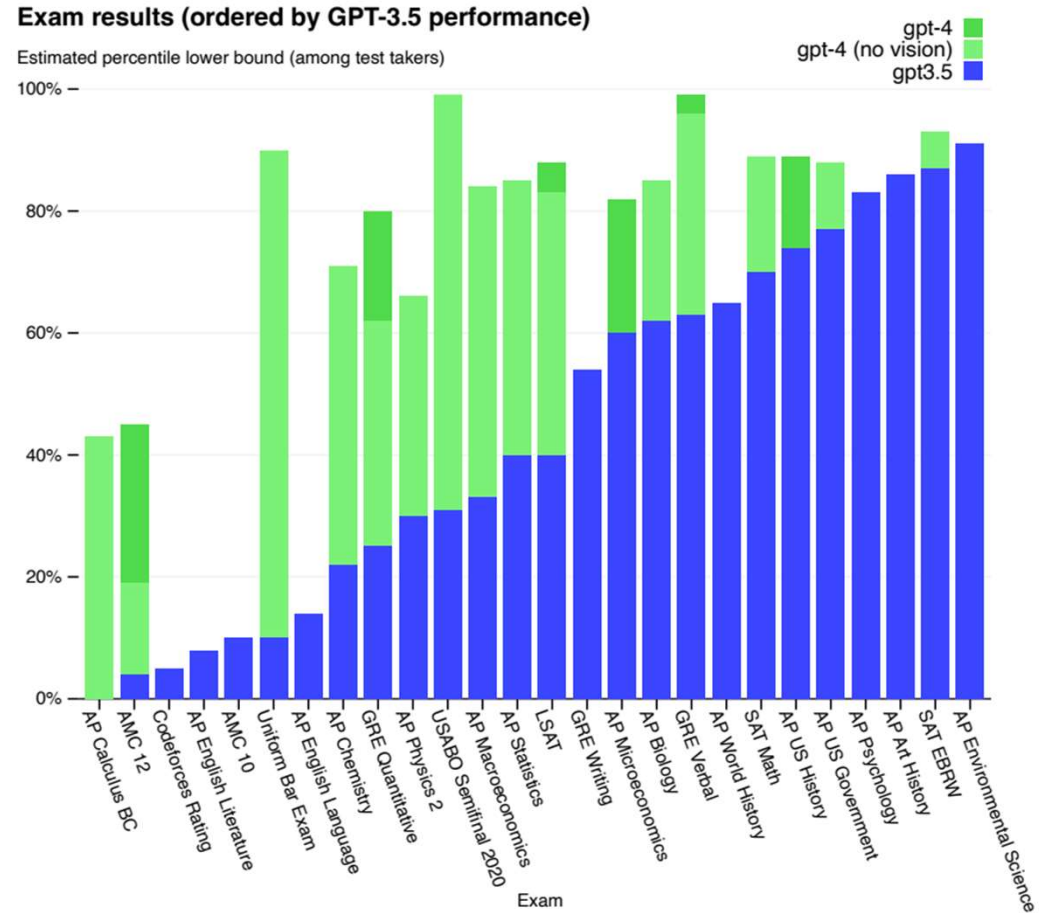
Is ChatGPT intelligent?



Exams

- Economics, Law
- Biology, Environmental Sciences
- Physics, Chemistry
- Language, Literature
- History
- Psychology
- Mathematics
- Programming

OpenAI (2023). GPT-4 Technical Report



Mathematics: errors of different types

GPT-4

Q: How many prime numbers are there between 150 and 250?

A: There are 13 prime numbers between 150 and 250.



GPT-4

Q: First list the prime numbers between 150 and 250, and then output the size of this list.

A: The prime numbers are 151, 157, 163, 167, 173, 179, 181, 191, 193, 197, 199, 211, 223, 227, 229, 233, 239, and 241.

So the size of this list is 18.



Bubeck, S., Chandrasekaran, V., Eldan, R., Gehrke, J., Horvitz, E., Kamar, E., ... & Zhang, Y. (2023). Sparks of artificial general intelligence: Early experiments with gpt-4. *arXiv preprint arXiv:2303.12712*.

AI hallucinations

“Factual inaccuracies generated by AI model”

- Examples:
 - Google’s Bard chatbot incorrectly claiming that the James Webb Space Telescope had captured the world’s first images of a planet outside our solar system.
 - Microsoft’s Bing chatbot admitted to falling in love with users and spying on Bing employees.
 - Meta pulled its Galactica LLM demo in 2022, after it provided users inaccurate information, sometimes rooted in prejudice.
- Don’t trust the output. Verify it.

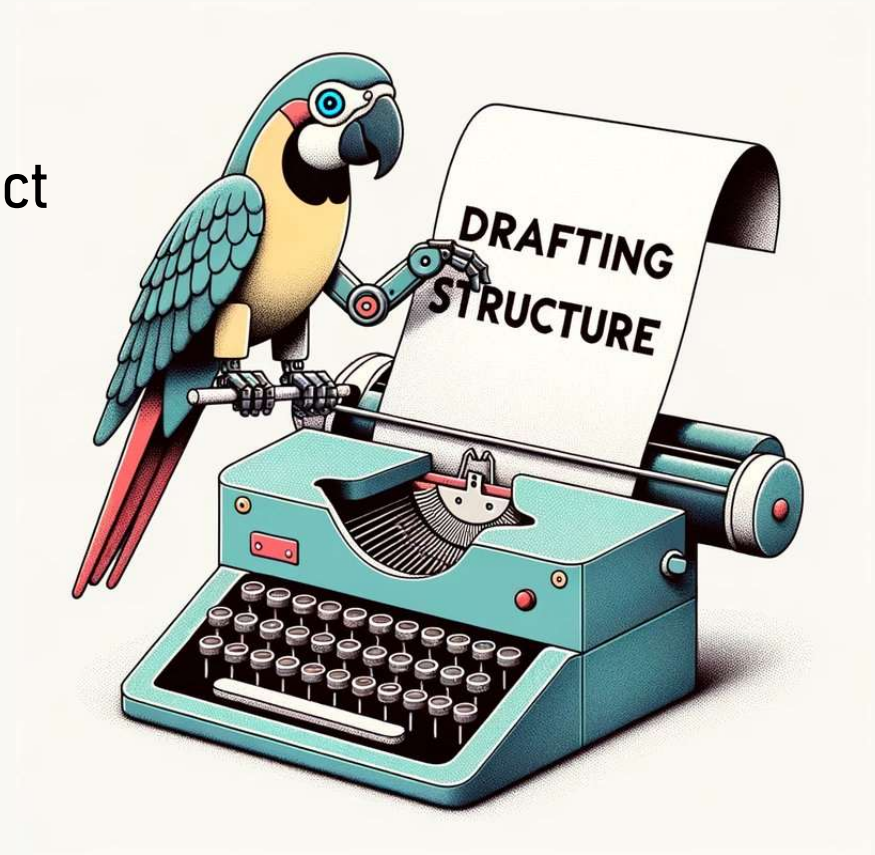


Part 2: Improving scientific writing



a) Generation of text

- Drafting the structure of a paper or project
- Expanding ideas into text
- Bridging content gaps
- Writing formal letters
- Etc.



b) Translation

- Simple prompt:
“Translate the following text to English: ...”
- Better prompt:
“I want you to act as an academic researcher. I will pass you texts in Spanish, which you will translate to English. You may change phrases and their order to improve the readability, without altering the meaning of the text. The result should be formal and academic English. The first text to translate is this one: ...”



I want you to act as an academic researcher. I will pass you texts in Spanish, which you will translate to English. You may change phrases and their order to improve the readability, without altering the meaning of the text. The result should be formal and academic English. The first text to translate is this one:

"En el Factor 3 Capacitación docente hacia la diversidad (ver Tabla 2) aparecen nuevamente diferencias estadísticamente significativas en la variable tipo de institución MUPES siendo el alumnado de las universidades públicas el que se valora como peor capacitado en el campo de la atención a la diversidad y la educación especial ($t=-3,040$; $p=0,003$)."



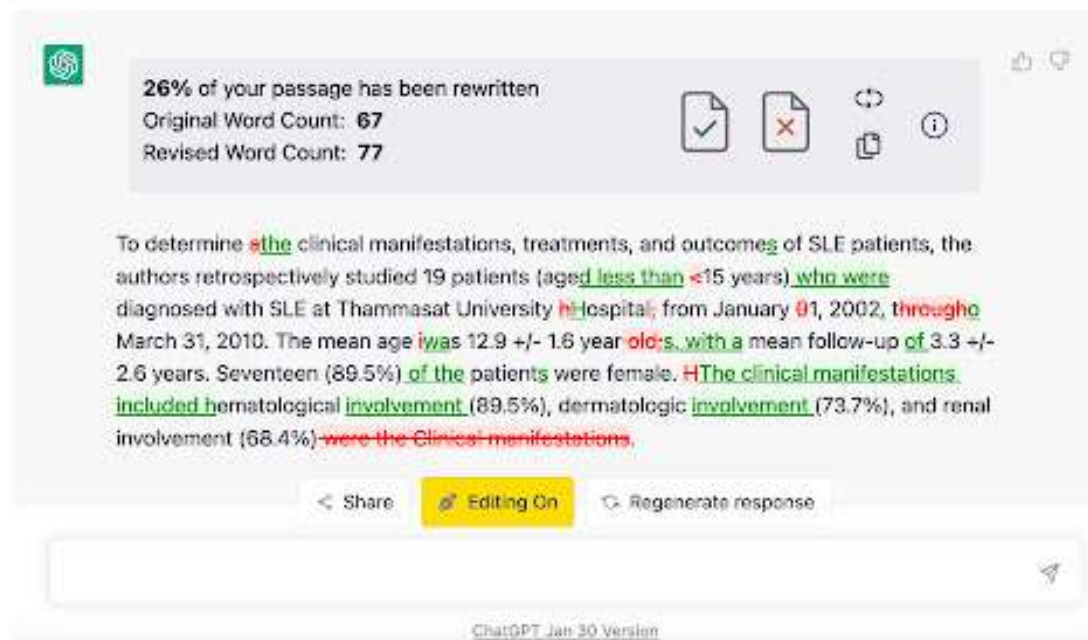
In Factor 3, Teacher Training towards Diversity (see Table 2), statistically significant differences appear once again in the variable of the type of institution MUPES, with students from public universities being assessed as less prepared in the field of attention to diversity and special education ($t=-3.040$; $p=0.003$).

GPT-4

c) Revision and proofreading

- ChatGPT with the EditGPT extension (editgpt.app) shows ChatGPT's edits.
- Or we can ask ChatGPT to summarize the changes it suggests.

proofread this, only fixing grammar: To determine a clinical manifestations, treatments, and outcome of SLE patients, the authors retrospectively studied 19 patients (age <15 years) diagnosed with SLE at Thammasat University hospital, from January 01, 2002 through March 31, 2010. The mean age is 12.9 +/- 1.6 year old; mean follow-up 3.3 +/- 2.6 years. Seventeen (89.5%) patient were female. Hematological (89.5%), dermatologic (73.7%), and renal involvement (68.4%) were the Clinical manifestations.



26% of your passage has been rewritten
Original Word Count: 67
Revised Word Count: 77

To determine ~~a~~the clinical manifestations, treatments, and outcomes of SLE patients, the authors retrospectively studied 19 patients (aged ~~less than~~ <15 years) ~~who were~~ diagnosed with SLE at Thammasat University ~~h~~ospital; from January 01, 2002, ~~througho~~ March 31, 2010. The mean age ~~i~~was 12.9 +/- 1.6 year ~~old~~s, with a mean follow-up of 3.3 +/- 2.6 years. Seventeen (89.5%) ~~of the~~ patients were female. ~~H~~The clinical manifestations ~~included~~ hematological ~~involvement~~ (89.5%), dermatologic ~~involvement~~ (73.7%), and renal involvement (68.4%) ~~were the Clinical manifestations~~.

< Share Editing On Regenerate response

ChatGPT Jan 30 Version

d) Improving the structure

- Including transition phrases
- Rewriting paragraphs as introduction or conclusions
- Summarizing text by extracting topic sentences
- Etc.

<https://twitter.com/MushtaqBilalPhD/status/1642405526444146688>



Mushtaq Bilal, PhD ✓
@MushtaqBilalPhD

3. Introduction

Writing a good introduction to a journal article or a dissertation is challenging for both experienced and novice academic writers.

You can ask ChatGPT to help you craft a great introduction.

7:56 AM · Apr 2, 2023 · 66.6K Views

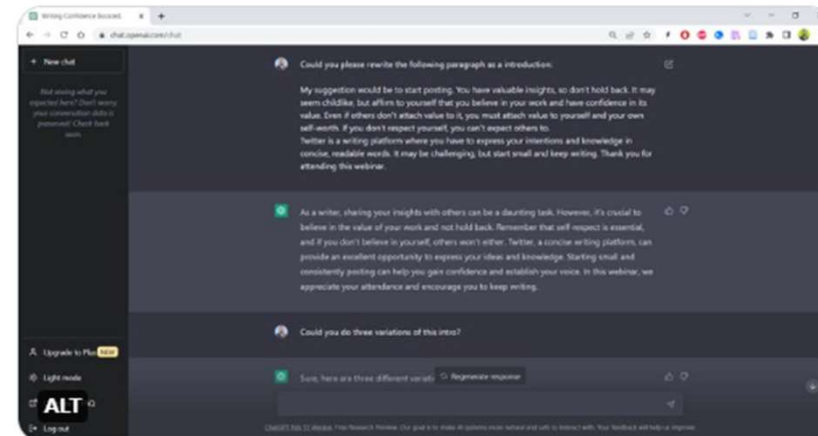
16 Retweets 152 Likes 33 Bookmarks



Mushtaq Bilal, PhD ✓ @MushtaqBilalPhD · Apr 2

Write a draft of your introduction and run it through ChatGPT with the following prompt. "Please rewrite the following paragraph as an introduction."

Rewrite the paragraph to suit your personal style.



e) Creative and intellectual tasks



- Brainstorm partner
- Generation of hypothesis
- Source of inspiration
- Conversation assistant
 - Ask for counterarguments, criticism, ...

Ethical and legal issues

- Copyright infringement
- Plagiarism of training sources
- Biases in generated content
- Privacy violation and misinformation
- Impact on the value of work and effort



Is generative AI allowed in academic writing?

- March 2023: Elsevier journals add “Declaration of generative AI in scientific writing” in author guidelines.

Declaration of generative AI in scientific writing

The below guidance only refers to the writing process, and not to the use of AI tools to analyse and draw insights from data as part of the research process.

Where authors use generative artificial intelligence (AI) and AI-assisted technologies in the writing process, authors should only use these technologies to improve readability and language. Applying the technology should be done with human oversight and control, and authors should carefully review and edit the result, as AI can generate authoritative-sounding output that can be incorrect, incomplete or biased. AI and AI-assisted technologies should not be listed as an author or co-author, or be cited as an author. Authorship implies responsibilities and tasks that can only be attributed to and performed by humans, as outlined in Elsevier’s AI policy for authors.

<https://www.ejancer.com/content/authorinfo>

Authors should disclose in their manuscript the use of AI and AI-assisted technologies in the writing process by following the instructions below. A statement will appear in the published work. Please note that authors are ultimately responsible and accountable for the contents of the work.

Disclosure instructions

Authors must disclose the use of generative AI and AI-assisted technologies in the writing process by adding a statement at the end of their manuscript in the core manuscript file, before the References list. The statement should be placed in a new section entitled ‘Declaration of Generative AI and AI-assisted technologies in the writing process’.

Statement: During the preparation of this work the author(s) used [NAME TOOL / SERVICE] in order to [REASON]. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

This declaration does not apply to the use of basic tools for checking grammar, spelling, references etc. If there is nothing to disclose, there is no need to add a statement.

Experiments on writing are ongoing

nature

NEWS | 07 July 2023 | Correction [11 July 2023](#)

Scientists used ChatGPT to generate an entire paper from scratch – but is it any good?

By designing an autonomous system that fed prompts to the chatbot, researchers produced a paper that was fluent and insightful. Yet they still have concerns.

<https://www.nature.com/articles/d41586-023-02218-z>

The Impact of Fruit and Vegetable Consumption and Physical Activity on Diabetes Risk among Adults

Data to Paper

June 23, 2023

Abstract

Diabetes is a global health concern, and identifying modifiable risk factors is essential for prevention. We investigated the association between fruit and vegetable consumption, physical activity, and the risk of diabetes among adults. Using data from the Behavioral Risk Factor Surveillance System (BRFSS) 2015 survey, logistic regression analysis was conducted, controlling for age, sex, BMI, education, and income. Our results show that higher fruit and vegetable consumption is associated with a reduced risk of diabetes. Moreover, engaging in regular physical activity strengthens this association. This study addresses a gap in the literature by providing evidence on the protective effects of

Sender writes

I want the job,
here's my resume.

Brian



Actual Email sent

Salutations and greetings, most esteemed Sir/Madam,

I am filled with exuberance and zeal as I present my candidacy for the esteemed job opportunity.

I am confident that my set of qualifications and experiences render me the ideal candidate for the position. Attached herewith, is my Curriculum Vitae in PDF format, which I humbly request you to kindly peruse at your leisure.

I remain ever so hopeful that my application has gained your favor and I eagerly await your response.

Yours most sincerely,

Brian s. Logan Esquire



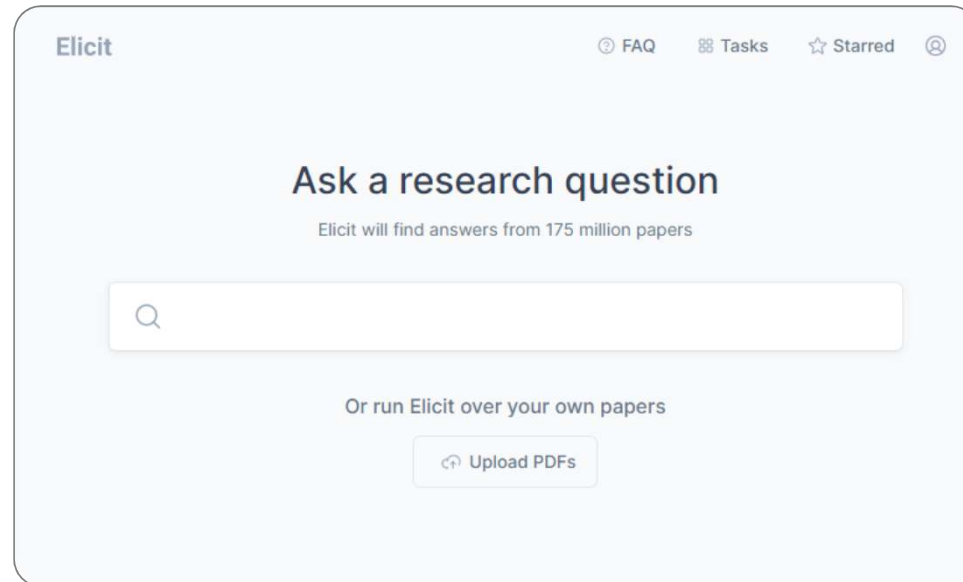
Receiver reads

Brian wants the job.
[Download PDF.](#)

<https://twitter.com/multikev/status/1616784555788075009>

Literature search and review

- Elicit uses LLMs to help you automate research workflow tasks, such as parts of a literature review. <https://elicit.org>



🔍 Systematic Review
🔍 Konstantinos I. Avgerinos, Nikolaos Spyrou, Konstantinos I. Bougio...
📄 *Experimental Gerontology* 📈

2018 37 Citations [PDF](#) [Semantic Scholar](#) [DOI](#)

Abstract summary

Oral creatine administration may improve short-term memory of healthy individuals.

Copy 📄 👍 💬

What did they test?

Oral creatine administration with varied doses and durations

What outcomes did they measure?

- Short Term Memory
- Intelligence/Reasoning
- Long-Term Memory
- Spatial Memory
- Memory Scanning
- Attention
- Executive Function
- Response Inhibition

🔍 Ask a question about this paper

Ask

Revolutionizing Modern Research with ChatGPT and Generative AI – Steven Van Vaerenbergh

inhibition, word fluency, reaction time and mental fatigue, the results were conflicting. Performance on cognitive tasks stayed unchanged in young individuals. Vegetarians responded better than meat-eaters in memory tasks but for other cognitive domains no differences were observed. **Conclusions: Oral creatine administration may improve short-term memory and intelligence/reasoning of healthy individuals but its effect on other cognitive domains remains unclear.** Findings suggest potential benefit for aging and stressed individuals. Since creatine is safe, future studies should include larger sample sizes. It is imperative that creatine should be tested on patients with dementias or cognitive impairment. **HIGHLIGHTS** Oral creatine supplementation improves memory of healthy adults. Findings suggest potential benefit for aging and stressed individuals. Future trials should investigate the effect of creatine administration on individuals with dementia or mild cognitive impairment.

1. Introduction

Creatine is a naturally occurring compound that is synthesized from the amino acids arginine, glycine and methionine through a two-step reaction (Andres et al., 2008). An amidino group is transferred from arginine to glycine by L-arginine-glycine amidino transferase (AGAT) leading to guanidinoacetate formation that is subsequently methylated to yield creatine by guanidinoacetate-methyltransferase (GAMT) (Wyss and Kaddurah-Daouk, 2000). A creatine transporter, SLC6A8, distributes creatine from the circulation to tissues (Wyss and Kaddurah-Daouk, 2000).

Analyzing documents



arXiv > physics > physics.acc-ph

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Accelerator Physics

Authors and titles for recent submissions

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- [Tue, 17 Oct 2023](#)
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[total of 13 entries: 1-13]
[showing up to 25 entries per page: [fewer](#) | [more](#)]

Fri, 20 Oct 2023

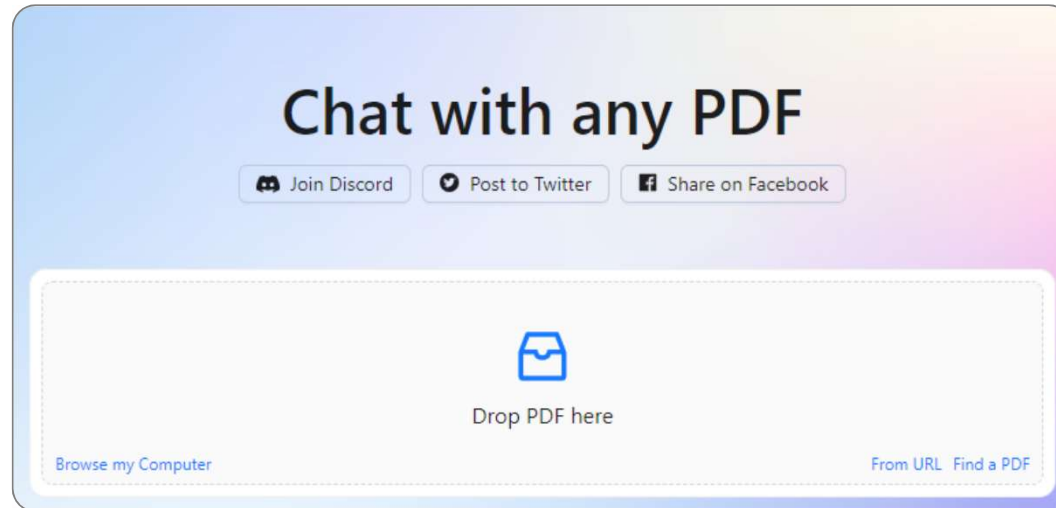
[1] [arXiv:2310.12744](#) [pdf]

Validation of a new 60 MeV proton beam-line for radiation hardness testing
[Petter Hofverberg](#), [Francoise Bezerra](#), [Marine Ruffenach](#), [Joël Hérault](#), [Julien Mekki](#), [Arnaud Dufour](#),
[Richard Trimaud](#)

Comments: RADECS conference 2022

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<https://www.chatpdf.com/>



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2310.11735.pdf

2310.11735.pdf

Performance of FPGA controller in ISAC-1 accelerator chain

K. Fong, X. Fu, Q.W. Zheng, T. Au, R. Leewe, TRIUMF, V6T2A3, Vancouver, Canada

Abstract

The LLRF of five of TRIUMF's ISAC-1 accelerator cavities have been replaced by 3 similar FPGA based system with different operating frequencies. These LLRF use internal digital phase locked loops for frequency generation and synchronization, feedback control using Amplitude/Phase regulation. These FPGAs also have internal stepper motor controller for resonance control. Various modes of resonance control are possible, including phase comparison and minimum seeking slide-mode control. Operational performance including frequency generation and synchronization, amplitude and phase noise, tuning speeds, compatibility to original remote controls, are reported.

Introduction

The LLRF of the original ISAC-1 accelerator RF system was VXI-based commissioned 2000. After 23 years of operations, spare parts for the DSP LLRF are getting difficult to obtain. The most failed parts are however the VXI mainframe and its built-in power supply. For these reasons, TRIUMF has embarked on replacing the LLRF controllers for ISAC-1. The controllers that were replaced in 2023 are the prebuncher, 2 Drift Tube Linacs and 2 bunchers, namely DTL-4, DTL-5, HEBT11 and HEBT15. The operating frequencies for the prebuncher are 11.786 MHz, 23.573 MHz and 35.36 MHz. The bunchers are 11.786 MHz, 35.36 MHz and 106.08 MHz for both DTLs, with the RF power ranges from 1.5 kW and 13 kW for the 2 bunchers to more than 20 kW for the DTLs. The new system has a core FPGA, designed by TRIUMF. It is mounted within a NIM module, and controlled via an USB/HID interface¹. Each FPGA can control up to 3 different phase-locked frequencies, providing amplitude and phase regulations, as well as stepping motor control for tuner operation. Amplitude and phase regulations are available for each channel. Table 1 gives a summary of the difference between the old VXI-based system and the NIM bus system.

USB/HID interface

The FPGA communicates to the external world uses USB/HID protocol. HID is a device class to supplement the USB interface. It is very compact but extensible and robust. Each report is 48-bits long, for transmitting commands and receiving status from the FPGA. A USB/HID based system offers many advantages over a much older VXI based system. No additional hardware or bus is required. Any modern computer offers multiple USB ports, device drivers are available in all operating systems. These operating systems also provide extensive diagnostic

of Python interpreter in the FPGA, the timing of each report is around 5 ms, but is sufficient for the purpose of supervisory control.

LLRF controller Algorithm

The FPGA is configured to use amplitude phase feedback regulation as opposed to the more commonly used I/Q feedback regulation. I/Q feedback is the preferred choice when the performance of analogue phase detector and modulator was poor, but with the advances of high speed digital circuitry and algorithm such as CORDIC, amplitude phase feedback can have the same precision as I/Q feedback. In addition, amplitude phase feedback avoids cross talk in I/Q feedback. This cross talk can induce 'AM-PM Conversion Instability', whereas amplitude phase system is immune to this kind of instability. Fig. 1 shows the block diagram of an I/Q controller, while Fig. 2 shows that with the addition of a CORDIC and a NCO, they transform the cartesian coordinates to polar coordinates to form an Amplitude Phase controller. The signal flow chart of an I/Q

VXI based controller	NIM based controller
2 DSPs	1 FPGA
VXI interface	USB-HID interface
1 RF channel	3 RF channels
Single frequency	Multi-frequencies
Base band	33.6 MHz IF, 75 MHz LO
200 kHz sampling	250 MHz sampling
I/Q control	Amplitude/Phase control
External stepper controller	Internal stepper controller
	Feedforward Ramping

Table 1. Comparison between VXI based controller and NIM based controller.

feedback controller and an Amplitude Phase controller are shown in Fig. 3 and Fig. 4 respectively². In the case of tuner is at resonant, it can be seen that there is no cross talk between the Amplitude channel and the Phase channel, while in an I/Q controller, the additional of the loop

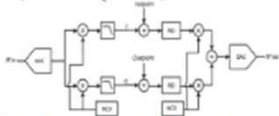


Figure 1. Block diagram of an I/Q controller

Chat

- What are the different operating frequencies of the FPGA-based LLRF controllers?
- How do the controllers use internal digital phase locked loops for frequency generation and synchronization?
- What are the various modes of resonance control available with the internal stepper motor controller?

What are the different operating frequencies of the FPGA-based LLRF controllers?

According to ¹, the operating frequencies for the prebuncher are 11.786 MHz, 23.573 MHz and 35.36 MHz. The bunchers are 11.786 MHz, 35.36 MHz and 106.08 MHz for both DTLs.

What are the conclusions of this paper?

According to ⁵, the conclusion of the paper is that the USB/HID FPGA controllers have been in operation since April 2023 and have operated satisfactorily. Amplitude/Phase regulation provides similar performance as I/Q regulation, without the need to control the loop phase. The position preset, phase alignment and sliding mode controllers are used in the new ISAC-1 resonance control.

Ask any question...



Analyzing documents with Edge sidebar

- Microsoft Edge explorer with Bing Chat (“Copilot”) in sidebar



Validation of a new 60 MeV proton beam-line for radiation hardness testing

Petter Hofverberg¹, Francoise Bezerra², Marine Ruffenach², Joël Héralut¹, Julien Mekki², Arnaud Dufour², Richard Trimaud¹

¹Centre Antoine Lacassagne, Nice, France

²CNES, Toulouse, France

Abstract—A 60 MeV proton beam-line has been developed in Nice, France, in collaboration with the *Centre National d'Etudes Spatiales* (CNES). Experimental results are presented here to validate the beam-line for radiation hardness testing.

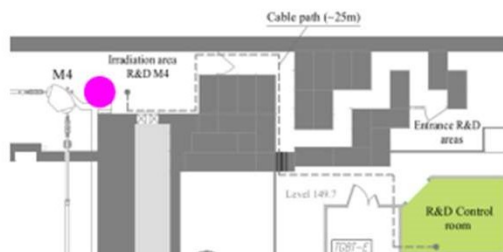
Index Terms—Beam instrumentation, dosimetry, protons, irradiation facilities

I INTRODUCTION

A new proton beam-line dedicated to R&D programs has recently been developed at *Centre Antoine Lacassagne* (CAL), in Nice (France), in collaboration with the *Centre National d'Etudes Spatiales* (CNES) [1]. This is the second beam-line of the MEDICYC 65 MeV cyclotron that is currently in operation, the first being the clinical 'eye-line' used for ocular proton therapy [2,3]. The R&D beam-line is proposed with two configurations, the first producing a Gaussian narrow beam of a few mm width, the second a 100 mm diameter flat beam. The second beam configuration has been developed in particular with irradiation tolerance tests of electronic components in mind. This facility could be used for various tests such as calibration of detectors, total non ionizing dose deposition or single event testing for components sensitive below 60 MeV. Following the development and commissioning of the R&D beam-line in 2020 and 2021 by CAL, a campaign has been conducted by CNES to validate the performance of the beam-line for radiation tolerance tests of electronic devices or systems. This paper presents a brief summary of the beam-line commissioning results and preliminary results from the validation campaign by CNES.

Standard cables (BNC, SHV, RJ45 and fiber) are preinstalled between the irradiation room and the control room and are freely available for users.

The device-under-test (DUT) is positioned in the beam-line by means of a fixation frame, originally designed by UCL [4]. Custom fixation frames can also be made on demand. The frame is positioned on the irradiation table at a distance of 229 cm from the beam nozzle, 5 cm downstream of the final 100 mm collimator. The collimator frame also contains the PMMA range shifters that can optionally be added to obtain a specific energy at the DUT, down to 20 MeV. Read-out electronics can either be positioned in the control room, in the labyrinth or next to the irradiation table depending on its tolerance to radiation. The required cable length in each case is 25 m, 8 m and 3 m respectively. The radiation inside the labyrinth is for most applications negligible, but the area is however not accessible for personnel during an irradiation. Polyethylene or lead shielding can be provided for equipment positioned next to the irradiation table, but sensitive equipment should be placed elsewhere.



Chat

Compose

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✓ Searching your page for information



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This document is a scientific paper that summarizes:

- **A new proton beam-line:** The paper describes the development and commissioning of a new 60 MeV proton beam-line at the Centre Antoine Lacassagne (CAL) in Nice, France, in collaboration with the Centre National d'Etudes Spatiales (CNES) [1] [2]. The beam-line is dedicated to R&D programs, especially radiation hardness testing of electronic components or systems.
- **The beam characteristics:** The paper reports the results of measuring the beam flux, homogeneity, and energy spread at different energies and positions. The paper



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0/4000



Part 3: Supercharged scientific coding



a) Creating a script

Write a Python script to generate 3 clusters of 2D Gaussian noise that overlap slightly. Include a plot. Export the data as CSV, including a column for the label of the cluster.





Bing Chat output (1)

Here is a possible Python script to generate 3 clusters of 2D Gaussian noise that overlap slightly. I have also included a plot and a CSV export with a column for the cluster label.

```
# Import libraries
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd

# Set random seed for reproducibility
np.random.seed(42)

# Define parameters for the clusters
n = 100 # number of points per cluster
mu1 = [0, 0] # mean of cluster 1
mu2 = [3, 3] # mean of cluster 2
mu3 = [0, 3] # mean of cluster 3
sigma = 1 # standard deviation of clusters

# Generate random points from normal distributions
x1 = np.random.normal(mu1[0], sigma, n)
y1 = np.random.normal(mu1[1], sigma, n)
x2 = np.random.normal(mu2[0], sigma, n)
```



Bing Chat output (2)

```
x3 = np.random.normal(mu3[0], sigma, n)
y3 = np.random.normal(mu3[1], sigma, n)

# Plot the clusters
plt.scatter(x1, y1, c='r', label='Cluster 1')
plt.scatter(x2, y2, c='g', label='Cluster 2')
plt.scatter(x3, y3, c='b', label='Cluster 3')
plt.xlabel('x')
plt.ylabel('y')
plt.legend()
plt.show()

# Create a data frame with the points and labels
df = pd.DataFrame({'x': np.concatenate([x1, x2, x3]),
                  'y': np.concatenate([y1, y2, y3]),
                  'label': np.repeat(['Cluster 1', 'Cluster 2', 'Cluster 3'], n)})

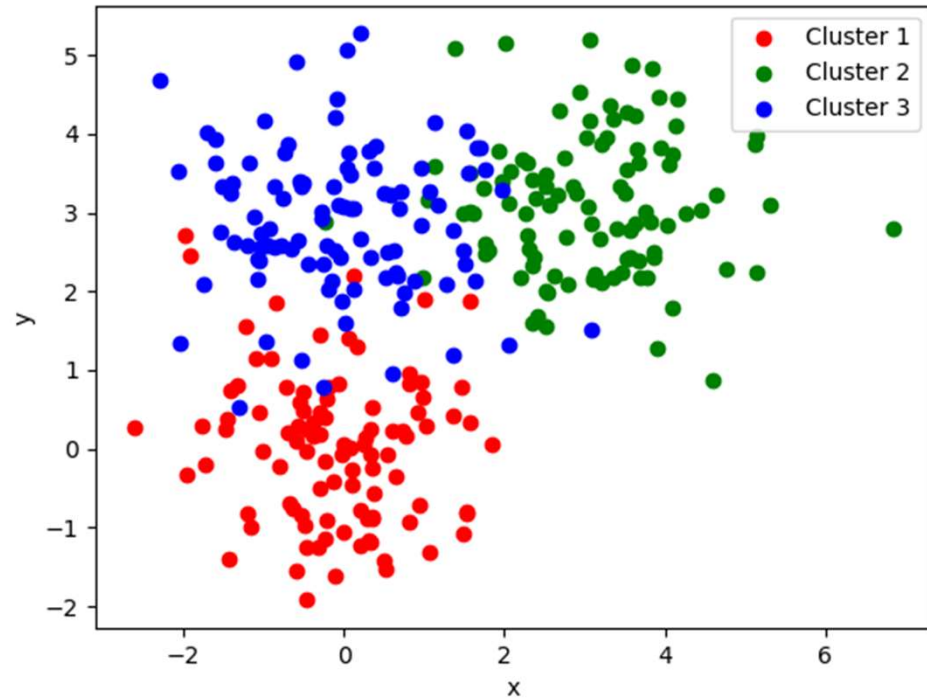
# Export the data frame as CSV
df.to_csv('clusters.csv', index=False)
```

1 of 20 ●

Output

- clusters.csv

	A	B	C
1	x	y	label
2	0,49671415	-1,41537074	1
3	-0,1382643	-0,42064532	1
4	0,64768854	-0,34271452	1
5	1,52302986	-0,80227727	1
6	-0,23415337	-0,16128571	1
7	-0,23413696	0,40405086	1
8	1,57921282	1,8861859	1
9	0,76743473	0,17457781	1
10	-0,46947439	0,25755039	1
11	0,54256004	-0,07444592	1
12	-0,46341769	-1,91877122	1
13	-0,46572975	-0,02651388	1
14	0,24196227	0,06023021	1



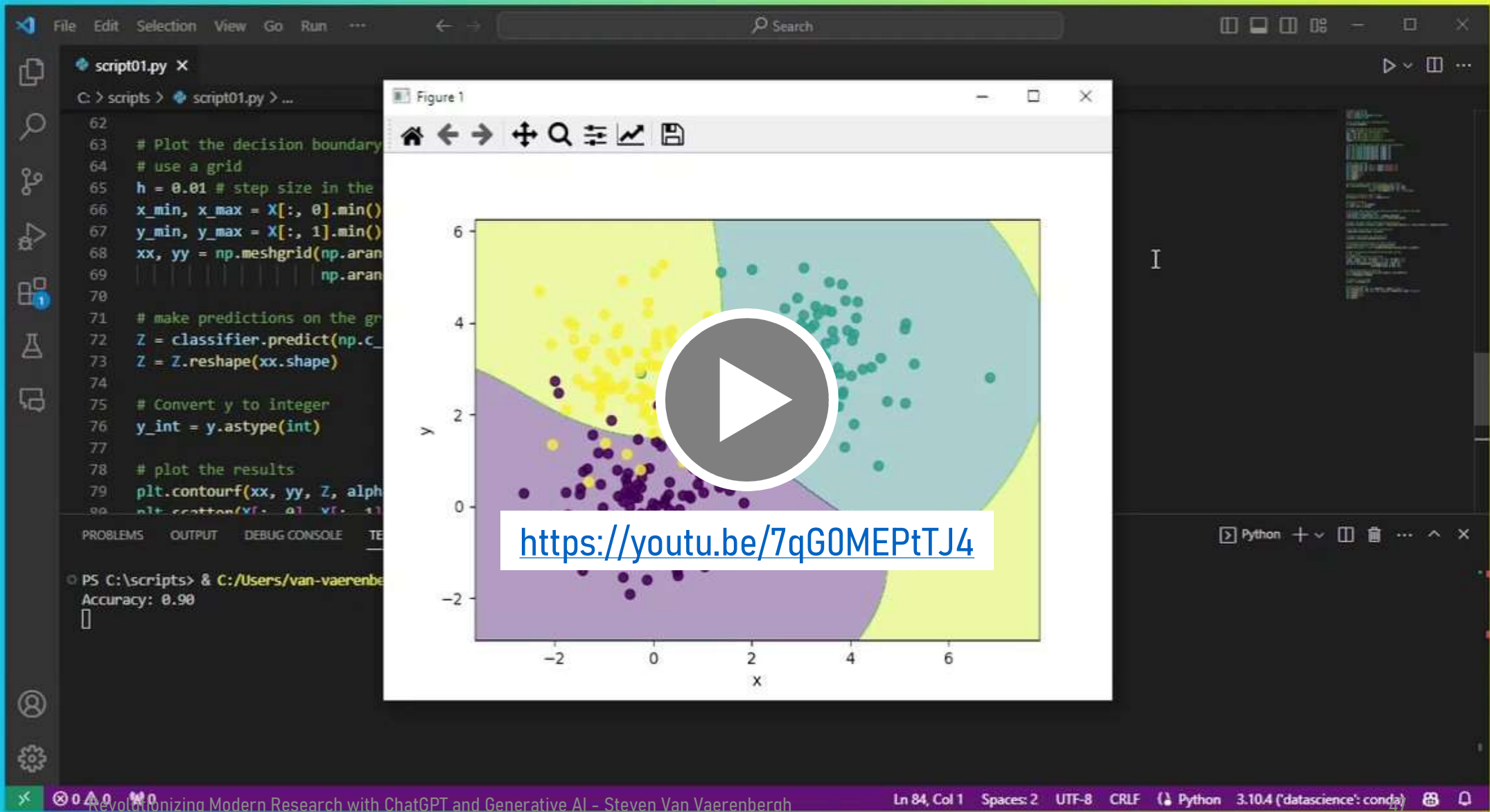
AI-based code assistants

- GitHub Copilot: “an AI pair programmer that helps you write better code”



GitHub Copilot

Let's see an example...





<https://youtu.be/PAilbwIFl8E>



Andrej Karpathy ✓

@karpathy



Nice read on reverse engineering of GitHub Copilot ✨. Copilot has dramatically accelerated my coding, it's hard to imagine going back to "manual coding". Still learning to use it but it already writes ~80% of my code, ~80% accuracy. I don't even really code, I prompt. & edit.

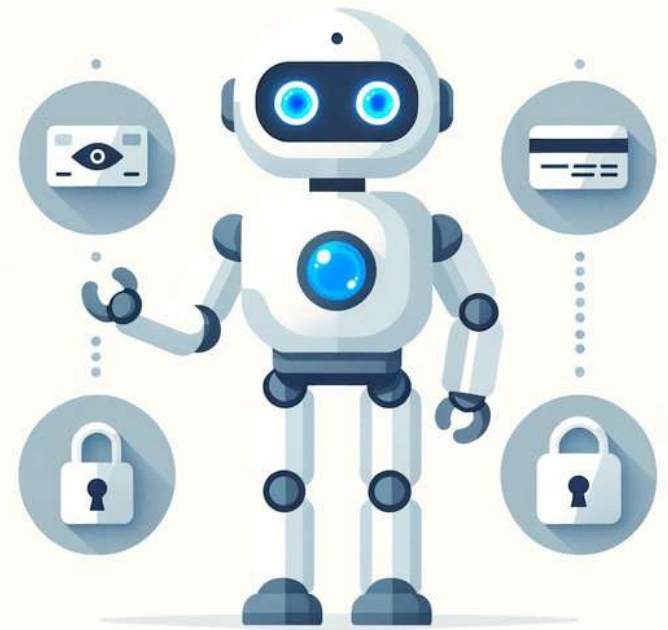
7:37 PM · Dec 30, 2022 · **1.7M** Views

556 Retweets 146 Quotes 4,366 Likes 1,656 Bookmarks

<https://twitter.com/karpathy/status/1608895189078380544>

Some remarks

- Price: GitHub Copilot is free for academic users
 - Step 1: Sign up to GitHub Global Campus:
<https://education.github.com/globalcampus/teacher>
 - Step 2: In Visual Studio Code, install GitHub Copilot plugin: <https://docs.github.com/en/copilot/getting-started-with-github-copilot>
- Privacy:
<https://github.com/features/copilot/#faq-privacy-copilot-for-individuals>
- Security: AI-generated code may contain vulnerabilities



Other code assistants

- Amazon CodeWhisperer
- CodeGeeX
- GPT-Code-Clippy
- Replit Ghostwriter
- Tabnine
- ...

AI Dev Codes	ChatGPT Plus	ExplainDev	Krater.ai	SinCode AI
AI Query	Cmd J	Fig	Lightly	Snappify
AirOps AI Data Sidekick	Codacy	Figstack	Marve Chat	SourceAI
AIWriter	Code GPT	Ghostwriter	MutableAI	Sourcegraph Cody
aiXcoder	Code Snippets AI	GitFluence	Noya	SpellBox
AlphaCode	CodeAssist	GitGab	OpenAI Codex	StarCoder
Amazon CodeWhisperer	Codefy.ai	GitHub Copilot	Phind	Stenography
AskCodi	CodeGeeX	GPT95	Programming Helper	Tabnine
Autocode	CodeGen	Hacker AI	ProMindGPT	Vivid
Bard	Codeium	IntelliCode	Q	Warp AI
Bito	CodeSquire	IntelliSense	Raycast	What The Diff
Blackbox AI	CodeWP	Jedi	Refact	Wing Python IDE
Bloop	CometCore	JetBrains Datalore	Refraction AI	YouChat
BotCity	Denigma	K.Explorer	Replit	Zentask
Buildt	DevBox	Kite	Safurai	
ChatGPT	DevKit	Kodezi	Second	

“A Critical Look at AI-Generated Software” IEEE Spectrum, July 2023 <https://spectrum.ieee.org/ai-software>



Sahil Lavingia ✓ @shl · Apr 10



If you haven't learned to code, AI won't get you from 0 to 1.

If you have, AI will get you from 1 to ∞.



47



197



1,224



202K



<https://twitter.com/shl/status/1645233436372905985>

Including GPT into our code

summarize_pdf.py

```
1  import os
2  import PyPDF2
3  import openai
4
5  # get API key from environment variable
6  openai.api_key = os.getenv("OPENAI_API_KEY")
7
8  # initialize summary
9  pdf_summary_text = ""
10
11 # read the pdf
12 pdf_file = open("doc/whitepaper.pdf", 'rb')
13 pdf_reader = PyPDF2.PdfReader(pdf_file)
14
15 # loop over pages
16 for page_num in range(len(pdf_reader.pages)):
17     page_text = pdf_reader.pages[page_num].extract_text().lower()
18
19     # request the summary of one page
20     response = openai.ChatCompletion.create(
21         model="gpt-3.5-turbo",
22         messages=[
23             {"role": "user", "content": f"Summarize this: {page_text}"},
24         ],
25     )
26
27     # append the page summary
28     pdf_summary_text += response["choices"][0]["message"]["content"] + "\n\n"
29
30     # write the results to file
31     with open("doc/whitepaper_summary.txt", "w+") as file:
32         file.write(pdf_summary_text)
33
34 pdf_file.close()
```



What if I don't want to use OpenAI?

- Claude by Anthropic, etc.
- Open-source alternatives (Llama 2 by Meta, Vicuna by LMSYS, ...)

Introducing Llama 2

The next generation of our
open source large language model

Llama 2 is available for free for research and commercial use.

[Download the Model](#)

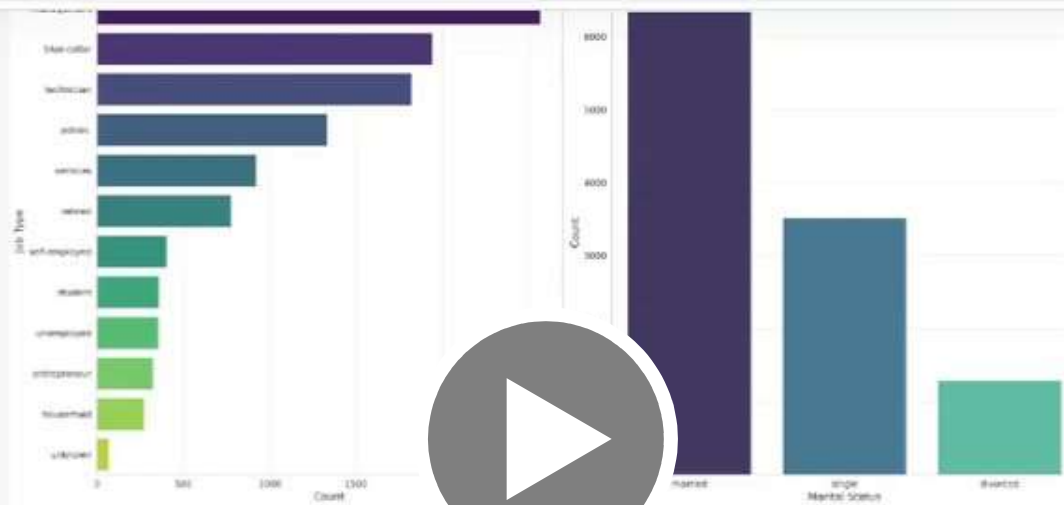
Vicuna: An Open-Source Chatbot Impressing GPT-4 with 90%* ChatGPT Quality

by: The Vicuna Team, Mar 30, 2023

We introduce Vicuna-13B, an open-source chatbot trained by fine-tuning LLaMA on user-shared conversations collected from ShareGPT. Preliminary evaluation using GPT-4 as a judge shows Vicuna-13B achieves more than 90%* quality of OpenAI ChatGPT and Google Bard while outperforming other models like LLaMA and Stanford Alpaca in more than 90%* of cases. The cost of training Vicuna-13B is around \$300. The [code](#) and [weights](#), along with an online [demo](#), are publicly available for non-commercial use.



Generating and executing code inside of ChatGPT



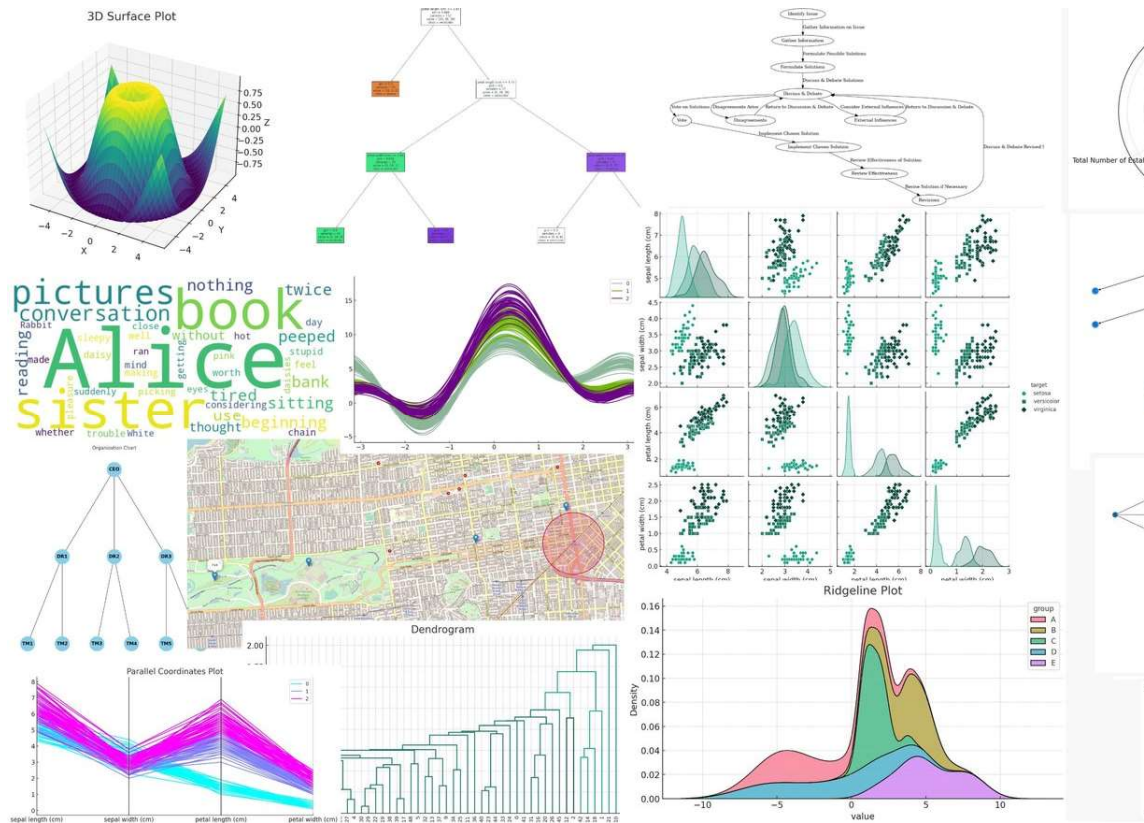
The visualizations provide the following information:

1. **Distribution of Age:** The age distribution shows a peak density around the age of 30.
2. **Distribution of Balance:** The balance distribution is highly skewed, with most clients having balances in the lower range. There are a few clients with a very high balance, which are visible as long tails in the distribution.
3. **Count Plot for Job Types:** The most common job categories are "blue-collar" and

+ Send a message

Code interpreter ("Advanced Data Analysis")

- Perform exploratory data analysis and visualization
- Automate data collection and preprocessing
- Open-source implementations exist
 - GPT-Code UI
(<https://github.com/ricklamers/gpt-code-ui>)
 - Open Interpreter
(<https://github.com/KillianLucas/open-interpreter>)



<https://www.oneusefulthing.org/p/what-ai-can-do-with-a-toolbox-getting>

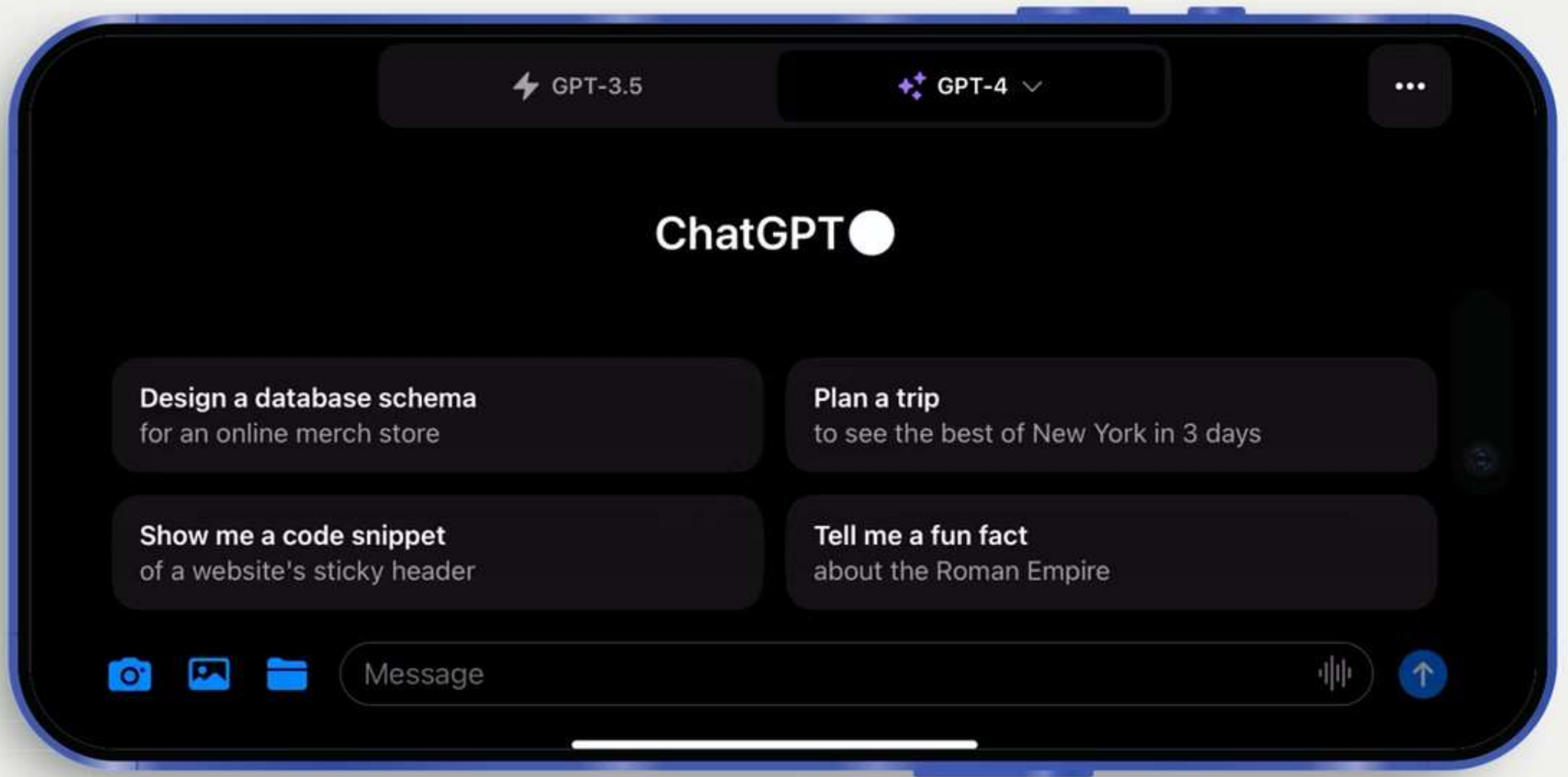
ChatGPT's visual capabilities

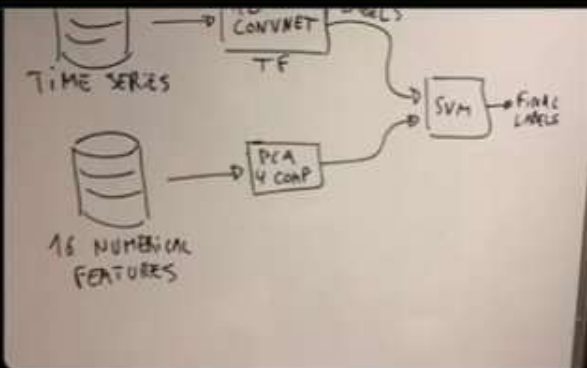


Weekly research group meeting...



Picture from <https://case.edu/universitycenter/rooms/second-floor-conference-room>





Provide the Python code corresponding to the diagram above.



CHATGPT

Based on the diagram you've shared, it seems you're designing a hybrid machine learning pipeline where time series data undergoes a 1D Convolution transformation (probably using TensorFlow), and numerical features are processed using Principal Component Analysis (PCA) to 4 components.

<https://youtu.be/Kpq97NyP5ww>



Message



More resources

Awesome Generative AI list

<https://github.com/steven2358/awesome-generative-ai>

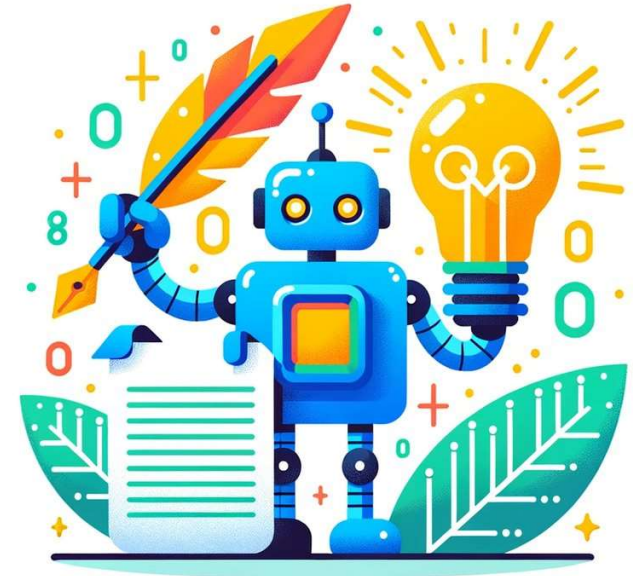
The screenshot shows the GitHub repository page for 'steven2358/awesome-generative-ai'. The repository is public and has 283 forks and 3.3k stars. The main content area displays a list of files: ARCHIVE.md, CONTRIBUTING.md, DISCOVERIES.md, LICENSE, and README.md. The README.md file is selected and shows the title 'Awesome Generative AI' with an 'awesome' badge. The description states: 'A curated list of modern Generative Artificial Intelligence projects and services.' It explains that Generative Artificial Intelligence is a technology that creates original content such as images, sounds, and texts by using machine learning algorithms. It also mentions that contributions are welcome and provides links to the 'Contribution Guidelines', 'pull requests', and 'Discoveries List'. The 'Contents' section lists various categories: Recommended reading, Text, Coding, Image, Video, Audio, Other, and Learning resources. The right sidebar shows the 'About' section with a description: 'A curated list of modern Generative Artificial Intelligence projects and services.' It also includes tags for 'awesome', 'ai', 'artificial-intelligence', 'generative-art', 'awesome-list', 'large-language-models', 'llm', and 'generative-ai'. The 'Releases' section shows 'No releases published' and the 'Contributors' section shows 32 contributors.

Conclusions



Conclusions

- Generative AI is revolutionizing written content
- Helpful assistant for ideation and hypothesis generation
- Code: The new frontier
- Don't trust, verify
- Many privacy and ethical challenges remain



To take advantage of generative AI tools, it is necessary to adopt an attitude of continuous exploration and experimentation.

The background is a vibrant, abstract composition. It features several large, overlapping, swirling shapes that resemble stylized rainbows or nebulae. These shapes are composed of many thin, parallel lines in a gradient of colors: deep blue, teal, light blue, yellow, orange, and red. Scattered throughout the background are numerous small, solid-colored circles in various sizes and colors, including blue, red, yellow, and green. The overall effect is one of dynamic energy and modern design.

Thank you