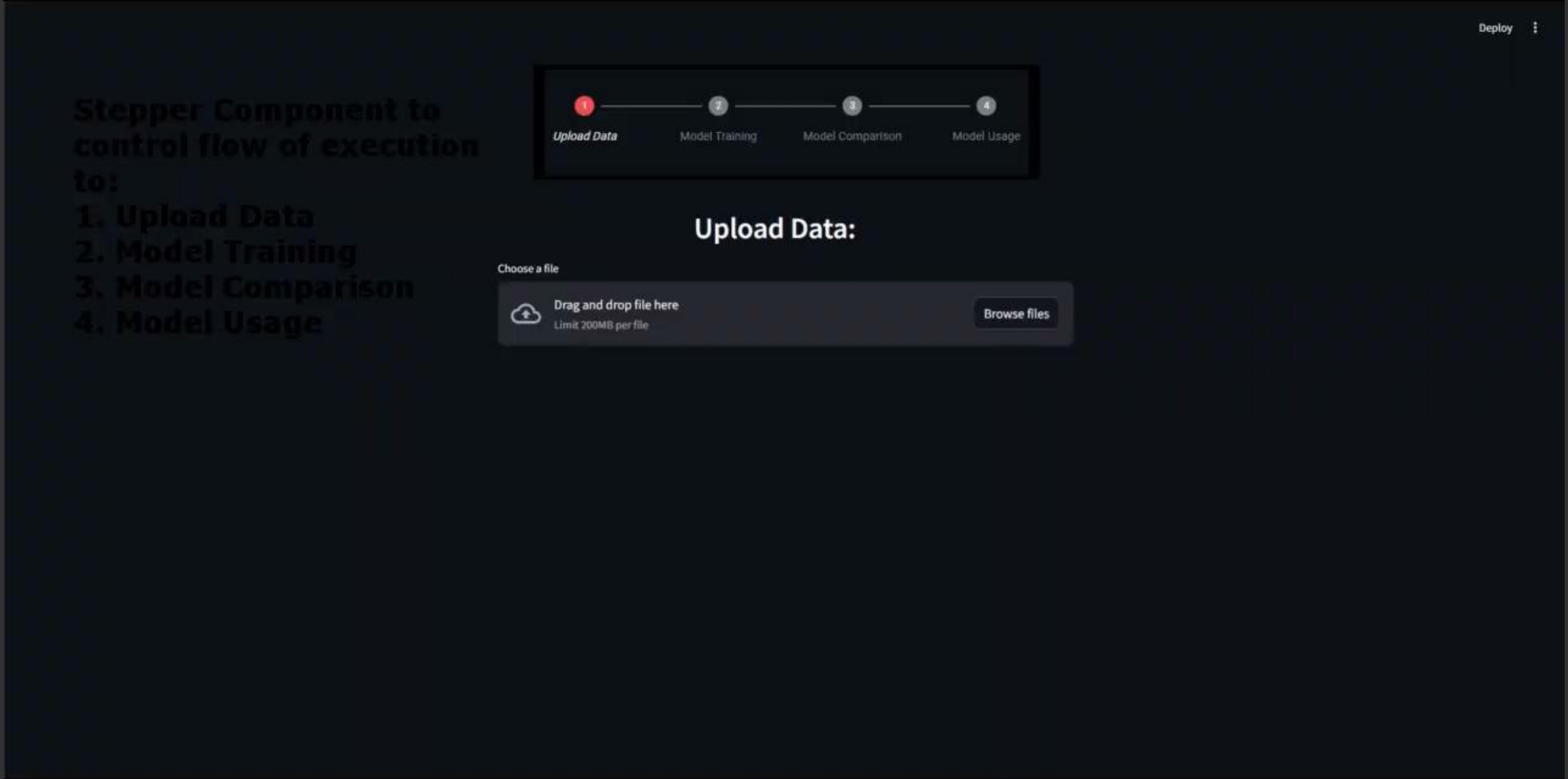
ITD105
Big Data Analytics

Lecture #5

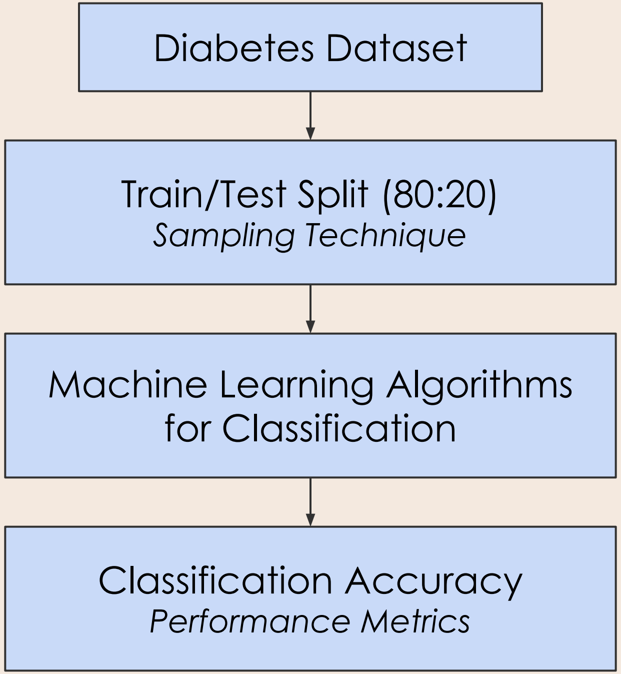
PAUL B. BOKINGKITO JR.

Stepper Component to control flow of execution to:

1. Upload Data
2. Model Training
3. Model Comparison
4. Model Usage



Architecture ML Algorithm (Classification)



Diabetes Dataset

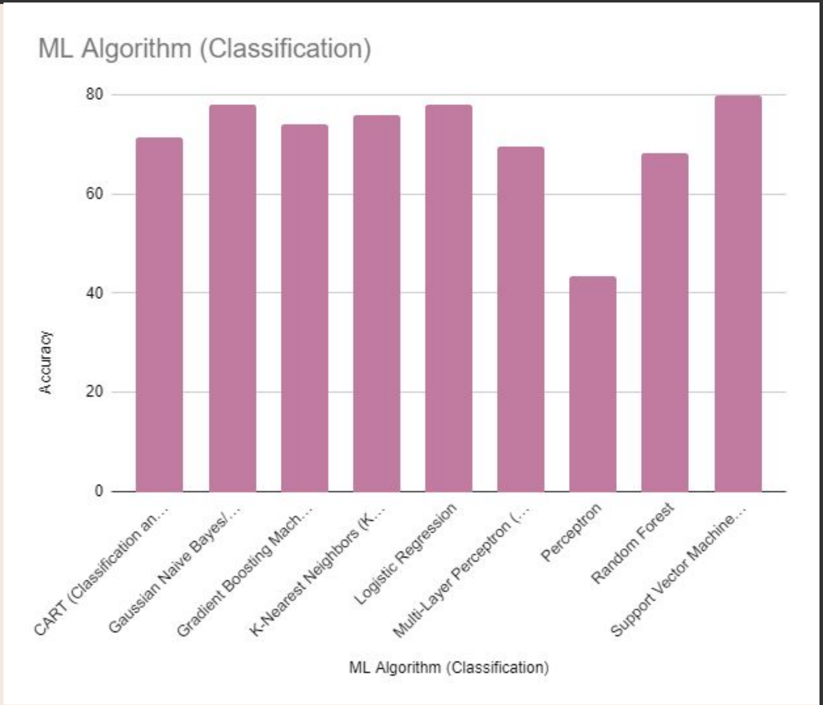
Train/Test Split (80:20)
Sampling Technique

Machine Learning Algorithms for Classification

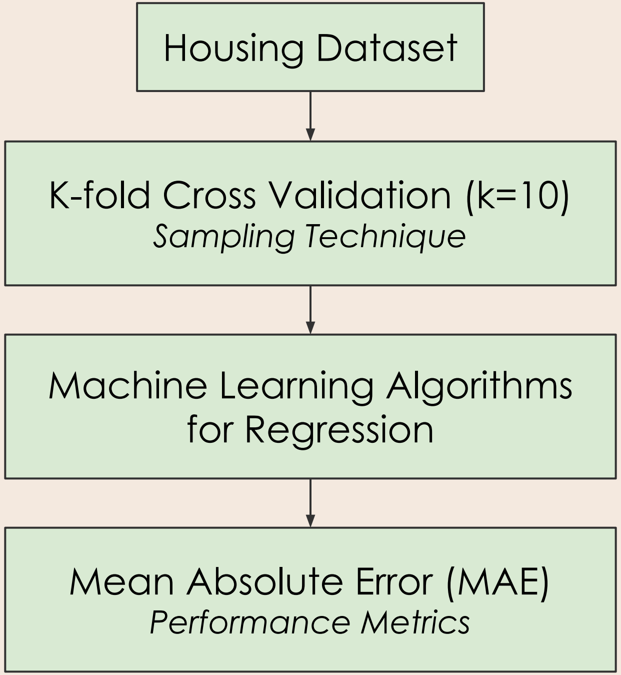
Classification Accuracy
Performance Metrics

ML Algorithm (Classification)

ML Algorithm (Classification)	**Accuracy**
CART (Classification and Regression Trees) - Decision Tree	71.429
Gaussian Naive Bayes/Naive Bayes	77.922
Gradient Boosting Machines (AdaBoost)	74.026
K-Nearest Neighbors (K-NN)	75.974
Logistic Regression	77.922
Multi-Layer Perceptron (MLP)	69.481
Perceptron	**43.506**
Random Forest	68.182
Support Vector Machines (SVM)	**79.870**



Architecture ML Algorithm (Regression)



Housing Dataset

K-fold Cross Validation (k=10)
Sampling Technique

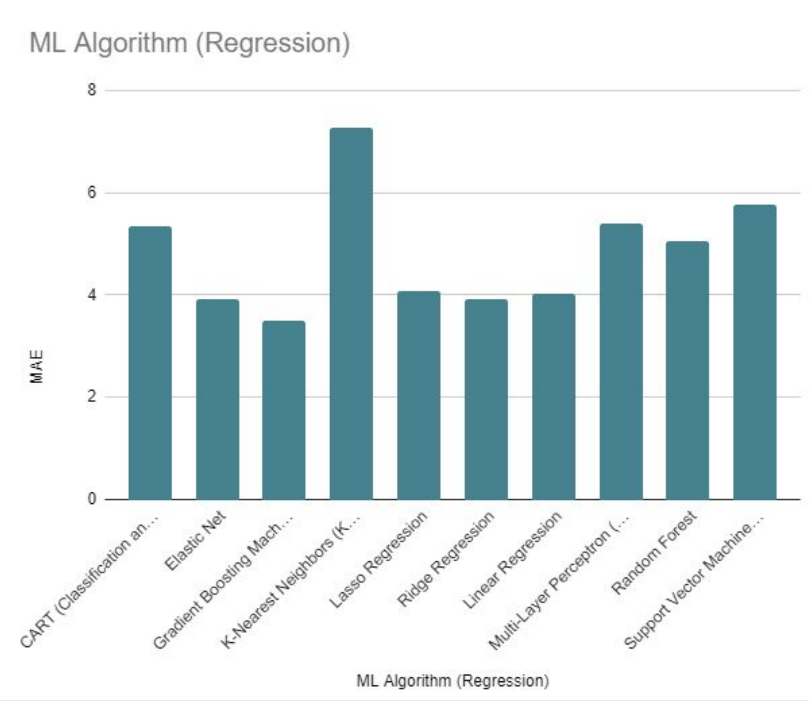
Machine Learning Algorithms for Regression

Mean Absolute Error (MAE)
Performance Metrics

ML Algorithm (Regression)

ML Algorithm (Regression)	MAE
CART (Classification and Regression Trees)	5.355
Elastic Net	3.911
Gradient Boosting Machines (AdaBoost)	**3.511**
K-Nearest Neighbors (K-NN)	**7.259**
Lasso Regression	4.083
Ridge Regression	3.924
Linear Regression	4.013
Multi-Layer Perceptron (MLP)	5.403
Random Forest	5.050
Support Vector Machines (SVM)	5.754

When comparing models,* ***a lower MAE is generally better.



Hyperparameter tuning

Hyperparameter tuning or model optimization, is the process of finding the best set of hyperparameters for a machine learning or deep learning algorithm to achieve the highest possible model performance.

It involves adjusting the hyperparameters, which are the settings or configurations that define how the algorithm works, in order to improve the model's accuracy, generalization, and overall effectiveness.

SVM Hyperparameter tuning

SVM Model	Test Size	Random Seed	Regularization Parameter (C)	Kernel	Accuracy
Model I	**20%**	**42**	**1.0**	**linear**	**79.87%**
Model II	20%	42	1.0	sigmoid	55.844
Model III	20%	42	1.0	rbf	77.273
Model IV	20%	42	1.0	poly	77.273

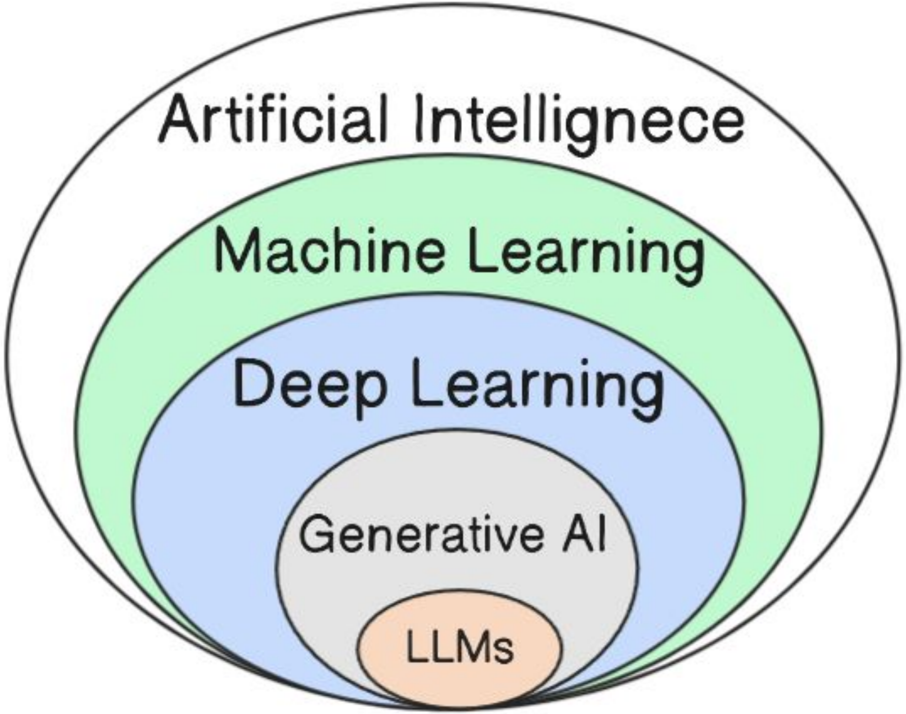
random seed refers to a fixed value used to initialize the random number generator, which can affect certain aspects of how the SVM is trained or evaluated.

regularization parameter C is a crucial hyperparameter that controls the trade-off between maximizing the margin (the decision boundary) and minimizing classification errors (misclassifications).

kernel function transforms the input data into a higher-dimensional space where it becomes easier to find a separating hyperplane.

CASE STUDY

AI taxonomy



Artificial Intelligence (AI) - Encompasses all techniques enabling machines to mimic human tasks.

Machine Learning (ML) - computers learn from data patterns and make predictions or decisions without being explicitly programmed for every possible input.

Deep Learning (DL) - focuses on neural networks with many layers. Inspired by the structure and function of the human brain

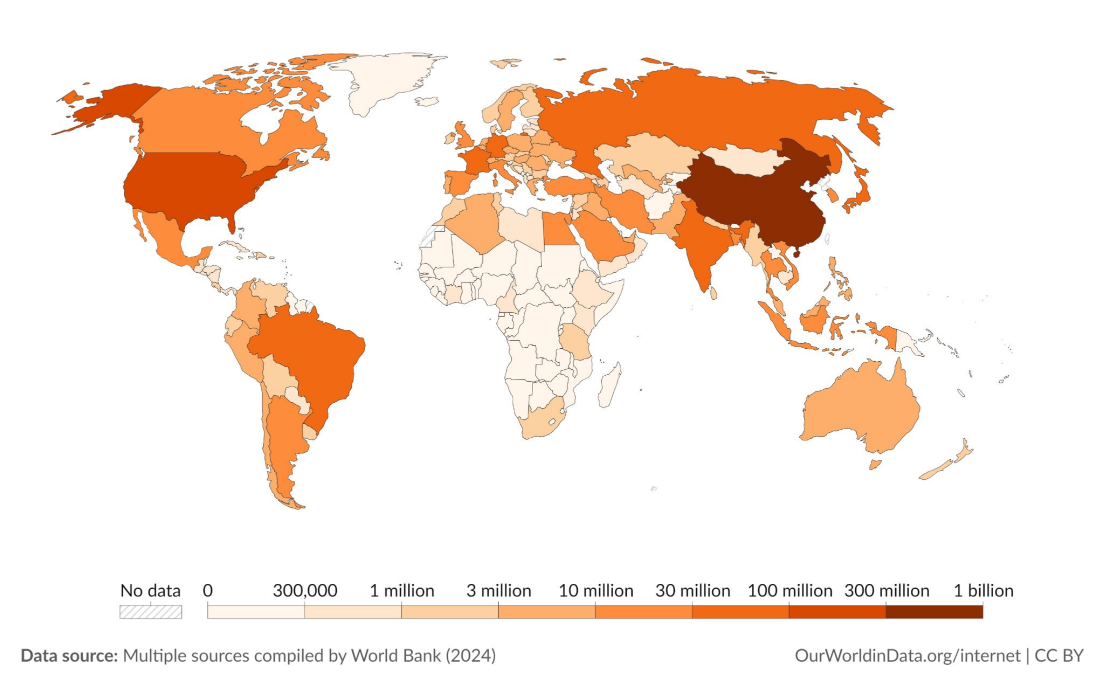
Generative AI - refers to algorithms that can generate new content, including text, images, audio, and even code.

Large Language Models (LLMs) - deep learning models trained on vast amounts of text data to understand and generate natural language.

Bias in Generative AI Models

It’s trained on biased stuff

- *these tools are trained on human-produced content. ChatGPT, for example, was trained on content from textbooks, articles, and the internet.*



Data source: Multiple sources compiled by World Bank (2024)

OurWorldinData.org/internet | CC BY

consider for a moment who in the world has access to the internet?

- therefore where in the world most material on the internet is produced.

“AI systems are biased when data is biased.

Sources of Bias in Generative AI Models

- **Training Data Bias -** For instance, datasets can overrepresent specific demographics or contain stereotypical content, influencing the model's outputs.

- **Gender Bias -** For example, when prompted to generate text about specific professions, models might associate men with roles like "engineer" and women with roles like "nurse."

- **Racial Bias -** For instance, text models may exhibit racial stereotypes, and image models might struggle to generate accurate representations of people of color.

- **Image Generation -** Studies have shown that generative image models can produce biased images, such as oversexualizing women or failing to accurately represent racial diversity.

- **Healthcare AI** (Generative Models for Medical Diagnosis) - biased generative models can lead to skewed medical recommendations, disproportionately affecting minority groups by overlooking or misclassifying conditions that are more prevalent in certain populations.

Impact of Bias in Generative AI

Research Direction

AI-generated content influenced by bias might lead researchers to focus on specific topics; thus **neglecting other critical areas of research**, and limiting the exploration of diverse perspectives.

Public Perception

If AI-generated content is biased, the public's perception of scientific research could be negatively impacted; thereby **eroding trust in scientific institutions and their findings.**

Inaccurate Findings

Bias in AI-generated content may introduce inaccuracies and misinterpretations, **potentially leading to flawed scientific findings** and unreliable research outcomes.

Reinforcing Prejudices

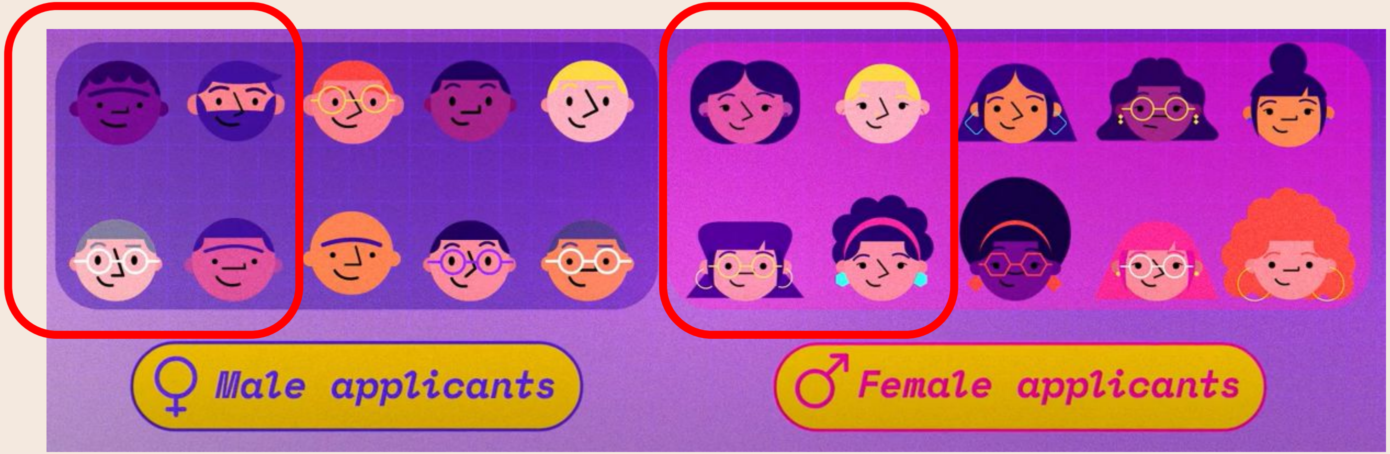
AI-generated content that reflects societal biases can reinforce existing prejudices and stereotypes, **contributing to systemic discrimination and inequality in research.**

Bias - So What's the Solution?

Fairness

Developers need to clearly define and explain which fairness criteria they are prioritizing, whether it's demographic parity, equal opportunity, or another standard.

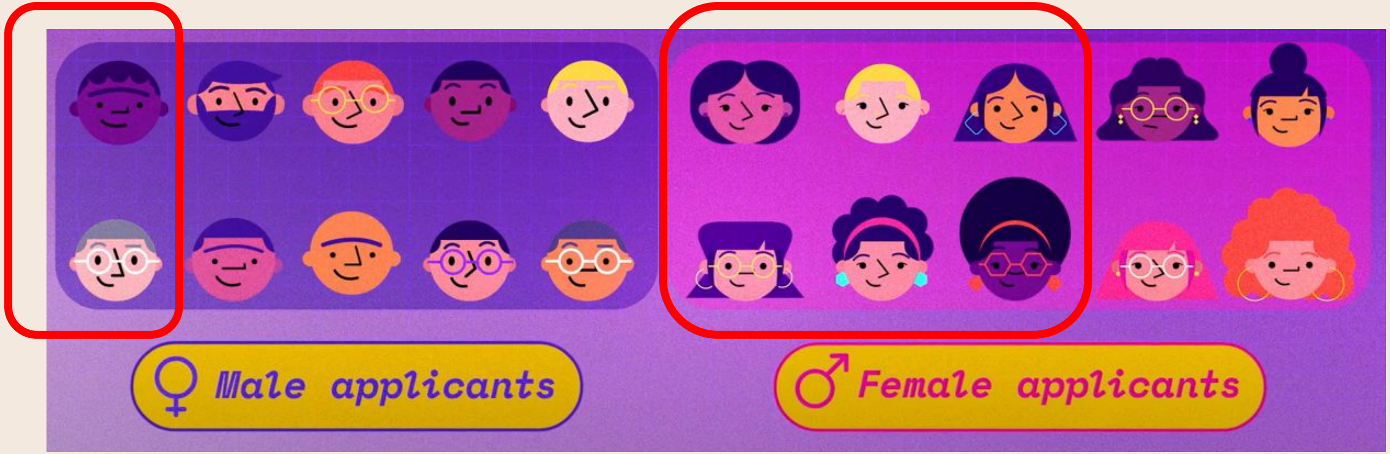
Is this the fairest outcomes?



Fairness

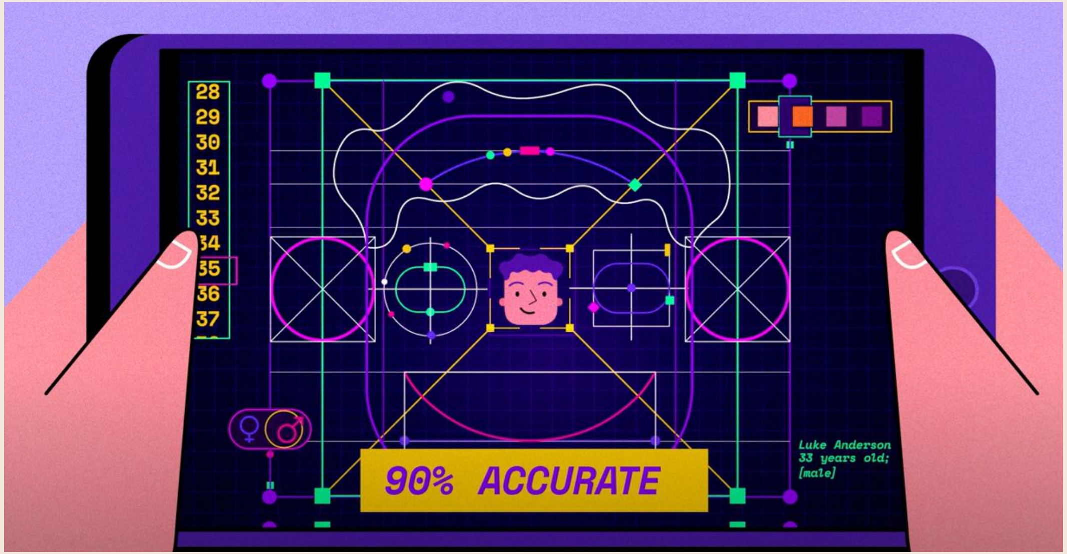
Developers need to clearly define and explain which fairness criteria they are prioritizing, whether it’s demographic parity, equal opportunity, or another standard.

or this if the women are more qualified



Transparency

It's important to **provide clear information about how the system was designed**, how it was tested, and how accurate it is.



Diversity

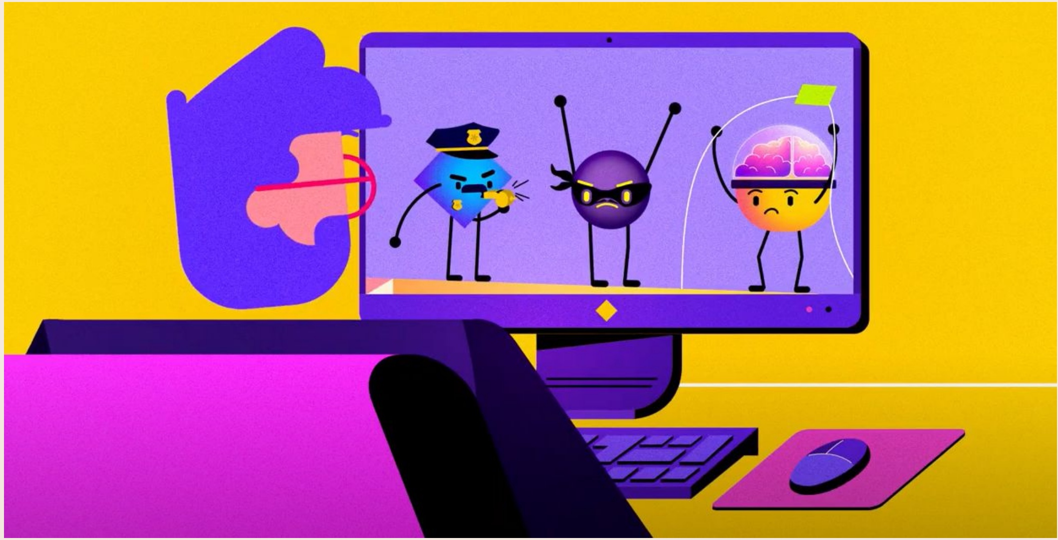
Developers should consult a broad cross-section of people, societal groups, and communities that their product might impact.

AI models should be trained on data that reflects the diversity of the community they serve, ensuring that **all populations are represented fairly and without bias.**

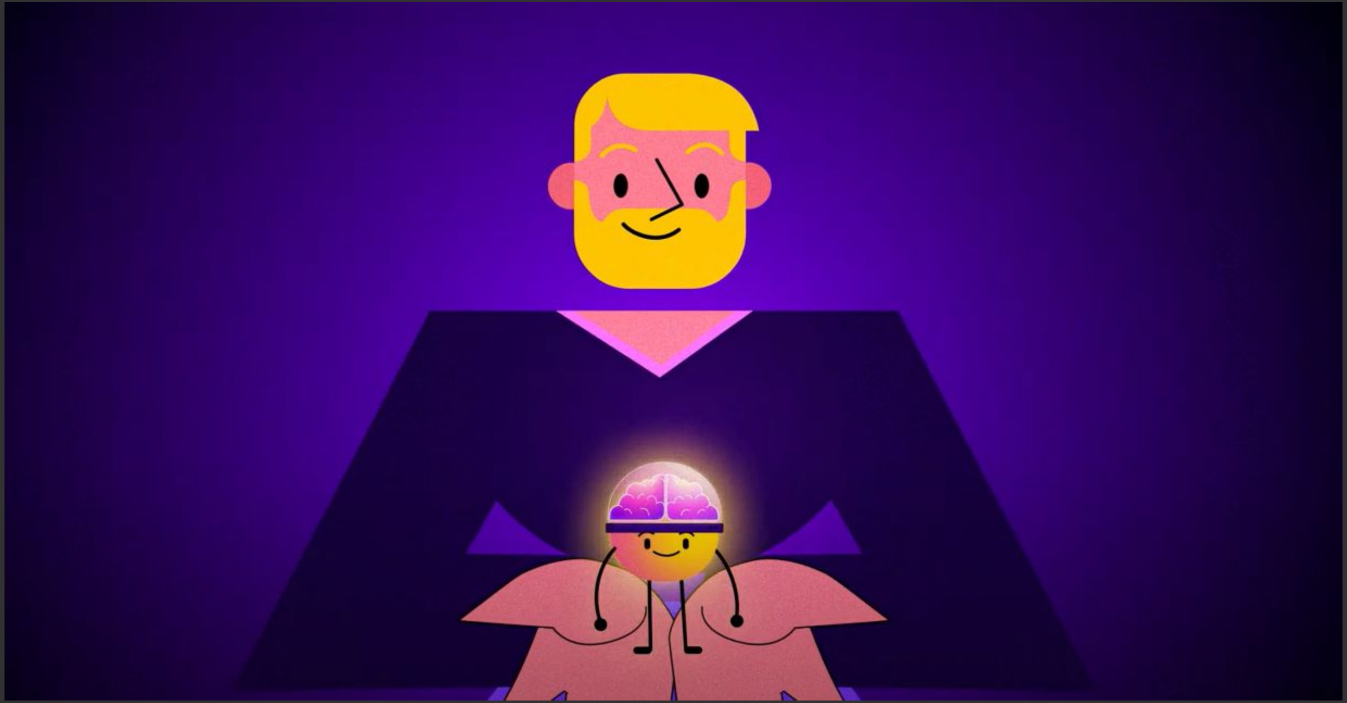
Privacy

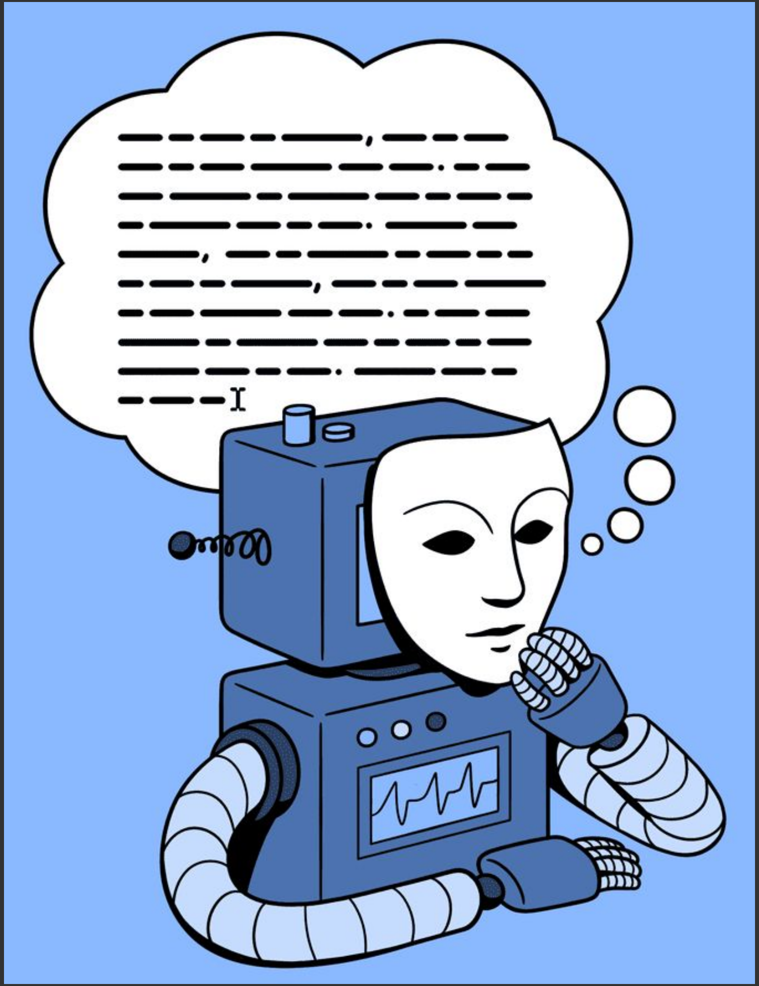
AI systems must fully protect the privacy of individuals whose data is used.

Transparency around data collection and usage is critical, and **users should have control over their data, with clear consent** mechanisms in place.



> “AI is just a tool, and, like any other tool, it can provide immense benefits when used correctly.





Large Language Model (LLMs)

A deep learning algorithm that's equipped to summarize, translate, predict, and generate human-sounding text to convey ideas and concepts.

INFRASTRUCTURE

- Inflection
- OpenAI
- Hugging Face
- Adept
- Google
- Meta
- co:here
- Tencent
- Bai du 百度
- AI21 labs
- EleutherAI

APPLICATIONS

Search

- YOU
- Twelve Labs
- Hebbia
- ZIR AI
- Constructor.io
- DASHWORKS

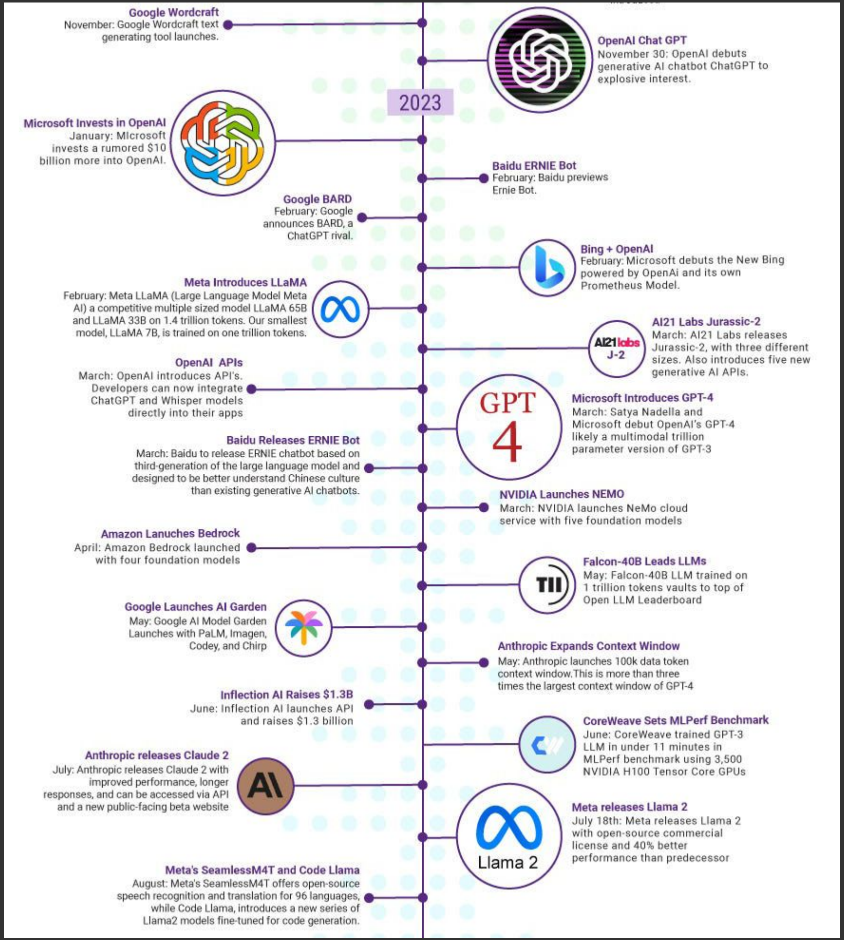
Synthesis

- Mintlify
- veezoo
- Ze ZEBRIUM
- DELV
- artifact
- CopyMonkey
- UNSCRAMBL
- Nabla

Generation

- tavus
- copysmith
- textio
- WRITER
- Jasper
- GitHub Copilot
- Diagram
- copy.ai
- anyword

Timeline of LLM Innovation



Google Wordcraft
November: Google Wordcraft text generating tool launches.

OpenAI Chat GPT
November 30: OpenAI debuts generative AI chatbot ChatGPT to explosive interest.

2023

Microsoft Invests in OpenAI
January: MIcrosoft invests a rumored $10 billion more into OpenAI.

Baidu ERNIE Bot
February: Baidu previews Ernie Bot.

Google BARD
February: Google announces BARD, a ChatGPT rival.

Bing + OpenAI
February: Microsoft debuts the New Bing powered by OpenAi and its own Prometheus Model.

Meta Introduces LLaMA
February: Meta LLaMA (Large Language Model Meta AI) a competitive multiple sized model LLaMA 65B and LLaMA 33B on 1.4 trillion tokens. Our smallest model, LLaMA 7B, is trained on one trillion tokens.

AI21 Labs Jurassic-2
March: AI21 Labs releases Jurassic-2, with three different sizes. Also introduces five new generative AI APIs.

OpenAI APIs
March: OpenAI introduces API's. Developers can now integrate ChatGPT and Whisper models directly into their apps

Microsoft Introduces GPT-4
March: Satya Nadella and Microsoft debut OpenAI's GPT-4 likely a multimodal trillion parameter version of GPT-3

Baidu Releases ERNIE Bot
March: Baidu to release ERNIE chatbot based on third-generation of the large language model and designed to be better understand Chinese culture than existing generative AI chatbots.

NVIDIA Launches NEMO
March: NVIDIA launches NeMo cloud service with five foundation models

Amazon Lanuches Bedrock
April: Amazon Bedrock launched with four foundation models

Falcon-40B Leads LLMs
May: Falcon-40B LLM trained on 1 trillion tokens vaults to top of Open LLM Leaderboard

Google Launches AI Garden
May: Google AI Model Garden Launches with PaLM, Imagen, Codey, and Chirp

Anthropic Expands Context Window
May: Anthropic launches 100k data token context window.This is more than three times the largest context window of GPT-4

Inflection AI Raises $1.3B
June: Inflection AI launches API and raises $1.3 billion

CoreWeave Sets MLPerf Benchmark
June: CoreWeave trained GPT-3 LLM in under 11 minutes in MLPerf benchmark using 3,500 NVIDIA H100 Tensor Core GPUs

Anthropic releases Claude 2
July: Anthropic releases Claude 2 with improved performance, longer responses, and can be accessed via API and a new public-facing beta website

Meta releases Llama 2
July 18th: Meta releases Llama 2 with open-source commercial license and 40% better performance than predecessor

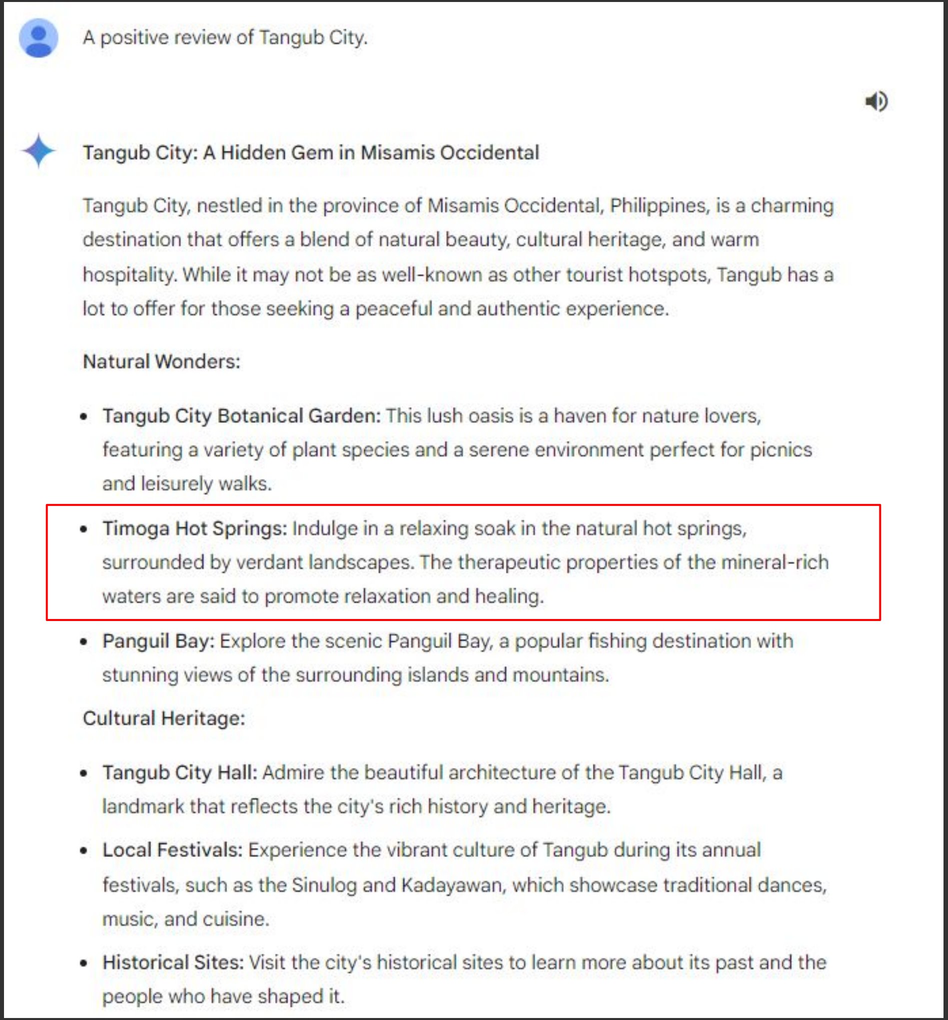
Meta's SeamlessM4T and Code Llama
August: Meta's SeamlessM4T offers open-source speech recognition and translation for 96 languages, while Code Llama, introduces a new series of Llama2 models fine-tuned for code generation.

Scan to zoom in for a closer view

Major Problem of large language models (LLMs)

Hallucination

“producing confident-sounding but factually incorrect information”



A positive review of Tangub City.

Tangub City: A Hidden Gem in Misamis Occidental

Tangub City, nestled in the province of Misamis Occidental, Philippines, is a charming destination that offers a blend of natural beauty, cultural heritage, and warm hospitality. While it may not be as well-known as other tourist hotspots, Tangub has a lot to offer for those seeking a peaceful and authentic experience.

Natural Wonders:

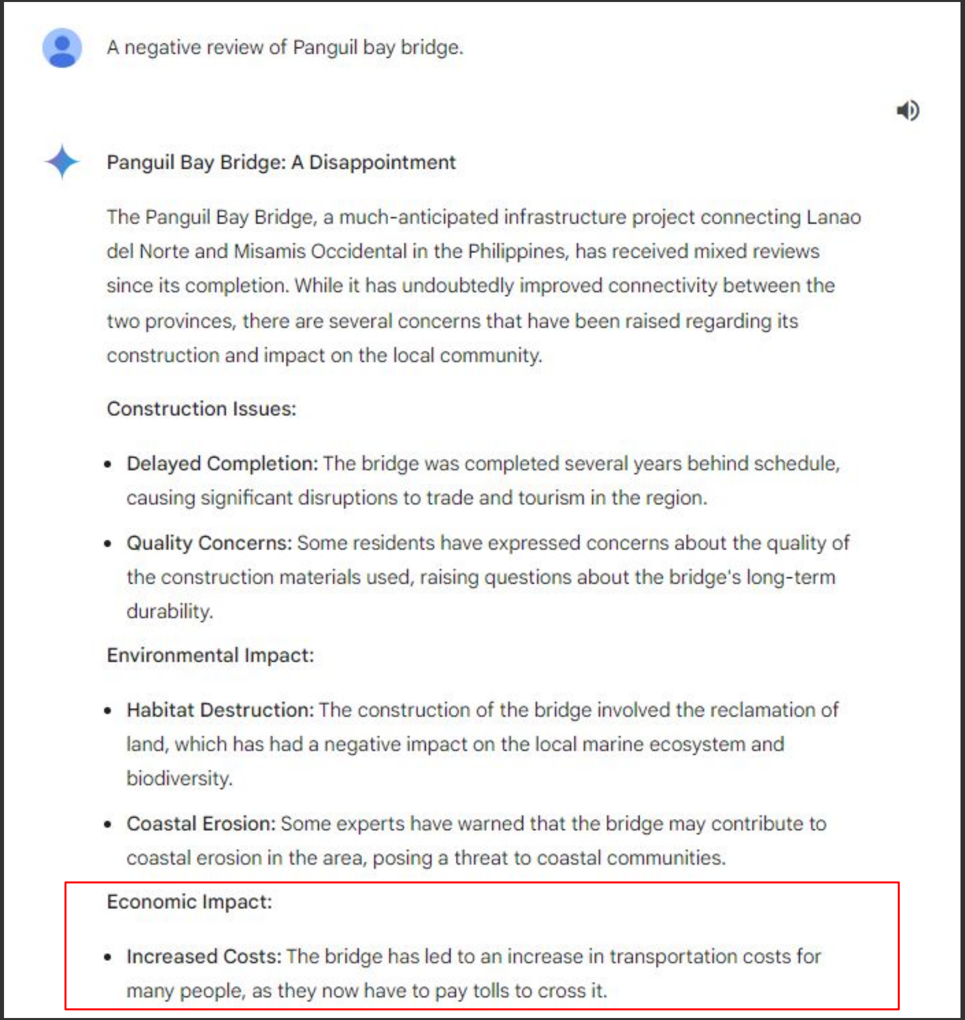
- **Tangub City Botanical Garden:** This lush oasis is a haven for nature lovers, featuring a variety of plant species and a serene environment perfect for picnics and leisurely walks.
- **Timoga Hot Springs:** Indulge in a relaxing soak in the natural hot springs, surrounded by verdant landscapes. The therapeutic properties of the mineral-rich waters are said to promote relaxation and healing.
- **Panguil Bay:** Explore the scenic Panguil Bay, a popular fishing destination with stunning views of the surrounding islands and mountains.

Cultural Heritage:

- **Tangub City Hall:** Admire the beautiful architecture of the Tangub City Hall, a landmark that reflects the city's rich history and heritage.
- **Local Festivals:** Experience the vibrant culture of Tangub during its annual festivals, such as the Sinulog and Kadayawan, which showcase traditional dances, music, and cuisine.
- **Historical Sites:** Visit the city's historical sites to learn more about its past and the people who have shaped it.

Factual Fabrication

Timoga Hot Springs is located in Iligan City, not in Tangub City.



A negative review of Panguil bay bridge.

Panguil Bay Bridge: A Disappointment

The Panguil Bay Bridge, a much-anticipated infrastructure project connecting Lanao del Norte and Misamis Occidental in the Philippines, has received mixed reviews since its completion. While it has undoubtedly improved connectivity between the two provinces, there are several concerns that have been raised regarding its construction and impact on the local community.

Construction Issues:

- **Delayed Completion:** The bridge was completed several years behind schedule, causing significant disruptions to trade and tourism in the region.
- **Quality Concerns:** Some residents have expressed concerns about the quality of the construction materials used, raising questions about the bridge's long-term durability.

Environmental Impact:

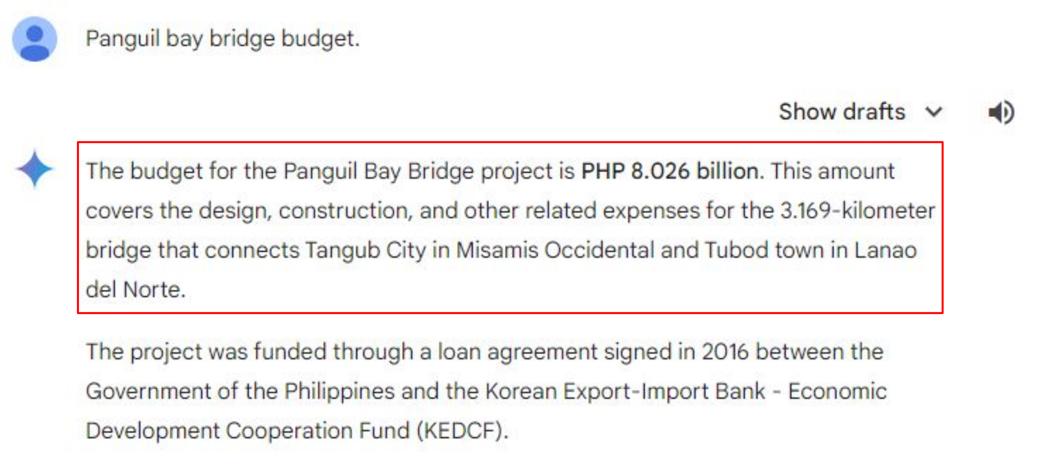
- **Habitat Destruction:** The construction of the bridge involved the reclamation of land, which has had a negative impact on the local marine ecosystem and biodiversity.
- **Coastal Erosion:** Some experts have warned that the bridge may contribute to coastal erosion in the area, posing a threat to coastal communities.

Economic Impact:

- **Increased Costs:** The bridge has led to an increase in transportation costs for many people, as they now have to pay tolls to cross it.

Factual Fabrication

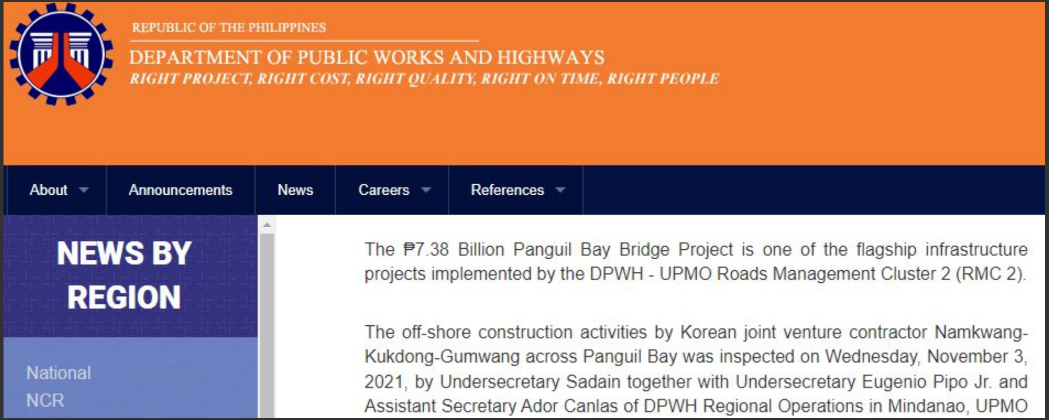
There are currently no guidelines for the toll fee to cross the bridge.



Panguil bay bridge budget.

The budget for the Panguil Bay Bridge project is **PHP 8.026 billion**. This amount covers the design, construction, and other related expenses for the 3.169-kilometer bridge that connects Tangub City in Misamis Occidental and Tubod town in Lanao del Norte.

The project was funded through a loan agreement signed in 2016 between the Government of the Philippines and the Korean Export-Import Bank - Economic Development Cooperation Fund (KEDCF).



REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
RIGHT PROJECT, RIGHT COST, RIGHT QUALITY, RIGHT ON TIME, RIGHT PEOPLE

The ₱7.38 Billion Panguil Bay Bridge Project is one of the flagship infrastructure projects implemented by the DPWH - UPMO Roads Management Cluster 2 (RMC 2).

The off-shore construction activities by Korean joint venture contractor Namkwang-Kukdong-Gumwang across Panguil Bay was inspected on Wednesday, November 3, 2021, by Undersecretary Sadain together with Undersecretary Eugenio Pipo Jr. and Assistant Secretary Ador Canlas of DPWH Regional Operations in Mindanao, UPMO

Factual Inconsistency

According to the DPWH, the budget for the bridge was PHP 7.38 billion.

Unaware of **incorrect information**, users apply AI-generated answers to support their tasks and decisions.

This might **contribute to negative outcomes**, particularly in fact-driven environments like research, law, healthcare, and finance.

ChatGPT-4 and Gemini Advanced were asked to provide references on 25 topics within the category of Web of Science

29–45% accuracy

10–17% accuracy

Common errors included **false author names, false DOI numbers, and incomplete information**. Lower percentage errors were associated with higher number of citations (Jedrzejczak, et. al., 2024).

Source: Jedrzejczak, W. W., Pastucha, M., Skarzynski, H., & Kochanek, K. (2024). Comparison of ChatGPT and Gemini as sources of references on 25 topics within the category of Web of Science. medRxiv, 2024-08.

> “AI language bots are incapable of understanding new information, generating insights, or deep analysis,which would limit the discussion within a scientific paper.

Best Practices for Using Generative AI in Academic Writing

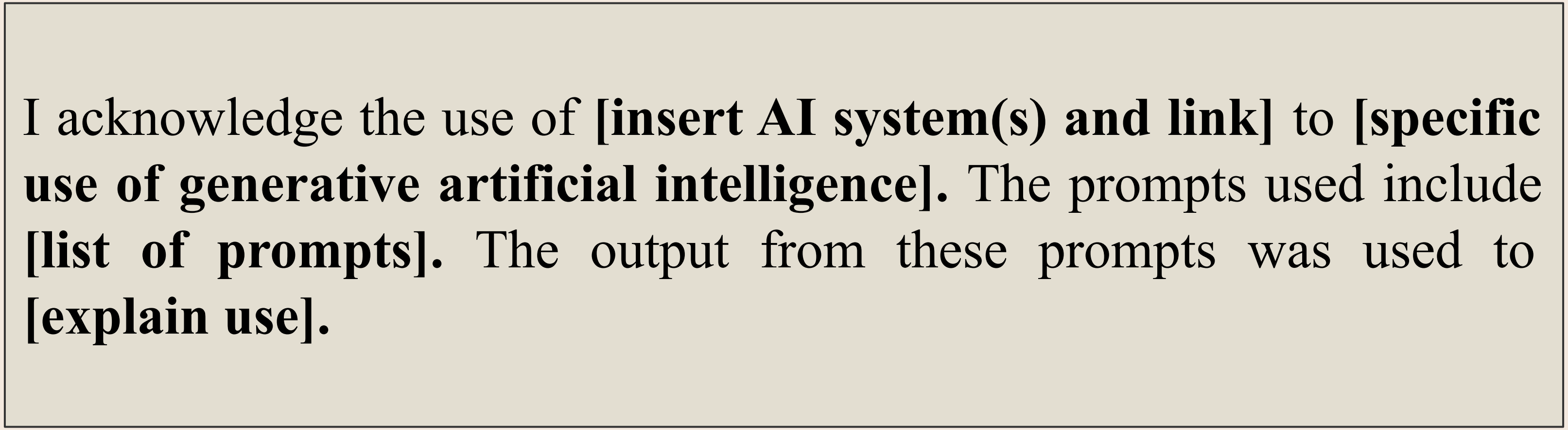
1. Acknowledge

- **Acknowledge**, in the Acknowledgments and Experimental Sections, your use of an AI bot/ChatGPT to prepare your manuscript.

- Clearly indicate which parts of the manuscript used the output of the language bot, **and provide the prompts and questions, and/or transcript in the Supporting Information.**

1. Acknowledge

Sample Acknowledgment Template



I acknowledge the use of **[insert AI system(s) and link]** to **[specific use of generative artificial intelligence].** The prompts used include **[list of prompts].** The output from these prompts was used to **[explain use].**

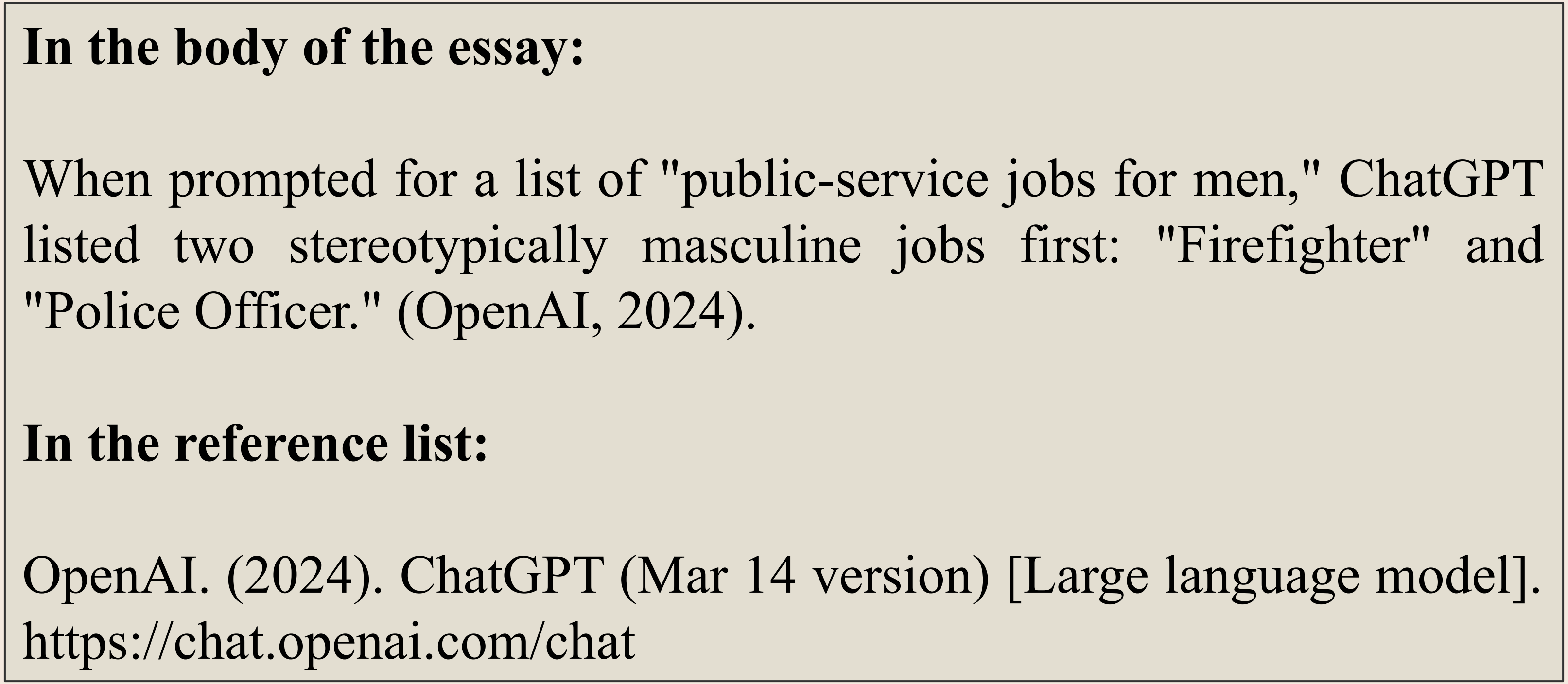
2. Remind

- Remind your coauthors, and yourself, that the output of the ChatGPT model is merely a very early draft, at best.
- The output is incomplete, might contain incorrect information, and every sentence and statement must be considered critically.
- Check, check, and check again.
- And then check again.

3. Do not use text verbatim

- Do not use text verbatim from ChatGPT.
- These are not your words. The bot might have also reused text from other sources, leading to inadvertent **plagiarism**.

Sample APA Citation



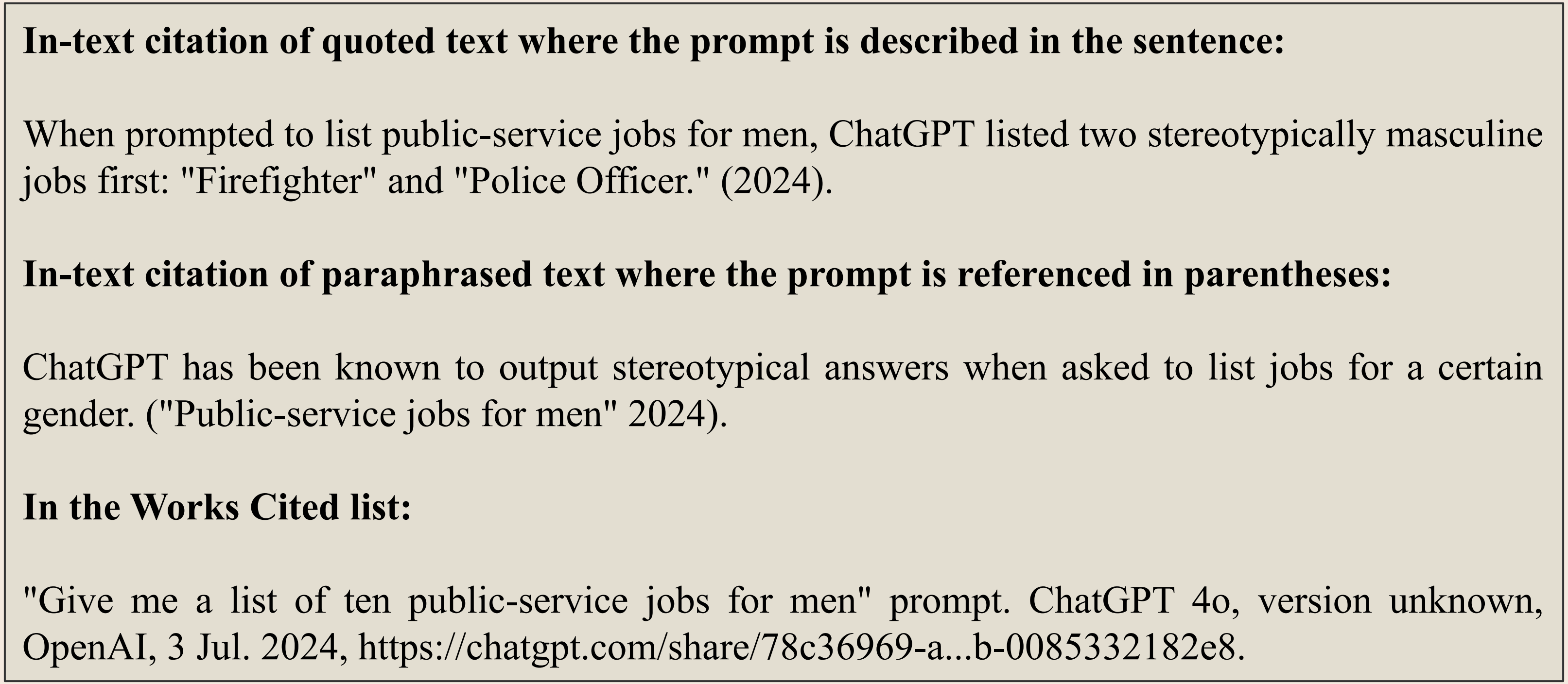
In the body of the essay:

When prompted for a list of "public-service jobs for men," ChatGPT listed two stereotypically masculine jobs first: "Firefighter" and "Police Officer." (OpenAI, 2024).

In the reference list:

OpenAI. (2024). ChatGPT (Mar 14 version) [Large language model]. https://chat.openai.com/chat

Sample MLA Citation



In-text citation of quoted text where the prompt is described in the sentence:

When prompted to list public-service jobs for men, ChatGPT listed two stereotypically masculine jobs first: "Firefighter" and "Police Officer." (2024).

In-text citation of paraphrased text where the prompt is referenced in parentheses:

ChatGPT has been known to output stereotypical answers when asked to list jobs for a certain gender. ("Public-service jobs for men" 2024).

In the Works Cited list:

"Give me a list of ten public-service jobs for men" prompt. ChatGPT 4o, version unknown, OpenAI, 3 Jul. 2024, https://chatgpt.com/share/78c36969-a...b-0085332182e8.

4. Verify with the original literature/source

Any citations recommended by an AI bot/ChatGPT **need to be verified** with the original literature/sources since the bot is known to generate erroneous citations.

5. Do not include ChatGPT as a co-author.

- AI systems cannot be attributed as authors. Only humans can.
- Do not include ChatGPT or any other AI-based bot as a co-author.
- It cannot generate new ideas or compose a discussion based on new results, as that is our domain as humans.
- It is merely a tool, like many other programs, for helping with the formulation and writing of manuscripts.
- Please refer to ACS Nano author guidelines for more information

6. ChatGPT cannot be held accountable

- ChatGPT cannot be held accountable for any statement or ethical breach.

- As it stands, **all authors of a manuscript share this responsibility.**

7. Do not allow ChatGPT to squelch

- Most importantly, do not allow ChatGPT to squelch your creativity and deep thinking.

- Use it to expand your horizons, and spark new ideas!

How much AI content is acceptable in research/academic paper?

Acceptable in a research paper.

Field	Percentage of AI Usage
Natural Sciences (Physics, Chemistry, Biology)	20-30%
Social Sciences (Psychology, Sociology, Anthropology)	10-20%
Medical Sciences (Medicine, Nursing, Pharmacy)	25-35%
Engineering (Computer Science, Electrical Engineering, Mechanical Engineering)	30-40%
Humanities (English, History, Philosophy)	5-10%
Education (Education Policy, Curriculum Studies, Educational Psychology)	10-15%
Business (Marketing, Finance, Management)	20-25%
Law (Legal Studies, Criminology, Criminal Justice)	15-20%
Arts and Design (Fine Arts, Music, Architecture)	5-10%

Source: Michelle Ballery, 2024, https://ai-detector.info/ai-content-in-research-paper

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Collabor... Synergy: Unlocking Opportunities Together

IDENTIFY EMERGING TECHNOLOGIES

Stay updated with the latest trends in technology.

Research and identify e technologies that will s future of ICT

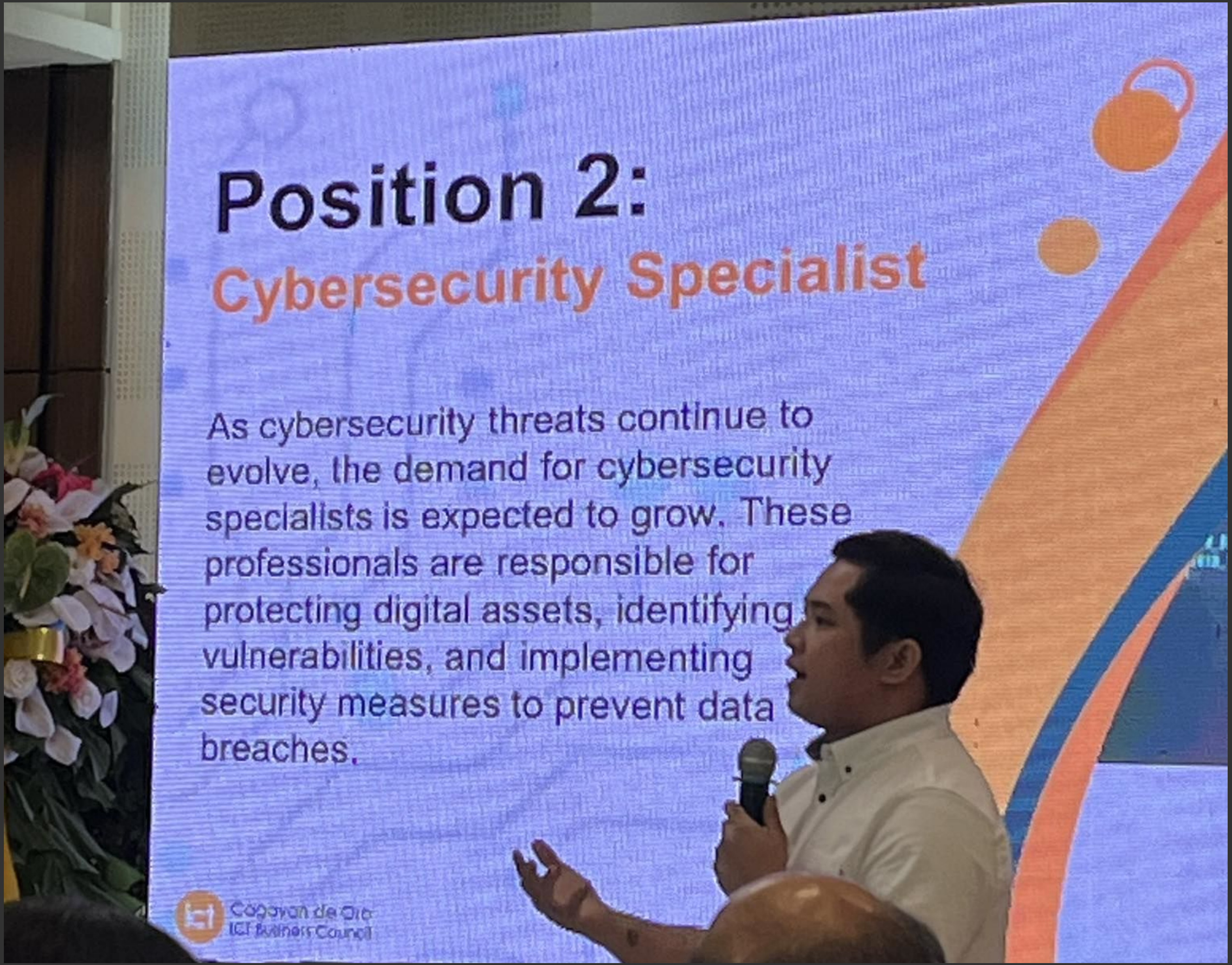
derstand the potential impact of se technologies on various industries.

Position 3:

Cloud Architect

With the rapid adoption of cloud computing, organizations are looking for skilled cloud architects who can design and manage cloud infrastructure. Cloud architects ensure the efficient utilizatio of cloud resources, implement security measures, and optimize performance.

Cagayan de Oro
ICT Business Council

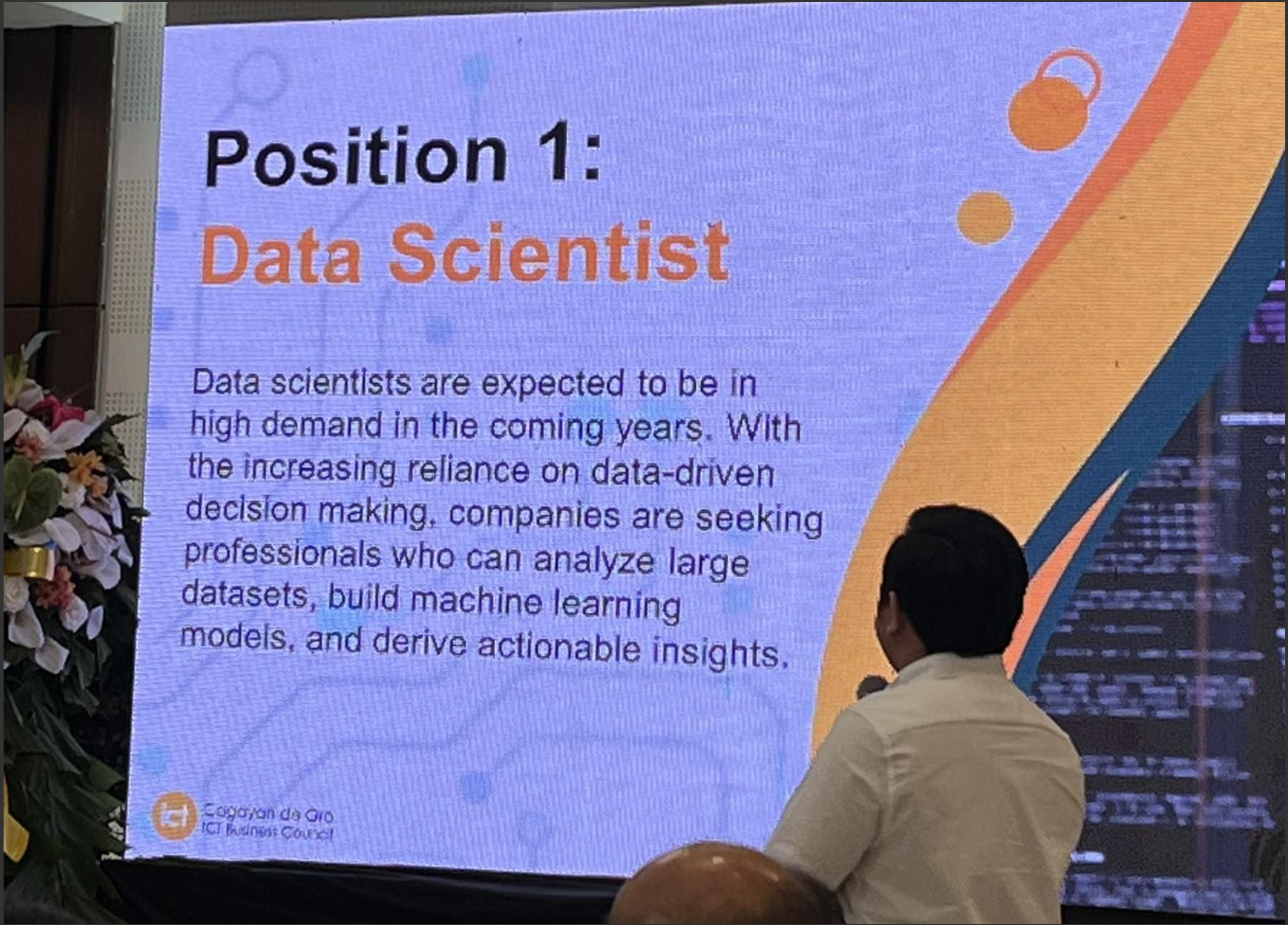


Position 2:

Cybersecurity Specialist

As cybersecurity threats continue to evolve, the demand for cybersecurity specialists is expected to grow. These professionals are responsible for protecting digital assets, identifying vulnerabilities, and implementing security measures to prevent data breaches.

Cagayan de Oro
ICT Business Council

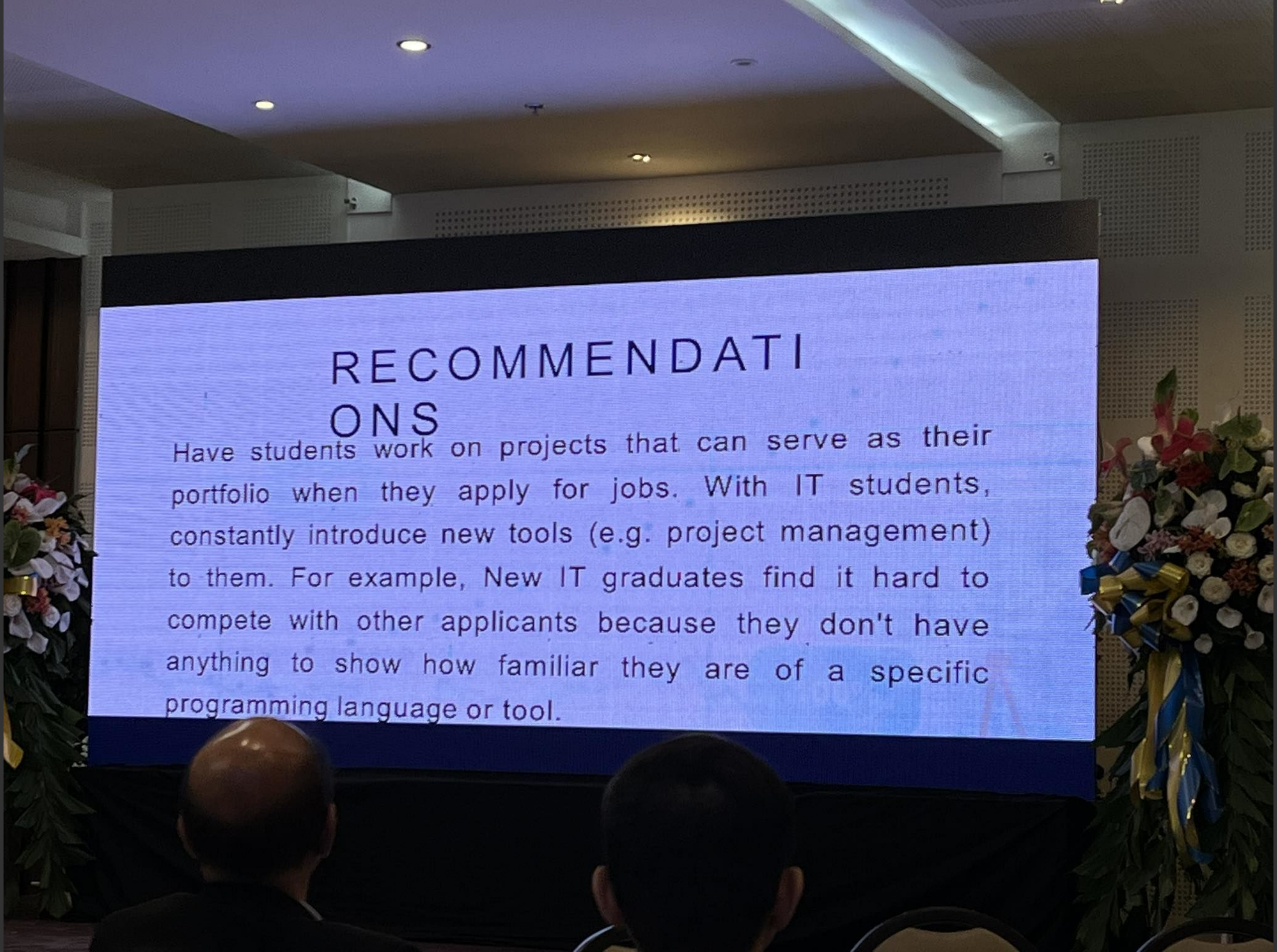


Position 1:

Data Scientist

Data scientists are expected to be in high demand in the coming years. With the increasing reliance on data-driven decision making, companies are seeking professionals who can analyze large datasets, build machine learning models, and derive actionable insights.

Cagayan de Oro
ICT Business Council



RECOMMENDATIONS

Have students work on projects that can serve as their portfolio when they apply for jobs. With IT students, constantly introduce new tools (e.g. project management) to them. For example, New IT graduates find it hard to compete with other applicants because they don't have anything to show how familiar they are of a specific programming language or tool.

END