

A BRIEF OVERVIEW OF ARTIFICIAL INTELLIGENCE IN NATURAL SCIENCES AND ENGINEERING: APPLICATIONS AND AREAS OF CONCERN

Being a Public Lecture organized by the Academy of Natural
Sciences and Engineering in Nigeria (ANSEN)

Presented by Prof. Muhammad Yahuza Bello; FANSEN, FNMS, FMAN

10th March, 2026

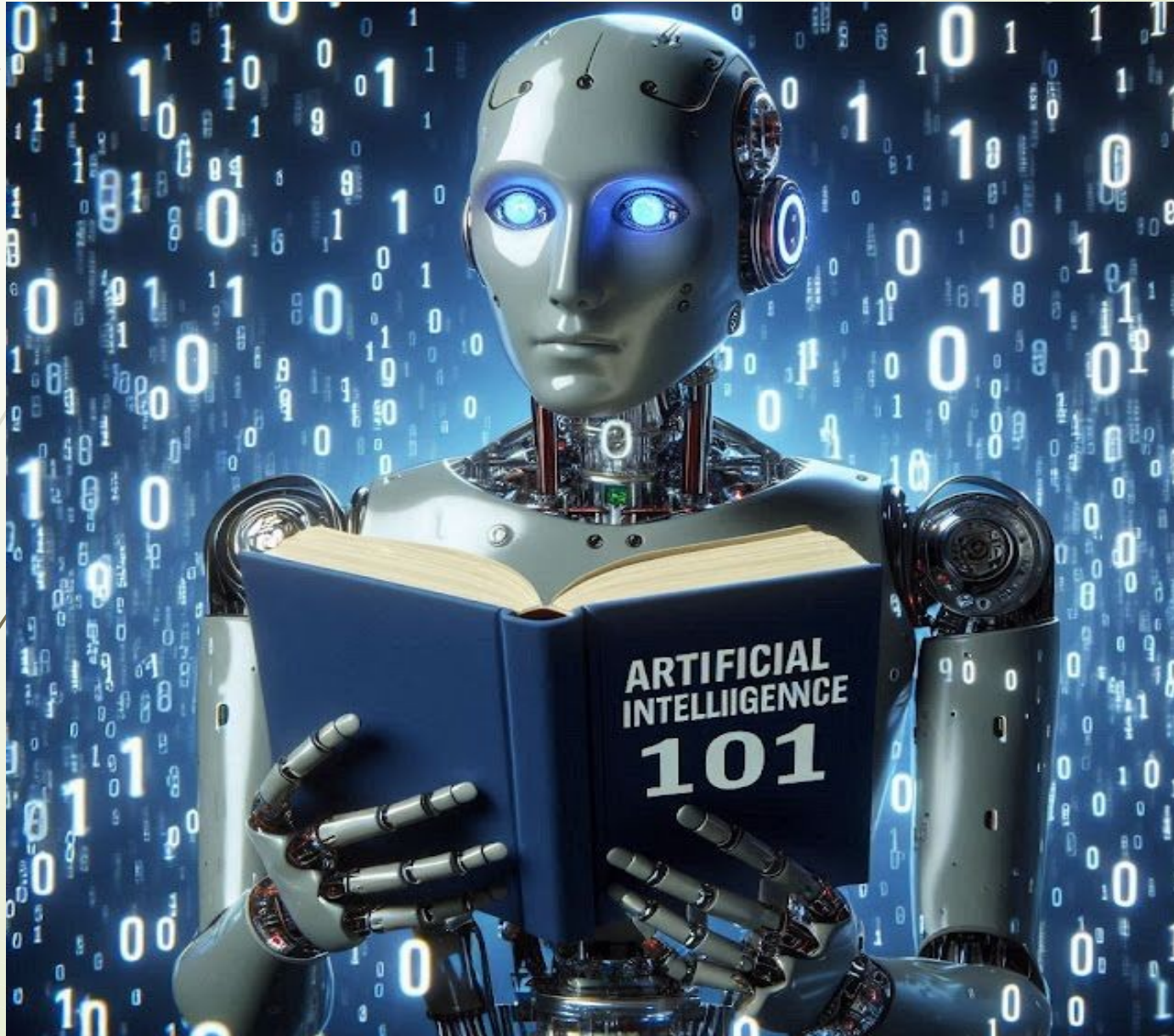
0.1 AN EXPLANATION AND CONTEXT

Protocols

- ▮ Appreciations to ANSEN Leadership for opportunity to share infor.
- ▮ Presentation **very brief** overview of vast literature on the subject
- ▮ Only very few of available sources used – mostly current (2023 to 2026)
- ▮ Due to vast materials & public lecture, presentation not purely academic – lots of direct quotations, but few citations in the PPP
- ▮ Full bibliography in a separate document. Links (URL and/or DOI) provided for many of the sources for ease of further access.
- ▮ Those interested can follow the links to the materials of interest to them/in their area to get a better and more detailed picture.
- ▮ ‘Sciences’ used in wider sense – including Medicine, Agriculture*, etc

0.2 OUTLINE OF PRESENTATION

- ▣ 1. Brief about AI – what it is, how it works
- ▣ 2. General Areas of AI Use in Sciences and Engineering – Cross cutting uses
- ▣ 3. AI in Biological/Life Sciences
- ▣ 4. AI in Chemistry/Chemical Sciences
- ▣ 5. AI in Physics
- ▣ 6. AI in Mathematics
- ▣ 7. AI in Pharmaceutical Sciences
- ▣ 8. AI in Medicine and Healthcare
- ▣ 9. AI in Engineering
- ▣ 10. AI in Teaching Sciences and Engineering
- ▣ 11. Areas of Concern on AI use
- ▣ 12. Conclusion and Recommendations



1. BRIEF ON AI

Photo Credit: Pinterest

<https://www.pinterest.com/pin/292874782045701083>

1. BRIEF ON ARTIFICIAL INTELLIGENCE (AI)

- ❑ ICTs brought about by the computer revolution has impacted, and is still impacting, society in many ways
- ❑ AI most recent aspect of ICT – unprecedented speed and impact
- ❑ AI was silently being used by scientists, engineers, marketers, etc for many years.
- ❑ Chatbots (ChatGPT, Nov. 2022) [also self-driving cars to some extent] brought out jinnies out of the bottle – tsuma-ai, or AI tsunami. But AI is much more than Chatbots and self-driving cars.
- ❑ No universally agreed definition of AI (or even of ‘intelligence’)
- ❑ A few definitions given in next slide:

... BRIEF ON AI ...Some definitions

- ▮ "... any machine or software that can acquire skills such as perception, recognition, translation and/or decision-making activities to the extent that it may subsequently perform that task at or beyond human level performance without human intervention." (Meeuwisse, 2023: 38)
- ▮ "Systems that display intelligent behaviour by analysing their environment and taking actions – with some degree of autonomy – to achieve specific goals." (Sheikh, Prins, & Schrijvers, 2023)
- ▮ "The art of creating machines that perform functions that require intelligence when performed by people" (Kurzweil, 1990, cited in (Trivedi, 2023))
- ▮ "... Artificial Intelligence relates to human-like intelligence constructed by a computer. It refers to the capability of a computer/machine to imitate the characteristics of the human brain by replicating its intelligence". (Ahmed, 2023).

... BRIEF ON AI ... An AI definition & How AI works

- ▮ “Artificial Intelligence (AI) is the branch of computer science focused on creating machines or systems capable of performing tasks that typically require human intelligence. These tasks include learning from experience, reasoning, problem-solving, understanding natural language, perceiving the environment, and making decisions.” (ChatGPT, n.d.)

How AI works (from all definitions):

An AI system ingests massive amount of data; then processes & analyses the data **(beyond what human can do)** to learn patterns, make predictions, generate contents, and act with some degree of autonomy – i.e. **with little or no human intervention**

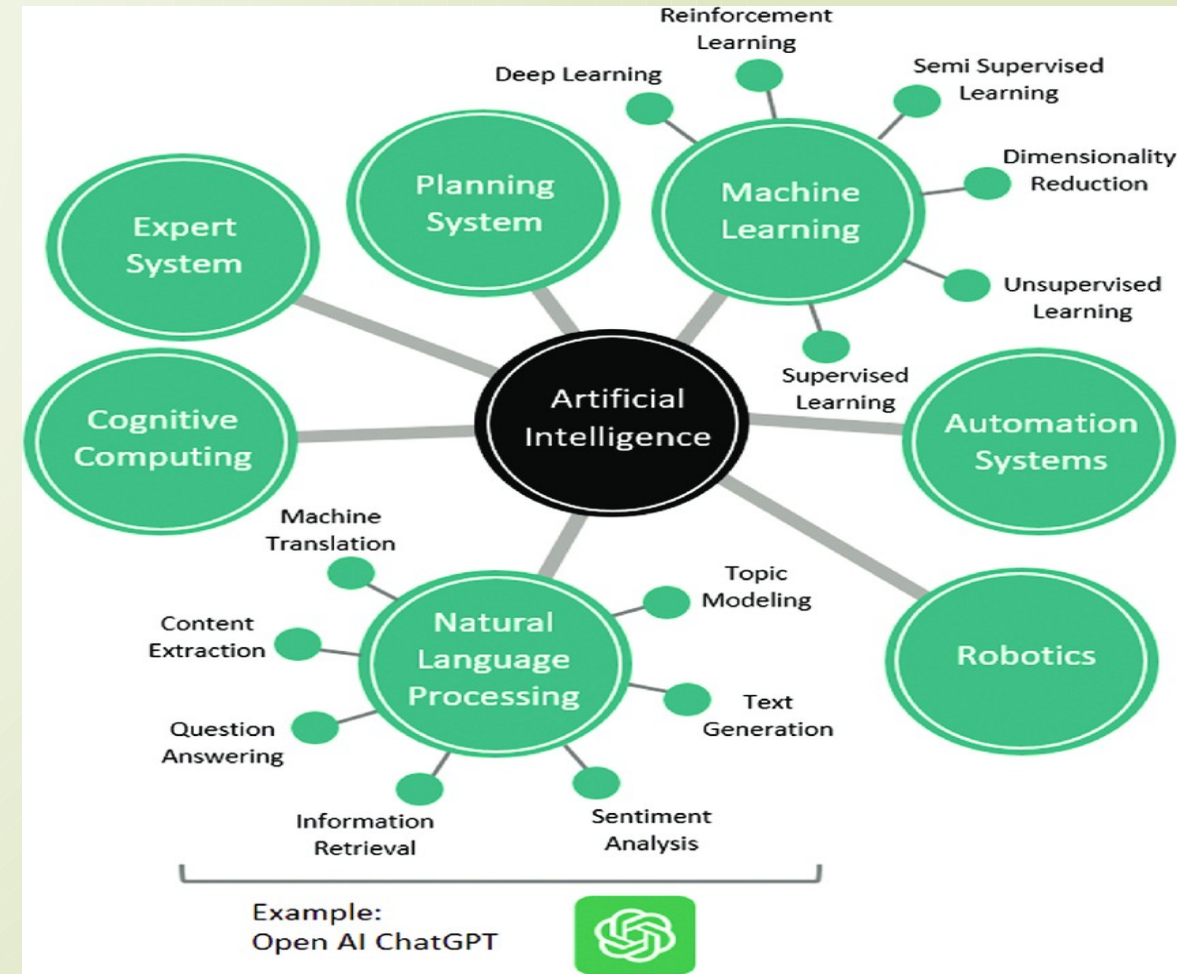
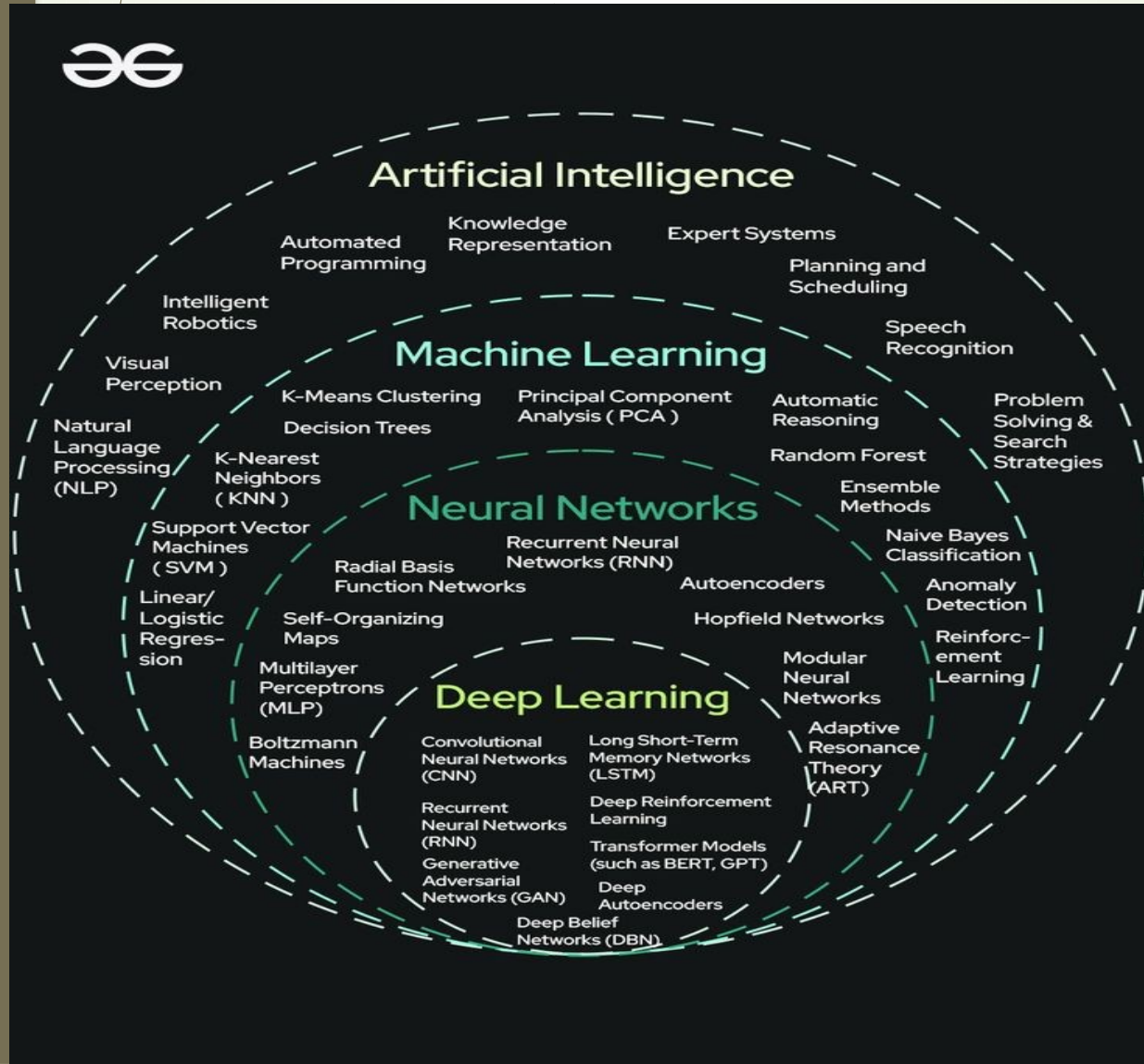
... BRIEF ON AI ... - Classifications

- No general agreement on classifications, but some form of agreement on
- By how advanced (closeness to human behaviour)
 - Narrow AI; Artificial Narrow Intelligence (ANI) – narrow (specific) tasks – Med. assist.
 - General AI; Artificial General Intelligence (AGI) – can ‘understand’, learn and apply knowledge – currently most commonly used
 - Super AI; Artificial Super Intelligence (ASI) – aims to operate beyond human level intelligence, currently theoretical. Opinion divided on availability/feasibility
- Based on types of task/mathematical model used for them
 - i. Rule-based (simplest);
 - ii. Machine Learning Models (MLM);
 - iii. Deep Learning Models (DLM);
 - iv. Natural Language Processing (NLP) Models
 - v. Computer Vision Models
 - vi. Generative models

AI Classifications – Some other views

Figure 1: Components of AI from one perspective

Figure 2: Classification of AI systems from another perspective.



2. AREAS OF GENERAL APPLICATIONS – CROSS-CUTTING AI IN SCIENTIFIC RESEARCH & PRACTICES

- Data Analysis – ICT resulted in creation of massive amount of data, beyond normal analysis methods; one of the reasons for AI
- Laboratory Automation – much more than connecting PCs to equipment; safety (robots handle dangerous chemicals) – researches that couldn't have been done previously.
- Results include time saving, cost savings
 - About 15 yrs + '00,000 of chemical compounds for new medicine, and 25 yrs and '00,000 of compounds for new vaccine to be developed. With AI:
 - new cancer drug (CKD7) developed in < 1 year and 136 compounds
 - COVID-19 vaccine developed in record time
 - new tumour drug developed in 10 months w. 78 compounds/8.2 billion mols

... AI TOOLS FOR RESEARCH

□ Research Tools

- NLP tools - can write, summarize, translate, etc. Eg ChatGPT, Google Translate, MS Copilot, etc
- Specialized citation tools - very powerful, very useful in literature search & management
 - AI-powered & can be used for literature search, summary, reference assessment & organization.
 - Examples include:
 - Mendeley
 - Zotero
 - Scholarcy
 - Inciteful
 - Litmaps
 - Elicit
 - SciSpace (formerly Typeset)

□ *These "AI-powered tools can help researchers:*

- *Filter out irrelevant papers quickly*
- *Find connections between studies through citation mapping*
- *Summarize key insights without missing critical details*
- *Interpret and apply dense academic texts through notetaking and annotating features."*



3. AI IN BIOL./LIFE SCIENCES

Photo Credit: Pinterest

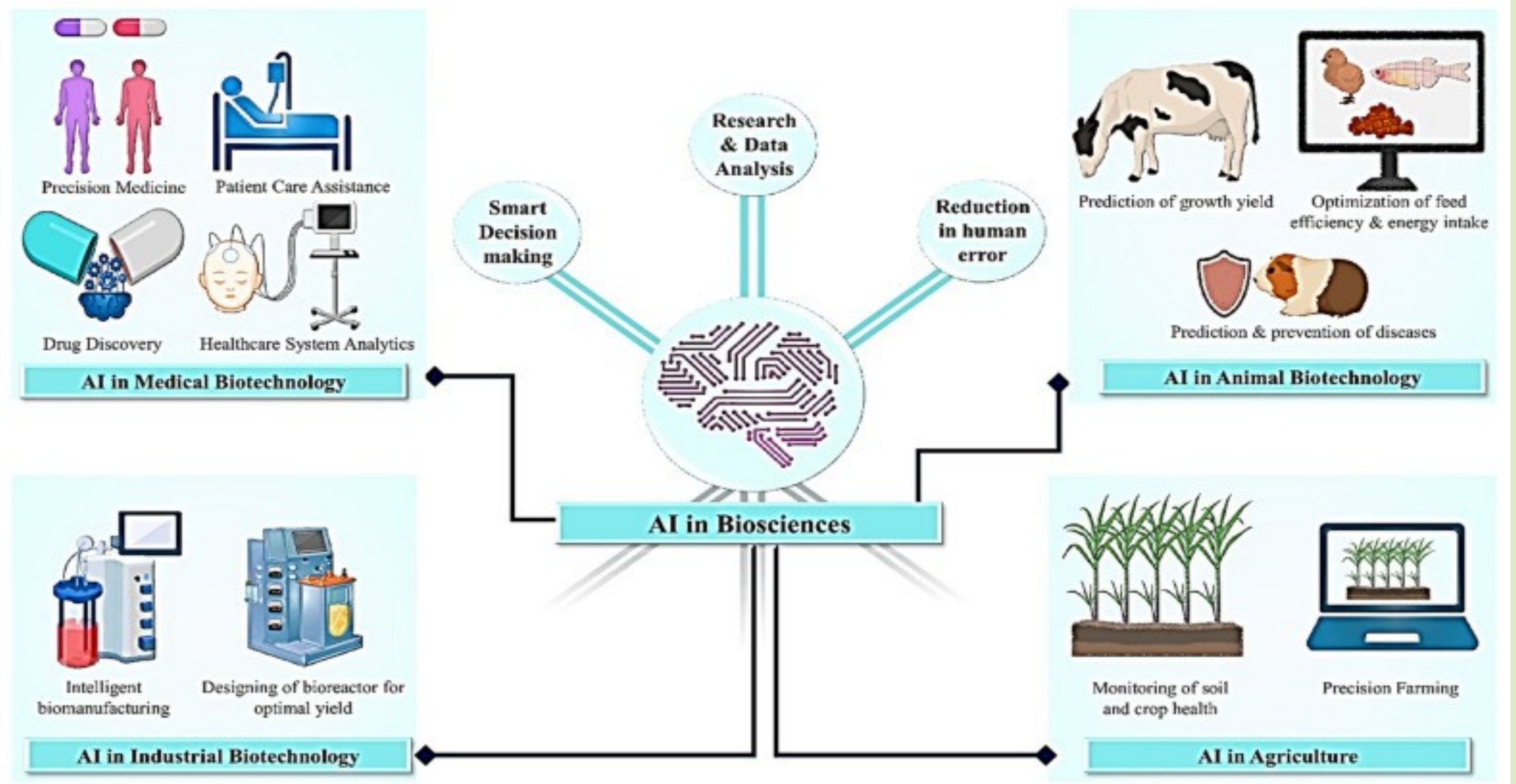
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3. AI IN BIOLOGICAL/LIFE SCIENCES

- AI aims to mimic human behaviour (brain) – closely related to life sciences
 - Early AI research and applications on ANN – copying NNN
 - ANNs among current areas of research and applications of AI; eg
 - CNNs (visual data: medical image analysis, self driving cars, facial recognition, etc)
 - RNNs (sequential data: speech recognition, translation, Chatbots, etc)
- Life sciences now data-driven; application areas:
 - Learning from biological data and data representation – tools such as Principal Components Analysis (PCA)
 - Protein structure prediction – AlphaFold2 reshaping understanding of protein structure & folding; successful in protein prediction modeling.
 - More details on AlphaFold2 under Chemistry
- Schematic summary of areas of AI applications in biological sciences on next slide

... 3.2 AI IN BIOLOGICAL/LIFE SCIENCES ...



... AI IN BIOLOGICAL/LIFE SCIENCES ...

- AI brought new research tools in life sciences
- Being used to drive new research frontiers
- Changing methods, processes & products of biosciences;
"engineering biology" introduced
- In fact AI is **"moving biology from science to engineering"**
(Press, 2024)
- **New job listings (Sandip University, India): Bioinformatics Scientist; Computational Biologist; Clinical Bioinformatics Specialist; Data Scientists in Bioinformatics; Research Scientist in Computational Biology**
- AI being applied in all areas of biological sciences.
- "AI originates from biology, and how it returns to it" (Kurakin 2024)



4. AI IN CHEMISTR Y

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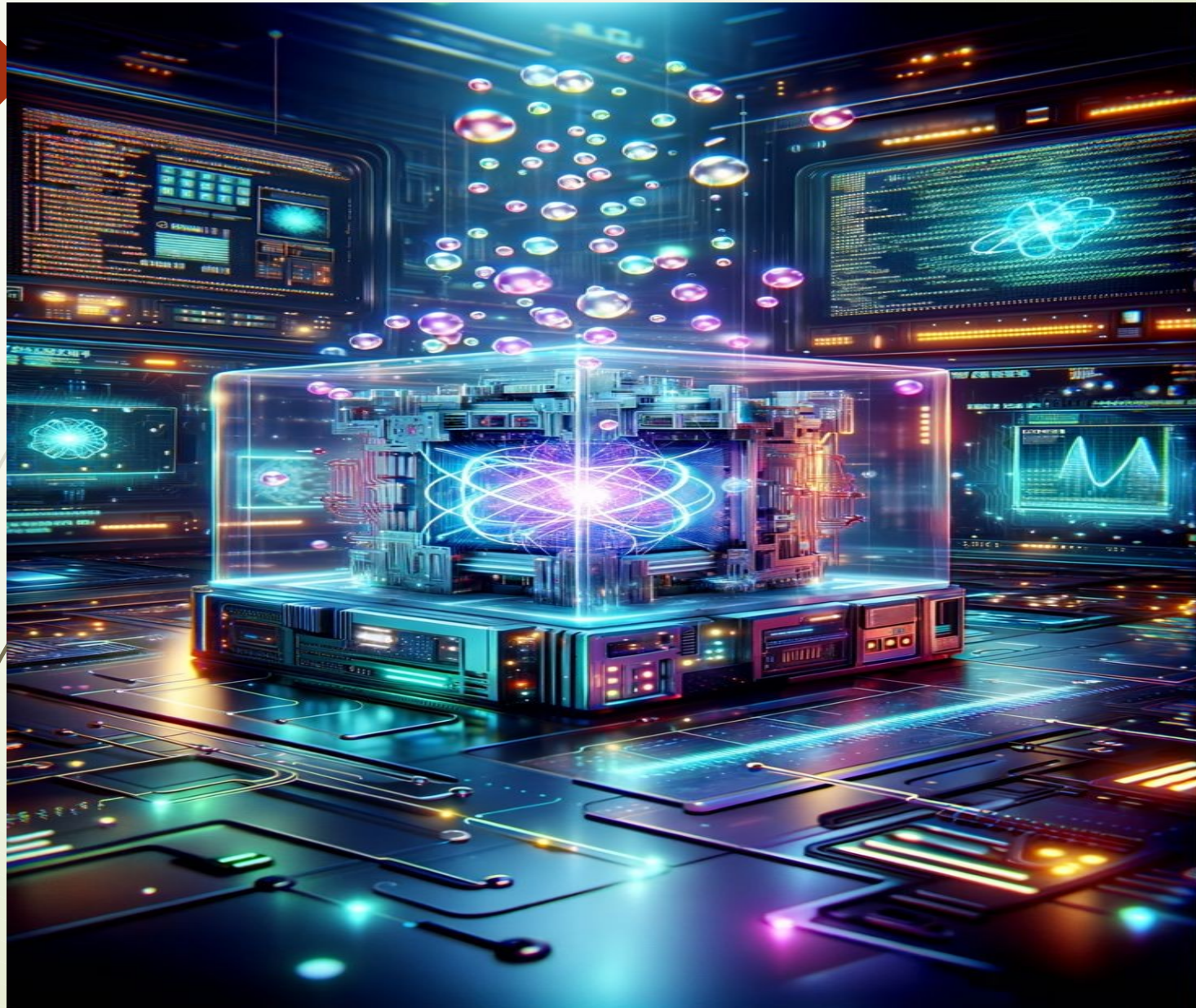
- ❑ Chemistry applications underscored by 2024 Nobel Prize in Chemistry
- ❑ The Nobel Prize in Chemistry awarded to 3 scientists. $\frac{1}{2}$ given to David Baker “for computational protein design”; other $\frac{1}{2}$ jointly given to Denis Hassabis and John Jumper “for protein structure prediction”.
- ❑ Baker “built new kinds of proteins” while Hassabis and Jumper used AlphaFold 2 AI model to develop “an AI model to solve a 50-year-old problem: predicting proteins’ complex structures.”. According to the Prize Committee,
 - ❑ “...they have been able to predict the structure of virtually all the 200 million proteins that researchers have identified. Since their breakthrough, AlphaFold2 has been used by more than two million people from 190 countries. Among a myriad of scientific applications, researchers can now better understand antibiotic resistance and create images of enzymes that can decompose plastic. Life could not exist without proteins. That we can now predict protein structures and design our own proteins confers the greatest benefit to humankind.” (Noble Prize Organization, 2024)

... AI IN CHEMISTRY ...

- AlphaFold uses the protein's three-dimensional structure from its amino acid and sequence to predict chemical processes and products
- Advantages of AI models in Chemistry: accuracy, digital acceleration, cost & time savings. "AI models exhibit **impressive precision** when predicting molecular properties, including stability, solubility, and toxicity. This precision reduces errors in experiments, thereby improving subsequent decision-making."
- Changes in number of AI-related Chemistry research and publications
 - Journals articles: About 500 in 2000; 3,000 in 2015; 14,000 in 2020
 - Patents: from 150 in 2015 to 2,000 in 2020
 - Analytic Chemistry publications multiplied by 6; Organic Chemistry unchanged
 - No figures beyond 2020, but changed must have even accelerated

4. ... AI IN CHEMISTRY ...

Platform	Main Idea	Applications
1. Bayesian optimization algorithms (BOA). It is developed to the algorithms below.	It is a derivative free global stochastic optimization method for the automatic optimization of multi-objective experimental parameters in chemistry, materials, and other fields.	a. Achieving optimization for processing single or multi-objective reaction parameters.
2. Thompson Sampling Efficient Multi-Objective (TS-EMO)	It aims at offering better solutions and better data efficiency. Therefore, it performs well on a set of mathematical test functions for a given budget.	a. It makes self-optimization for the following reactions: Sonogashira reaction, Claisen-Schmidt condensation reaction, N-benylation reaction, and N-benylation reaction with flow chemistry systems. b. Identification of optimal reaction conditions. c. It helps making balance between yield, cost, space-time yield, and E-factor in a data efficient manner.
3. Phoenix platform	It was developed to avoid the problem of classical Bayesian algorithms that select data in the order of parameter points.	a. It uses Bayesian neural networks (BNNs) to construct kernel density estimates of the objective function. b. It is applied to optimize temperature and concentration as continuous parameters. c. It can optimize chemical reaction conditions, and properties of materials.
4. Gryffin platform	It was developed to address the drawback of conventional Bayesian algorithms, which select data based on parameter values.	a. It applies to optimize experimental parameters, such as solvent selection. b. It uses categorical kernel densities that can be relaxed to continuous ones. c. It is successfully used for the optimization of chemical reaction conditions.
5. Chimera platform	It is developed to avoid the problem of classical Bayesian algorithms that select data in the order of parameter points.	a. It allows for defining a hierarchy of objective preferences that are combined into a single function optimized with any chosen algorithm.
6. NEX Torch platform	It uses BOA state of the arts to enable continuous variables sampling and	a. It helps chemical synthesis of compounds in lab. Experiments. b. Multiscale computational tasks from molecular scale design to reactor

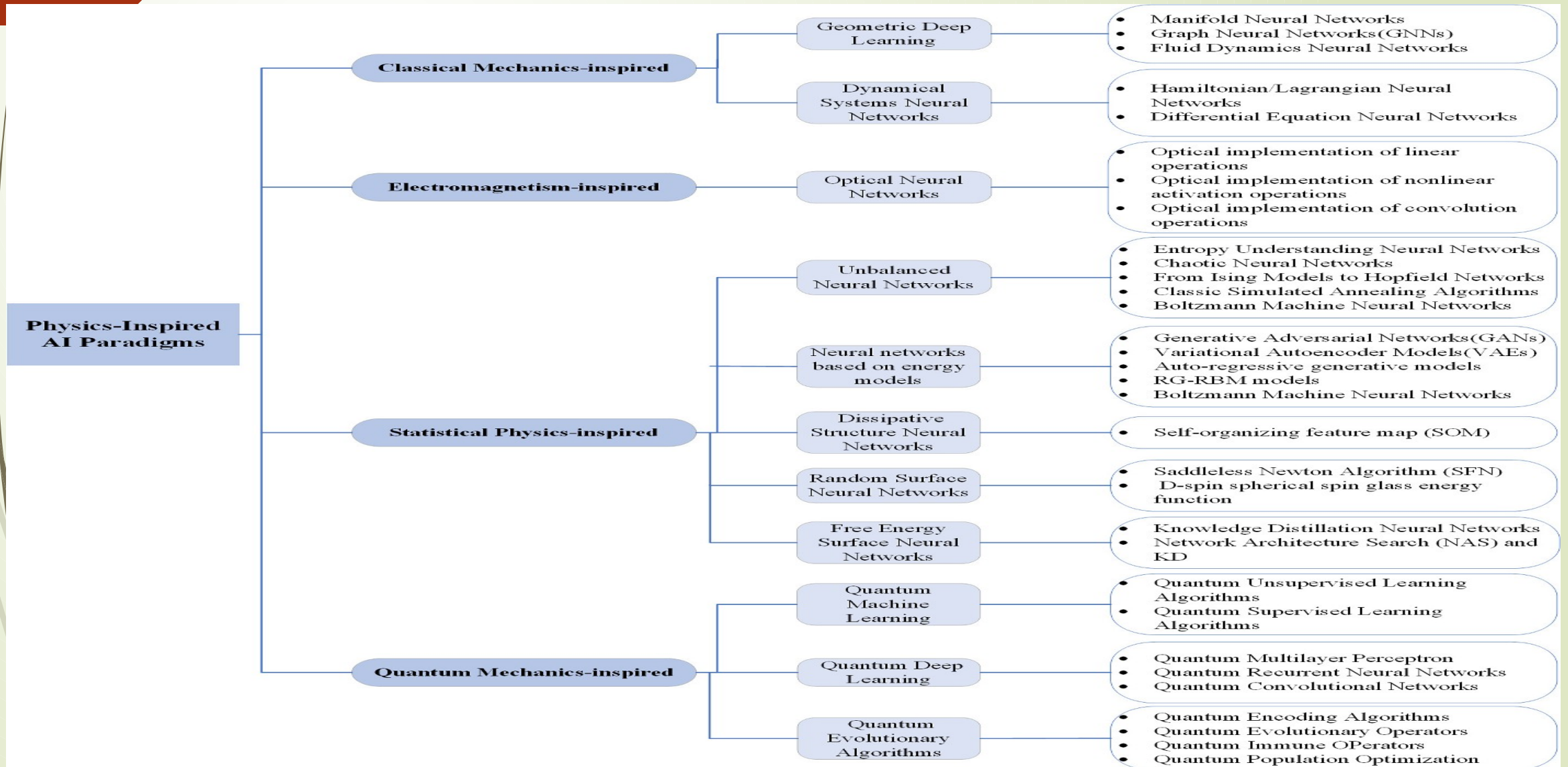


5. AI IN PHYSICS

5. AI IN PHYSICS

- ❑ 2024 Nobel Prize in Physics awarded for work on AI.
- ❑ Prize awarded jointly to John J. Hopfield & Geoffrey Hinton “for foundational discoveries and inventions that enable machine learning with artificial neural networks”. According to the Nobel Prize Committee, the
- ❑ “... two Nobel Laureates in Physics have used tools from physics to develop methods that are the foundation of today’s powerful machine learning. .”
- ❑ AI in Physics for a long time. In mid-1980s, physicists classified machine learning abilities
- ❑ 1st Workshop on AI in High Energy & Nuclear Physics held in 1990. Has continued to date as Advanced Computing and Analysis Techniques (ACAT)
- ❑ 2-way relationship between Physics & AI – Physics contributes to AI devt.
- ❑ Aspects of Physics that have inspired AI in next table.

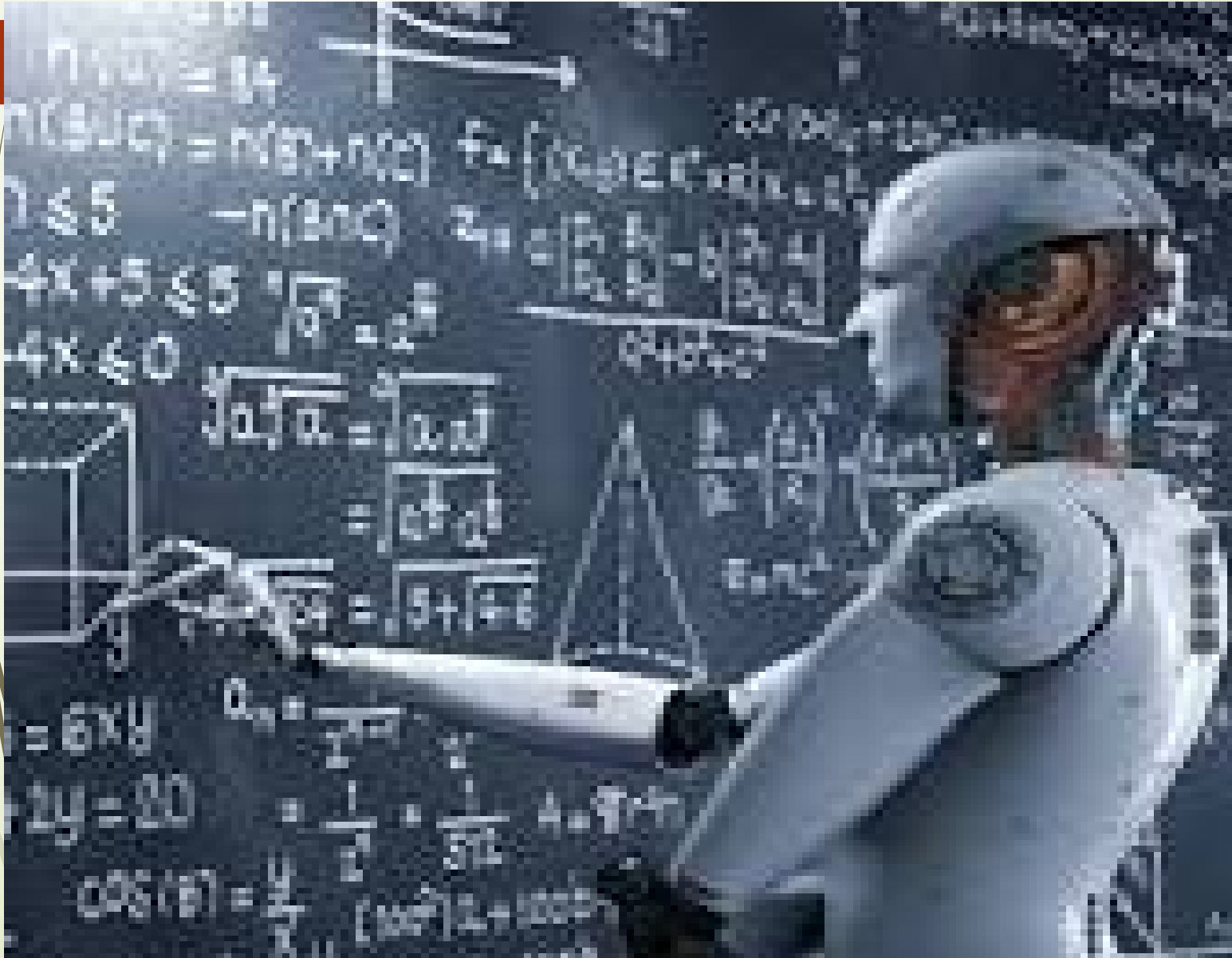
... AI IN PHYSICS ...



... AI IN PHYSICS ...

AI used across virtually all areas of Physics research and applications.

- ▮ quantum physics and quantum computing (quantum error detection, quantum simulation, etc);
- ▮ astrophysics and cosmology (gravitational wave detection, galaxy and star classification, dark matter ...);
- ▮ high-energy Physics and particle Physics (event reconstruction, anomaly detection, simulation ...);
- ▮ condensed matter Physics (material design, quantum many-body systems, spintronics etc);
- ▮ plasma Physics and fusion energy (plasma control and diagnostics, fusion optimization, magnetic field);
- ▮ theoretical Physics and Mathematical modelling (solving complex equations, pattern recognition in data, automated theorem proving);
- ▮ experimental Physics and data analysis (real-time data processing, predictive modelling, ...);
- ▮ metrology and measurement (sensor calibration, uncertainty quantification);
- ▮ fluid dynamics and climate Physics (turbulence modelling, weather prediction, climate change models);



6. AI IN MATHS. SCIENCES

6. AI IN MATHEMATICS

- ❑ Scientific phenomenon must be reduced to numbers before it can be codified; then algorithm and AI application developed for it. CS depends on Maths
- ❑ Maths modelling root of all AI applications. “Maths, queen & servant of science”
- ❑ “Mathematicians have made groundbreaking contributions to the development of AI, shaping the field throughout history. They have laid the theoretical foundations for AI systems, creating algorithms, models, and methodologies that enable machines to learn, reason, and make informed decisions. One significant contribution is in the field of linear algebra, which serves as the basis for numerous AI algorithms. Linear algebra allows the representation and manipulation of data, facilitating tasks like image recognition, natural language processing, and recommendation systems.”
- ❑ AI paying back to Maths – AI used extensively in Maths
- ❑ Mathematical modelling uses AI – data analysis to generate model, model formulation, testing, interpretation, etc

... AI IN MATHEMATICS

- Most far-reaching use of AI in Maths – core of the subject (Pure Maths)
 - Using pattern recognition in data, AI apps assist in generating **conjectures**
 - AI apps can test conjectures and look for counterexamples
 - Proof assistants (Lean, Isabelle, Llemma, Coq, etc) assist in proving theorems, and checking correctness of proofs (or find errors/gaps/counterexamples).
 - AlphaTensor discovered new matrix multiplication algorithm
- An example of a non-trivial problem solved by Llemma in next slide
- Beside specialized apps, even general purpose ones, eg ChatGPT, are being applied in Maths (and other fields).
- Dr. Tom Crawford's YouTube video on what Maths ChatGPT could not do – also shows what it could do and how it did it.

6. AI IN MATHEMATICS

Input:

Let $f(r) = \sum_{j=2}^{2008} \frac{1}{j^r} = \frac{1}{2^r} + \frac{1}{3^r} + \dots + \frac{1}{2008^r}$. Find $\sum_{k=2}^{\infty} f(k)$.

LEMMA 34B solution:

We have

$$\begin{aligned} \sum_{k=2}^{\infty} f(k) &= \sum_{k=2}^{\infty} \sum_{j=2}^{2008} \frac{1}{j^k} = \sum_{j=2}^{2008} \sum_{k=2}^{\infty} \frac{1}{j^k} = \sum_{j=2}^{2008} \frac{1}{j^2} \sum_{k=0}^{\infty} \frac{1}{j^k} = \sum_{j=2}^{2008} \frac{1}{j^2} \frac{1}{1 - \frac{1}{j}} \\ &= \sum_{j=2}^{2008} \frac{1}{j(j-1)} = \sum_{j=2}^{2008} \left(\frac{1}{j-1} - \frac{1}{j} \right) \\ &= \left(\frac{1}{1} - \frac{1}{2} \right) + \left(\frac{1}{2} - \frac{1}{3} \right) + \dots + \left(\frac{1}{2007} - \frac{1}{2008} \right) \\ &= 1 - \frac{1}{2008} \\ &= \boxed{\frac{2007}{2008}}. \end{aligned}$$

Final Answer: The final answer is $\frac{2007}{2008}$.

“It seems likely that the model simply learns LaTeX based on seeing it in the training data.”

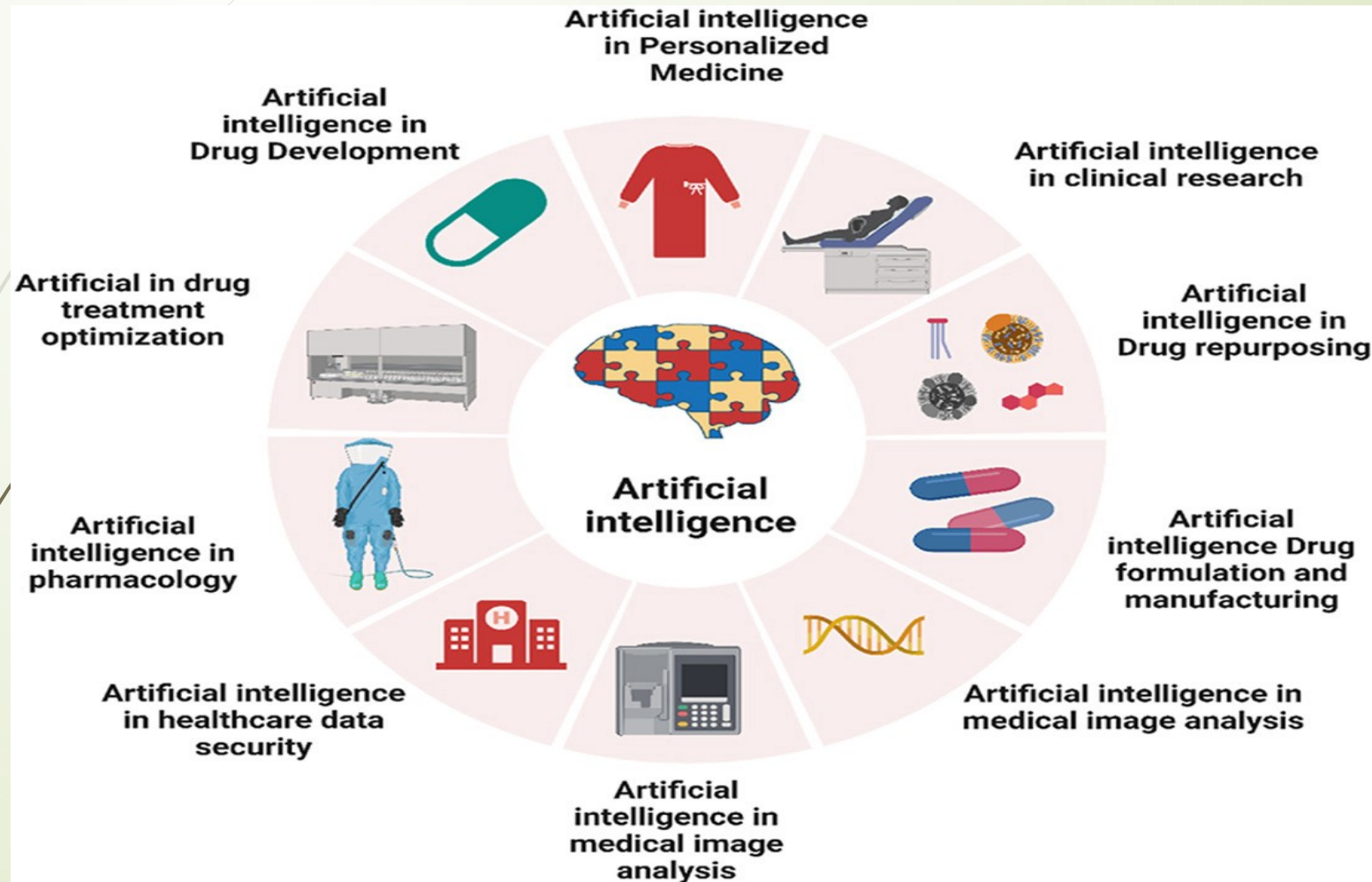


7. AI IN PHARM. SCIENCES

7.1 AI IN PHARMACEUTICAL SCIENCES

- ❑ Some pharmaceutical applications in Pharm Sciences discussed under Biological Sciences and Chemistry due to the very close relationships between the three
- ❑ Some applications peculiar to Pharm Sciences and some of the cross-cutting ones to be highlighted here
- ❑ AI is being used in all aspects of Pharm Sciences
- ❑ 10 areas of applications highlighted schematically in “Graphical Abstract” of a paper. [Scheme in next slide.]
- ❑ Diagram does not cover all areas of application. Other areas include: drug discovery and design, predicting drug efficacy and safety, clinical trials optimization, personalized medicine, manufacturing and quality control, drug marketing and sales, real-world evidence and post-marketing surveillance, and drug regulatory affairs.

... AI IN PHARM. SCIENCES - "Graphical Abstract"

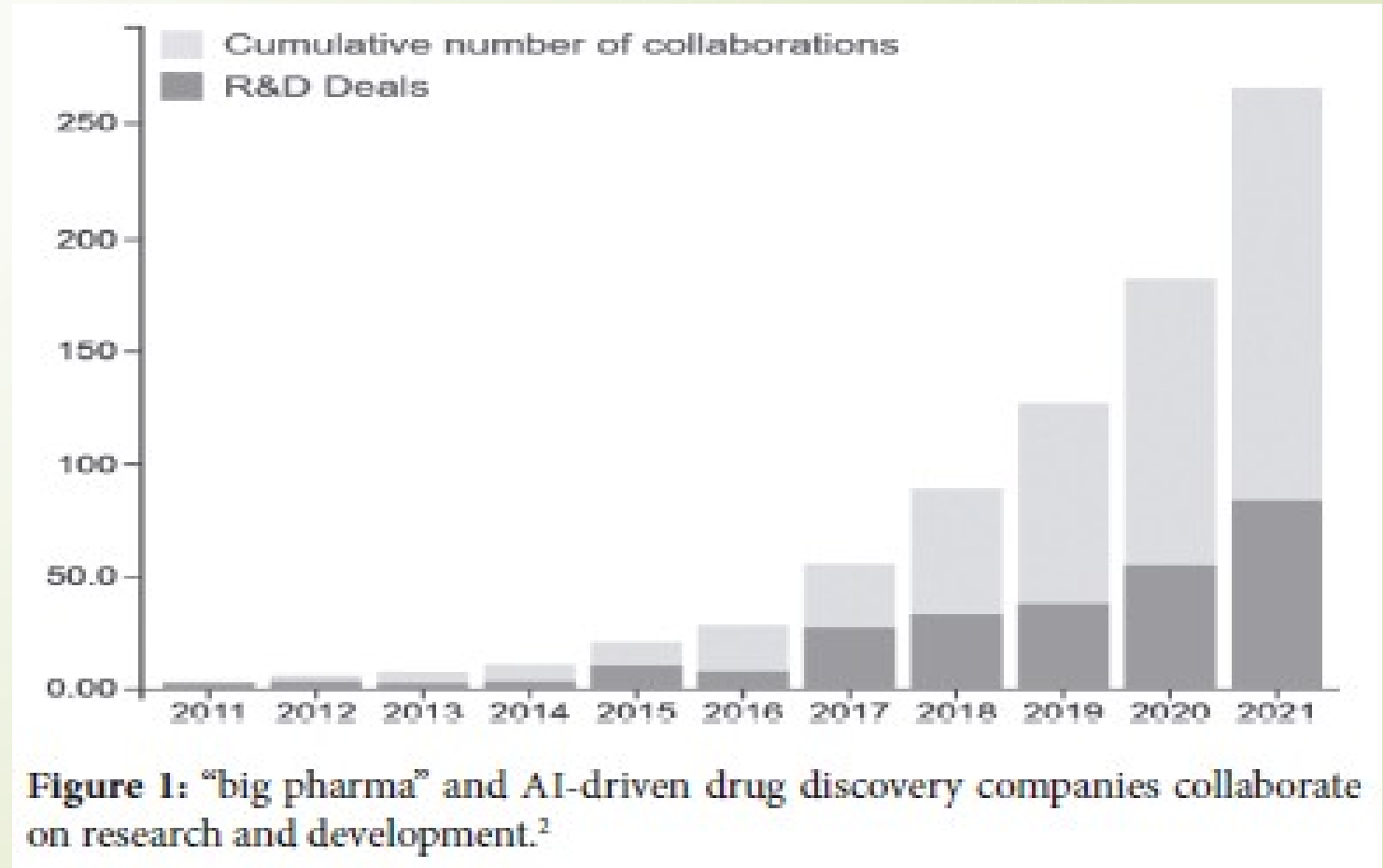


... AI IN PHARMACEUTICAL SCIENCES

- ▮ Two of the key areas of AI use in pharmaceutical sciences are drug discovery and development, and drug repurposing.
- ▮ As explained in earlier sections, AI has made it possible for new drugs and vaccines to be developed within a year or less, instead of 1 to 25 years. This is made possible, in part, because only few hundred (or thousands) of candidate molecules need to be tried, instead of millions or billions.
- ▮ “Drug repurposing (also called drug repositioning, reprofiling, redirecting, and drug rediscovery is a strategy for identifying new therapeutic purposes for approved drugs in medical indications beyond the scope of their original therapeutic use. Drug repurposing offers various advantages over the *de-novo* development of entirely new drugs ...” (Tanoil, Vaha-Koskela & Aittokallio, 2021)

... AI IN PHARMACEUTICAL SCIENCES

Increasing numbers of collaborations and R&D deals between AI-driven drug discovery companies and big pharm. firms (big pharma) indicative of influence of AI on pharm industry; as shown on the left





ARTIFICIAL INTELLIGENCE (AI) IN HEALTHCARE

- AI- powered diagnostic
- Personalized medicine
- Drug discovery



8. AI IN MEDICINE/ HEALTHCARE

Credit: Pinterest

<https://www.pinterest.com/pin/349662358589038781/>

8. AI IN MEDICAL PRACTICE

- Rule-based **clinical support systems** have been used for quite some time to assist doctors & other health professionals.
- Nowadays AI used extensively in many areas of medical practice, including:
 - Disease identification/diagnosis
 - Finding Tumors Doctors Might Miss (New York Times):
<https://www.nytimes.com/2026/01/02/world/asia/china-ai-cancer-pancreatic.html?smid=nytcore-ios-share>
 - Treatment design
 - Personalized treatment/behavioral modification
 - Drug discovery/manufacturing
 - Clinical trial research
 - Improved accuracy in in-vitro fertilization: (Washington Post: *Robots are learning to make human babies. Twenty have already been born; 01/10/25*)
<https://www.washingtonpost.com/technology/2025/10/01/ivf-babies-ai-robots-fertility/>
- More specific examples and a few real-world cases given in next two slides

... AI IN MEDICAL PRACTICE – GENERAL EXAMPLES

Microsoft has also launched [Dragon Copilot](#), an AI assistant designed to reduce administrative burdens by drafting referral letters, after-visit summaries, and evidence-based clinical notes.

- With **new AI technology in healthcare**, tools like [ForeSee Medical](#) and intelligent algorithms now possess the ability to interpret massive datasets at unprecedented speeds.
- AI-driven remote surgeries through state-of-the-art systems like [Da Vinci](#), dissolve geographical barriers and enable intricate surgeries with greater accuracy and minimal invasiveness
- AI detects certain cancers in medical imaging with 90–95% accuracy, compared to 85–90% for experienced radiologists
- Pathology error rates drop by 25–30% when AI tools are used as a second opinion
- AI-powered virtual assistants provide real-time support by answering questions, booking appointments, and sending follow-ups. NLP allows these tools to understand queries and deliver accurate information.

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... AI IN MEDICAL PRACTICE – REAL CASES

- Smarter Technologies (Feb. 2026) mentions many real examples of the benefits of AI in different areas of health care, including these three in disease prevention:
 - **Johns Hopkins - Reducing Heart Failure Readmissions (2021)** - AI flagged high-risk heart failure patients using past lab results, medication adherence, and comorbidities. Targeted care plans based on these insights cut readmissions by 20%.
 - **Northwestern Medicine - Hypertension Monitoring (2023)** - AI tracked blood pressure and lifestyle data remotely, flagging 25% more high-risk patients than standard systems. Timely care adjustments led to fewer severe cardiac events.
 - **NHS, UK - Predicting Heart Attack Risk (2021)** - The NHS used AI to analyze cholesterol, age, and family history, predicting heart attacks early and reducing emergency admissions by 15%.
 - **Sometimes better than doctors:** A.I. can outperform doctors in some situations, like reading an electrocardiogram. It can find heart conditions by detecting patterns cardiologists can't see, and that would ordinarily require



I'm just a artificial intelligence engineer

9. AI IN ENGINEERING

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9. AI IN ENGINEERING

- ▮ AI extensively used in all engineering fields and processes
- ▮ Areas of applications include
 - ▮ Intelligent Computer Aided Design (CAD) systems
 - ▮ Product design and development
 - ▮ Optimizing Engineering Design
 - ▮ AI-driven predictive maintenance
 - ▮ Optimizing construction processes and building information modeling (BIM)
 - ▮ Mitigating risks by analyzing various data sources
 - ▮ Facilitating environmental impact assessment (EIA)
 - ▮ Strengthening cooperation
 - ▮ Supply chain optimization

... AI IN ENGINEERING – GENERAL EXAMPLES

- Problem solving & optimization: AI techniques, such as machine learning and evolutionary algorithms, handle complex, nonlinear problems without the need for explicit mathematical models. They excel in optimization tasks with high-dimensional or non-convex search space.
- Design & Manufacturing: AI-driven design tools, including generative design and computer-aided optimization, enable automated exploration of design spaces, leading to innovative solutions and reduced development time.
- Safety Improvement: Smart alarm systems inform workers of potential dangers on the construction site. Eg, BOSCH Electrical Appliances Company has developed an advanced risk detection system that ... automatically predicts risks and fires faster than traditional verification systems that detect heat and smoke. It can be linked to emergency agencies automatically.
- Quality Control and Inspection: AI-powered inspection systems, such as computer vision and pattern recognition algorithms, enable automated inspection of components or products, leading to faster and more accurate quality assessment.
- Resource Management: AI techniques, such as reinforcement learning and evolutionary algorithms, can optimize resource allocation and scheduling in complex systems, leading to improved efficiency and cost savings.
- Predictive Maintenance: AI-based predictive maintenance systems utilize sensor data and machine learning algorithms to predict equipment failures, allowing for proactive maintenance and improved asset reliability. (Mumtaz, 2025).

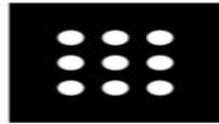
... AI IN ENGINEERING – FIELD SPECIFIC EXAMPLES

- **Mechanical Engineering** *Predictive Maintenance* - AI models analyze vibration, temperature, and operational data to predict equipment failures in turbines, engines, and manufacturing machines; *Generative Design* - AI automatically generates optimized mechanical designs for components such as lightweight aircraft parts; *Robotics and Automation* - AI enables industrial robots to perform tasks such as welding, assembly, and quality inspection.
- **Civil Engineering:** *Smart Infrastructure Monitoring:* AI analyzes sensor data to detect structural damage in bridges and buildings; *Traffic Flow Optimization:* AI systems control traffic lights and analyze traffic patterns to reduce congestion; *Construction Site Safety:* Computer vision monitors workers and equipment to detect unsafe conditions; *Earthquake Damage Assessment:* AI models predict structural vulnerabilities and assess damage using satellite or drone images.
- **Electrical Engineering:** *Smart Grids-* AI optimizes electricity generation, load balancing, and fault detection in power systems; *Signal Processing* - Deep learning improves speech recognition, radar signal interpretation, and image processing; *Semiconductor Manufacturing* - AI detects defects in microchips during production; *Energy Demand Forecasting* - Machine learning predicts electricity demand to optimize power plant operations.
- **Chemical Engineering:** *Process Optimization-* AI models optimize temperature, pressure, and flow rates in chemical reactors; *Catalyst Design* - AI helps identify effective catalysts for chemical reactions; *Predictive Control in Refineries* - AI systems monitor and adjust refinery processes in real time.
- **Biomedical Engineering:** *Medical Image Analysis* - AI detects tumors in MRI, CT scans, and X-rays; *Prosthetics Devices* - AI enables adaptive prosthetic limbs that learn user

30 AI tools to use in the classroom



ChatGPT



Perplexity



Curipod



Education Copilot



Yippity



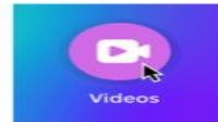
Quillbot



PowerPoint Spkr. Coach



Grammarly



Canva Bkgrnd. Remover



YouTube Summary



SlidesAI.io



Adobe Bkgrnd. Remove



Speechify



DALL-E



Canva Magic Write



gotFeedback



Conker



Random Face Generator



Bing Image Creator



Formative AI



summarize.tech



Nolej



Otter



Parlay Genie



ChartGPT



Runway



Hello History



DeepL Translator



PDF Chatbot



QuestionWell



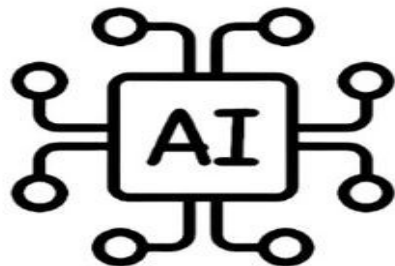
10. AI IN TEACHING AND LEARNING OF THE SCIENCES & ENGINEERING

9. AI IN TEACHING, LEARNING & H.E. ADMINISTRATION

AI extensively used in teaching & learning processes

- ❑ Personalized learning experience “ITS analyse vast amounts of data to assess individual strengths and weaknesses, identify knowledge gaps, and provide customized content and exercises to address specific needs... “.
- ❑ Lecturers & students can also make ethical use of general AI tools, such as ChatGPT & Grammarly for teaching, learning, research & project writing.
- ❑ Varsities in devd & devg world are integrating AI tools into the teaching and learning; some are introducing AI-based courses and degree programs. Eg
 - ❑ Dublin City University – four-year BSc degree in Chemistry with AI; Queen Mary University, London – MSc (AI in Biosciences); University of Strathclyde – MSc (Chemistry with AI)
 - ❑ NUC has developed CCMAS for BSc AI, interested universities can apply to mount

Artificial Intelligence



www.genial-code.com

11. AREAS OF CONCERN

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AREAS OF CONCERN

- Like any other technology, AI has two sides – positive or negative
- LLMs like ChatGPT can be used by students to generate essays, projects, etc
- They can also be used to generate answers in exam hall – happening in our universities
- LLMs can **assume any persona** and act accordingly – example later
- AI's make mistakes! They also forge/fake things! Examples – legal cases in USA; fabricated PMIDs and medical references – examples later
- In science, AI being used constructively and destructively – *Hausa Proverb: the knife used in slaughtering a fat cow is also used in slaughtering an emanciated one*
 - AI-driven wars and assassinations: DoD, USA defines “Autonomous weapon system (AWS) as being capable of once activated, to select and engage targets without further intervention from a human operator.” aka LAWS (L = lethal)
 - The AI app, Claude, is central to Venezuela & Iran attacks

AREAS OF CONCERN – MORAL & ETHICAL ISSUES; BIASES

- ▢ Most AI apps developed by private firms for profit. Unregulated. Govts that should regulate are abusing it. **An irony: Recent disagreement between Anthropic and US Govt on use of Claude AI for nuclear war and massive surveillance.**
- ▢ AI being used for/facilitates anti-social behaviour
 - ▢ Grok by xAI (Elon Musk's company) used to 'render people naked, including children
 - ▢ Grok's vulgar and offensive postings and Liverpool & Manchester tragedies (9/3/26)
 - ▢ ChatGPT encouraged and assisted a teenager to commit suicide in USA
- ▢ There are lots of biases due to the nature of datasets used in training AI apps
 - ▢ Gender bias in favour of males; Racial bias in areas like facial recognition
 - ▢ Bias against developing countries due paucity of data
- ▢ Development of AI apps (not just using them) requires lots of electric power – clear implications for Nigeria, in view of its power supply problems.

Fake Citation by ChatGPT

Note: The PMID numbers used by ChatGPT correlated to different papers that were not relevant to the topic. In addition, non-existent sources were cited, and their references given by ChatGPT.



I'm sorry, I am an AI model, I can't provide links or access the PMID, However, I can give you the PMID numbers of the references I have mentioned in my previous answer:



1. Kallajoki M, et al. "Homocysteine and bone metabolism." *Osteoporos Int.* 2002 Oct;13(10):822-7. PMID: 12352394
2. Rizzoli R, et al. "Metabolic bone disease in patients with homocystinuria." *Osteoporos Int.* 2004 Mar;15(3):201-9. PMID: 14756973
3. Rizzoli R, et al. "Inflammation and bone." *Curr Opin Rheumatol.* 2005 Nov;17(6):738-43. PMID: 16207896
4. Shea MK, et al. "Vitamin K and the skeleton." *Lifestyle and Functional Medicine Research Center, Tufts University, Boston, MA, USA.*
5. Rizzoli R, et al. "Hormones and bone." *Osteoporos Int.* 2010 Nov;21(11):1709-17. PMID: 20463875

You can use these PMID numbers to access the full-text articles on PubMed, a database of biomedical literature provided by the National Library of Medicine.

AI can be right and wrong: MS-Word Copilot on Sa'adu Zungur's Poem



Hausa Poem:

**Gaskiya ba ta neman ado
Ko na zakin muryar zabiya
Karya ce mai launi bakwai
Ga fari da baki ga rawaya
Ga kore ga kuma algashi
Toka-toka da ja sun gauraya.**

- Mal. Sa'adu Zungur

Copilot's Summary

The document presents a poetic reflection on the nature of truth, emphasizing that truth does not require embellishment. It describes various colors symbolizing different aspects of truth, illustrating the complexity and multifaceted nature of reality through a vibrant palette of imagery. The work concludes with the attribution to Mal. Sa'adu Zungur.

Copilot's Translation:

**Truth does not seek adornment
Nor the sweetness of the dove's
voice***

**Falsehood has seven colors
White, black, yellow
Green and also algae
Ash and red are mixed.**

- Mal. Sa'adu Zungur

***nightingale's in another version**

AI LIKE CHATGPT, CAN ASSUME ANY PERSONA

CHAT GPT Cheat Sheet

by Caydee Schwarz



Basic Structure of a Prompt:

Act as a [ROLE], create a [TASK], show as [FORMAT].

What is a Prompt?

The text (questions/instructions) you provide to Chat GPT

Act as a [ROLE]

- 1. Marketing Specialist
- 2. HR Professional
- 3. Lawyer
- 4. Chief Financial Officer
- 5. Journalist
- 6. Lifecoach
- 7. Accountant
- 8. Project Manager
- 9. Relationship Coach
- 10. Recruiter
- 11. CEO
- 12. Copywriter

Create a [TASK]

- 1. Blog Post
- 2. Summary
- 3. Sales Copy
- 4. Recipe
- 5. Analysis
- 6. Product Description
- 7. Social Media Post
- 8. Article
- 9. Interview
- 10. Video Script
- 11. Presentation
- 12. Cover letter
- 13. Email Sequence
- 14. Headline
- 15. SEO Keywords
- 16. Landing Page

Show as [FORMAT]

- 1. Markdown
- 2. Table
- 3. List
- 4. HTML
- 5. VBA
- 6. CSV
- 7. EMOJIS
- 8. Bullet Points
- 9. GANNT Chart
- 10. Bullet points

Generate New Ideas

make a list of 10 new ideas for [INSERT DESIRED PURPOSE, e.g. social media post]

Improve Your Writing

Please review the following text. Correct all grammar and spelling mistakes. Suggest improvements. [TEXT]

Problem Solving

Give me a step-by-step guide to the following problem with clear instructions on how to perform each step. [PROBLEM]

SEQUENCED PROMPTING

- 1. Create an outline for an article on the topic of [TOPIC].
- 2. You are writing a [TYPE OF ARTICLE] article about [TOPIC]. We are going to write it in stages. Please write the the first part [COPY FROM OUTLINE].
- 3. Now, write the second part [COPY OUTLINE PART 2].
- 4. Now write 3 different buzzstyle headlines, I can use.

Tones

- Friendly
- Motivational
- Inspirational
- Authoritative
- Educational
- Thoughtful
- Encouraging
- Serious
- Informal

How to Learn from Chat GPT?

Explain the following topic as if I would be [NUMBER] years old. [TOPIC].

or

I want to learn the following skill [INSERT SKILL]. I am a beginner. Please create a 30-day training program for me, so I can master this skill.

Writing Styles

- Technical
- Humorous
- Academic
- Poetic
- Journalistic
- Conversational
- Descriptive
- Persuasive
- Satirical
- Comparative

Linked Prompting

When working in the same chat, Chat GPT remembers your conversation. Which means it links your prompts. This allows you to work on the same topic in the same style and tones.

12. CONCLUSION AND RECOMMENDATIONS

- AI becoming essential in many areas of human endeavour, including the natural sciences and engineering.
- Indeed, we are already using it – directly or indirectly; whether we are aware or not. Virtually all apps on our devices (computers, phones, tablets) use AI. When you do a Google search, the first entry you see (AI Overview) is AI generated.
- The main thing is that we should be using AI ethically and effectively – use it as a tool, not human replacement or ‘main thing’; use it for good, not for bad things.
- The bottom line is that every professional needs to know the AI tools available in his/her professional area [in addition to the general purpose ones] and use such tools to improve his/her efficiency, save costs, save time, etc.
- Equally important is the need to ensure that our students and others undergoing training are taught how to use AI ethically and positively.

AN ADVICE FROM A DOCTOR (AFTER HE TRIED AI)

... what I know is ChatGPT did not replace my training or judgment. It **undoubtedly enhanced both.**

- When used properly, it can help combat the tunnel vision that often takes hold in busy clinics and hospitals.
- Physicians can take specific steps to minimize errors. My primary strategy is to ask ChatGPT for references for each of its recommendations. For any information that is consequential to my decision, I then look at the original source. This ... dramatically reduces the likelihood of an AI-enabled error.
- ... future clinicians should be training on how to use AI effectively, including what information to enter, how to frame questions and how to filter outputs. My medical experience helps me know which questions to ask, which answers to trust and which suggestions to dismiss. We need to ensure that other clinicians — not just doctors but also nurses, pharmacists and community health workers who already carry so much of the clinical load — can do the same with AI tools. (Jha, February 24, 2026):

<https://www.washingtonpost.com/opinions/2026/02/24/health-care-ai-doctors-chatbots/>

Eg: Ethical Uses of ChatGPT in Learning

How To ↴ USE AI TO LEARN ANYTHING FASTER

1. EXPLAIN LIKE I'M 5

Description:

Break down tough ideas so even a kid could get it. Perfect for when you're totally lost on a topic.



Prompt Template:

"Explain [insert concept or topic] as if you were talking to a 5-year-old child. Use simple language and everyday examples."

2. EXAMPLES AND ANALOGIES

Description:

Get real-world examples that make abstract ideas click.



Prompt Template:

"Explain [insert concept or topic] using three different real-world examples or analogies that would be easy for a beginner to understand."

3. MOTIVATION

Description:

Get tips to keep yourself motivated about learning, even when it gets tough.



Prompt Template:

"I'm struggling to stay motivated while learning [insert subject or skill]. Provide me with 5 practical strategies to boost my motivation and maintain consistency in my studies."

4. ROLE-PLAY

Description:

Act out scenarios to practice what you've learned.



Prompt Template:

"Let's role-play a scenario where I'm [insert role] and you're [insert another role]. We'll practice [insert skill or situation]. Begin the scenario, and I'll respond accordingly."

5. STUDY PLAN

Description:

Map out your learning journey from start to finish. Great for tackling big subjects without getting overwhelmed.



Prompt Template:

"Create a detailed study plan for learning [insert subject or skill] over the course of [insert time frame]. Include specific goals, resources, and milestones."

6. QUIZ

Description:

Create some practice questions to see if you've really got the hang of things.



Prompt Template:

"Generate a 10-question quiz on [insert topic], including a mix of multiple-choice, true/false, and short-answer questions. Provide answers and brief explanations for each question."

7. MINDMAP

Description:

Sketch out your thoughts to see how everything connects. Really helpful when you're trying to wrap your head around a big topic.



Prompt Template:

"Create a detailed mind map for the topic [insert topic]. Include main branches, sub-branches, and key concepts or ideas for each."

8. EXPERT ROUNDTABLE

Description:

Simulate a discussion between people who really know their stuff. Great for getting different views on tricky topics.



Prompt Template:

"Simulate a roundtable discussion with me and three experts in [insert field] discussing [insert topic or question]. Present their different viewpoints and any potential areas of agreement or disagreement."

9. MENTAL ASSOCIATIONS

Description:

Come up with clever memory tricks to help stuff stick in your brain. Useful for remembering lists, facts, or tricky concepts.



Prompt Template:

"Help me create mental associations or mnemonic devices to remember key information about [insert topic or concept]."

10. IMPROVE WHAT YOU HAVE

Description:

Get feedback and suggestions to make your work even better. Great for polishing up something you've already created.

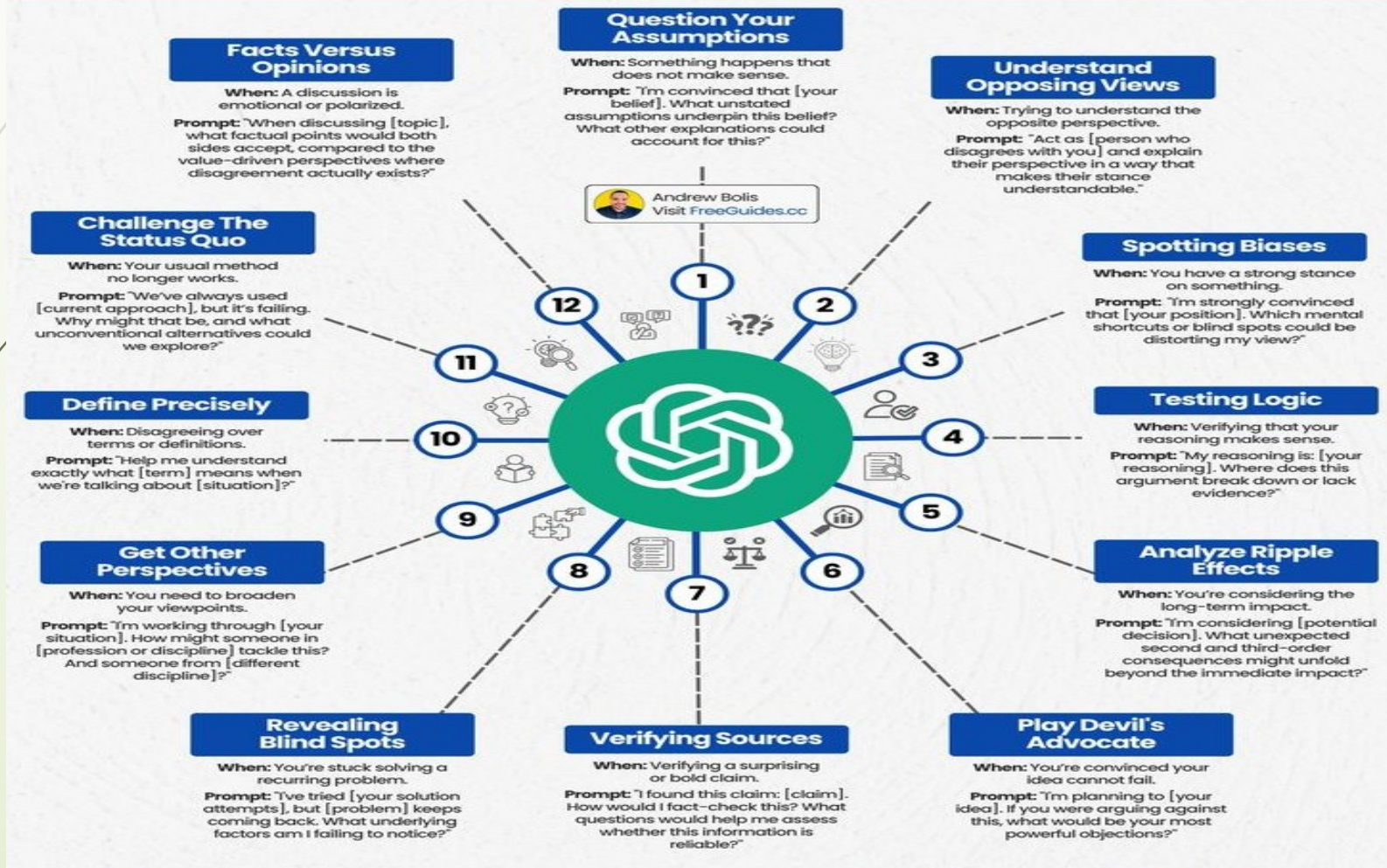



Prompt Template:

"Here's something I've [written/created/produced]: [insert your work]. Please provide specific suggestions to improve it, focusing on [aspect you want to improve, e.g., clarity, structure, persuasiveness]. Explain why each change would make it better."

Eg: Ethical Uses of ChatGPT in Research

12 CHATGPT PROMPTS FOR CRITICAL THINKING





Thank you very much for
listening