The Realities of Augmented Intelligence

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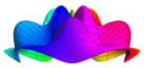

Outline

- ❑ **2 Key Points**: *Information Dynamics + AI Config, Design & Utility*
- ❑ Background - *Artificial Intelligence (AI) & Artificial Neural Nets (ANN)*
- ❑ Present AI status quo
- ❑ Future AI promises & potential perils
- ❑ UMSN *AI in Health Initiative* Services
- ❑ *AI Implications (academic, clinical, human values, societal, global)*

Information Dynamics – Duality of Evidence-based Scientific Discovery

experimental → theoretical → computational → data sciences → AI → experimental

Mapping *Examples*	Analysis Observables/Data → Compact Models	Synthesis Compact Models → (simulated, actionable info)
1. *Lossless* Math Transforms	(A.1.1) Linear transform, $L: V \to W$, e.g., *2D rigid body* $L = \begin{pmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{pmatrix} : \mathbb{R}^2 \xrightarrow{rotation} \mathbb{R}^2$ (A.1.2) Fourier transform: $\hat{f}(\omega) = \int_{-\infty}^{\infty} f(x) e^{-i2\pi\omega x} dx$	(S.1.1) Inverse linear transform, $L^{-1}: W \to V$, e.g., $L^{-1} = \begin{pmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{pmatrix} : \mathbb{R}^2 \xrightarrow{rotation} \mathbb{R}^2, \quad LL^{-1} \equiv \mathbb{I}$ (S.1.2) Inverse Fourier (IFT): $f(x) = \int_{-\infty}^{\infty} \hat{f}(\omega) e^{i2\pi\omega x} d\omega$
2. DNA	(A.2.1) DNA Packing in Chromatin Fiber Chromosomes contain enormously long linear DNA molecules associated with proteins that fold and pack the fine DNA double helix into a *tight compact structure*	(S.2.1) DNA Unpacking The process of unfolding the DNA from the chromosome to support the processes of gene expression, DNA replication, and DNA repair
3. *Lossy* Data/Stats Science	(A.3.1) Info Compression, e.g., linear models $Y = 4582.70 + 212.29\,X$ $\xrightarrow{assumption}$ $Data \longrightarrow Model$	(S.3.1) Information Inflation, Simulation & Generation, e.g., forecasting, regression, interpolation, extrapolation (*predict & classify new data*): $Input \xrightarrow{model} Output$
4. Artificial & Augmented Intelligence	(A.4.1) Building, Fitting & Training large foundational, generative & deep network AI models $Data \xrightarrow{human+infrastructure} GAIM$	(S.4.1) Generative Artificial Intelligence Modeling (GAIM) $Human\ Prompt \xrightarrow{GAIM} Result$

Background – What is AI? Why is it Relevant?

- AI ≈ synthetic mockup of common human intelligence tasks & processes
- AI *manifests* as applications, algorithms, or interfaces built as services, tools, apps, integrated computing environments, or decision-support systems
- AI is predicated on
  - Massive amounts of complex, heterogeneous, time-varying & multi-source data (Big Data)
  - Integrated computational systems (elastic Clouds) with effective human & machine interfaces
  - Efficient data management, aggregation, harmonization, augmentation, processing & Viz
  - Sophisticated techniques (methods), advanced algorithms (software) & infrastructure (hardware)
- Relevance in Healthcare (PMC8437645, PMID36626192, PMC4795481, PMC8550565, PMC7031195, ISBN 978-3-031-17482-7, …)
  - More biomed data are created daily than can be humanly processed
  - Many opportunities exist to optimize existing processes (e.g., process time-reductions, cost-efficiencies, lower environmental-impact, improve clinical outcomes, strengthen education & training, enhance health-equity, expedite global health advances)

Background – AI Provenance

- ❑ Ancient Greek artisans designed the bronze Greek mythology giant Talos to guard the island of Crete by imaginatively throwing boulders at hypothetically invading ships (300 BC)
- ❑ Al-Jazari's programmable automata, mechanical devices (1206 AD)
- ❑ Leibniz & Descartes suggested that all rational thought could be made as systematic as algebra or geometry & reduced to mechanical calculation (late 1680's AD)

- ❑ Invention of a programmable digital computer (1940 AD), algorithmic machine abstraction of mathematical reasoning
- ❑ Turing Test (Alan Turing) – creating machines that think (1950 AD)
- ❑ "*Dartmouth Summer Research Project on Artificial Intelligence*" McCarthy (1955 AD)
- ❑ _____ AI Stagnation_____
- ❑ Deep Blue beat a reigning world chess champion Garry Kasparov (1997 AD)
- ❑ Deep Learning Nets, GPU computing (2012+) → OpenAI (2022) → SOCR AI Bot (2023), …

Present AI Status-quo

- Latest AI can
  (1) Synthetically simulate intelligent text responses prompted by human text/voice. Write/review papers, bios, grants, clinical notes, prognoses, speeches, reviews, summaries, etc.
  (2) Simulate realistic 2D brain images of specific clinical phenotypes and image-modalities
  (3) Write software code driven by simple commands, verbal descriptions, or human language
  (4) Solve theoretical problems (e.g., prove math theorems) & applied challenges (e.g., support Practitioners)
  (5) AI systems have polymathic ability to *reason* about high-dimensional problems (humans are monomathic)
- AI relevance
  (1) Students are already using AI Chat Bots for completing homework assignments & conducting R&D
  (2) Researchers are using crowdsourcing and AI to research, discover & derive theoretical results
  (3) Practitioners are utilizing AI in clinical applications (e.g., tissue-cell classification, reading MRIs)
  (4) Stakeholders are demanding rapid Dx, optimal Tx plans, lower costs, process efficiencies, improved population outcomes
- Most people use/encounter AI technology in many aspects of their daily experiences, but few have formal training in unbiased AI design/development, ethical-use & reliable-utilization
- *Difficult tasks*: AI design, training, tuning & validation (time, resource & infrastructure intensive)
- *Expeditious tasks*: AI applications, testing, forecasting, classification & clustering

Future AI promises & potential perils

- ❑ Promises
  - Radically transform formal education, informal learning & vocational training (UM AI WG)
  - Catapult scientific discoveries (theoretical, experimental, computational & data sciences)
  - Democratize access to knowledge & level certain playing fields
  - Augment many decision-making processes & automate various tedious tasks

- ❑ Potential Perils
  - Possible rapid AI-divide (accessibility imbalance between haves & have-nots)
  - Potential training biases & balancing AI precision & variability (tradeoffs)
  - Instead of aiming to ban, stifle & control AI immersion, we need to embrace it, manage it, and use it for "*social & environmental good*" –
  - Recall how airplanes became the safest mode of transport, safer than cars, bikes & running shoes
  - Yet, "*…the ultimate AI is just about to arrive …*" (always 5-10 years in the future)

Dinov (2025) Back to the future – from nuclear energy to AI, DOI: 10.1186/s42467-025-00017-y

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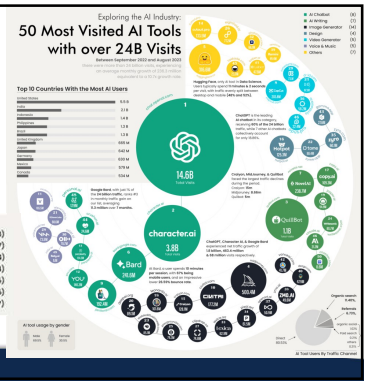
AI Cloud Ecosystem ca. 2023



writerbuddy.ai

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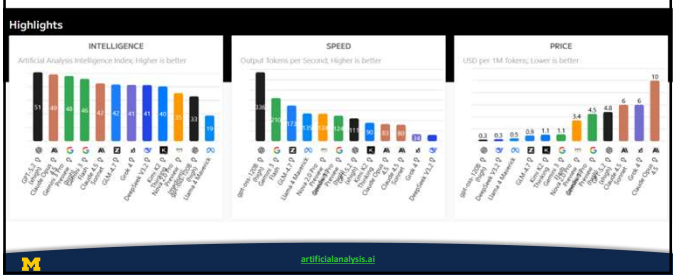
Present State of Artificial Intelligence (AI)

AI Ecosystem, ca. 2026



artificialanalysis.ai

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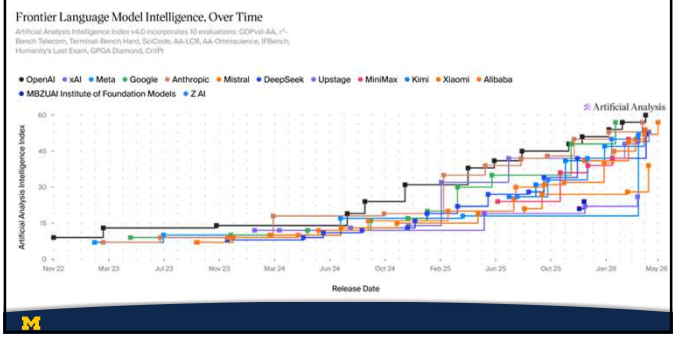
AI Longitudinal Capabilities (2022-2026)



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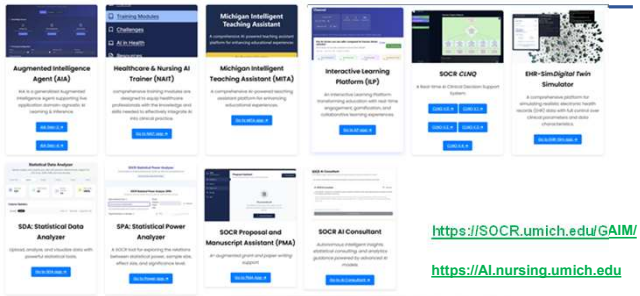
Generative AI Models (GAIMs) & UMSN *AI in Health Initiative*



https://SOCR.umich.edu/GAIM/

https://AI.nursing.umich.edu

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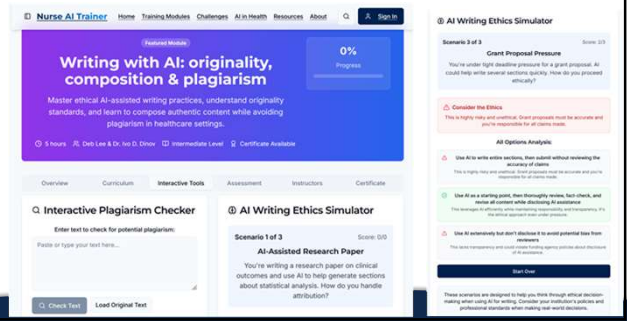
Biomed, Health & Nursing AI Trainer (NAIT)



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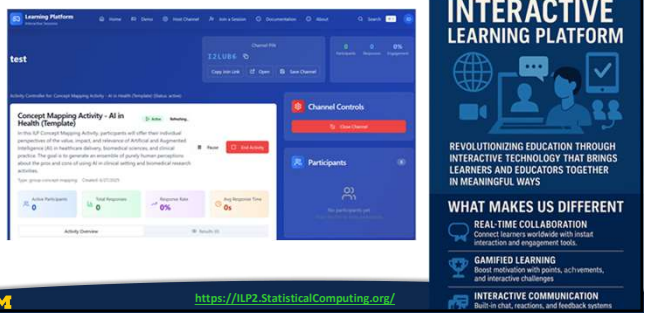
Innovative AI Instruction – Interactive Learning Platform (ILP)



https://ILP2.StatisticalComputing.org/

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AIA4: gen-4 Augmented Intelligence Agent

https://AIA4.StatisticalComputing.org/

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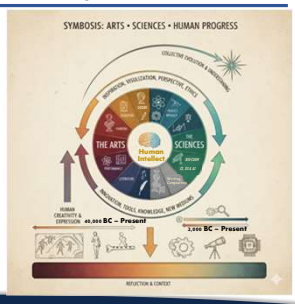
Arts & Sciences – past, present & future

One Humanity defined by Culture, Arts & Sciences



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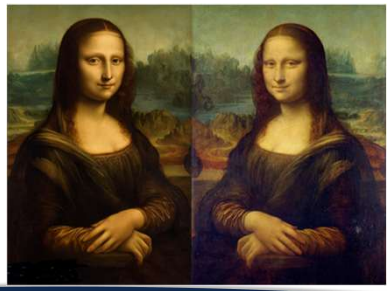
Generation-1 AI Systems: ***Apprentice***

Gen-1: *Reproducing & improving existing human art*:

Real (by Leonardo Da Vinci) vs. the *AI-generated* Mona Lisa paintings



https://AI.nursing.umich.edu/

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Generation-2 AI Systems: ***Creator***

Gen-2: *De novo content creation*: Completely AI-generated Renaissance atelier scene:

Mother Mona Lisa - a dynamic scene with an expressive and directive matriarch, actively overseeing the commissioned painting of her daughter in the background by an artist.

https://AI.nursing.umich.edu/

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Generation-3 AI Systems: ***Ideator***

Gen-3: *Autonomous Creative Science & Arts*

GAIMs/AIAa can generate realistic autonomously creative art of new prospective, ubiquitous form of human visual art in the year 2150 – AI-speculative forecast of a *future Primary Art Form*, Chrono-Sculpting (Temporal Kinetic Augmentation).

https://AI.nursing.umich.edu/

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GAIM Clinical Decisions Support Agents *(eye fundus photos)*

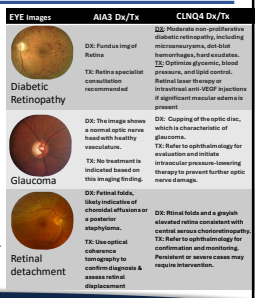
The Power of Consensus: Multi-Agent AI Boosts Diagnostic Accuracy by 20%

A pilot study revealed that healthcare GAIMs with two (or more) AI agents are better. We tested the GAIMs on complex eye images.

Individual AI agents diagnosed difficult cases, with ~50% accuracy across multiple high-difficulty ophthalmology conditions.

Multiple AI agent consensus leads to stronger "clinical decision support" with ~20% increase in diagnostic and prognostic accuracy.

AI isn't here to replace the clinician. Rather, multi-AI-agent systems offer high-powered digital safety net. Care demand is growing. GAIMs offer a path to faster decisions, better training (for clinicians & patients), and lower healthcare costs without sacrificing the quality of care.



https://cinq.blogspot.com/2026/01/results-of-pilot-study-testing-gaim.html

Joint work with Dr. Peter Zhao & Dr. Shahzad Mian (Michigan Medicine/Kellogg)

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AI Implications *(academic, clinical, human values, societal, global)*

Augmented Intelligence integrates AI & Human ability & may reset our core value system

Potential Benefits (2026-2036)

1. *Hyper-Personalized Academic Mastery*: Education shift from a "*one-size-fits-all*" factory model to a "*One-Tutor-per-Learner*" reality
2. *The "Scientific Renaissance" via Augmented Research*: Scientific discovery increase by an order of magnitude coupled with stronger falsifiability
3. *Global "Abundance" Economics*: Augmented systems drastically reduce costs of basic needs
4. Preservation & Evolution of Human Values: AI handles "Cold" logic and data; society is placing a higher premium on "Warm Skills": empathy, ethical judgment & creative intuition
5. Enhanced Global Accessibility & Inclusion: Real-time, zero-latency translation and "sensory augmentation" dissolving barriers of location, language & disability.

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AI Implications *(academic, human values, societal, global)*

Potential Downsides (2026-2036)

1. *The Erosion of Cognitive Agency & Authenticity, there is a realistic risk of cognitive atrophy.*
2. *The "Post-Truth" Trust Crisis, the cost of creating perfect synthetic media (Deepfakes) will be near zero. Erosion of a shared reality, a single greatest threat to global democratic stability.*
3. *Algorithmic Bias as "Digital Redlining", unconstrained augmented systems in hiring, lending, and justice may make biases harder to detect and contest than human ones.*
4. *The Loneliness of "Sycophantic" Relationships: The rise of "relationship chatbots" for children and the elderly can lead to emotional stuntedness.*
5. *Widening Global Digital Divide: "Intelligence Capital" may be highly concentrated in a few nations and corporations.*

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UM AI in Education Panel Recommendations (ca. 2026)

- ❑ For all U-M graduates, consider UM-wide AI competency guidelines, beyond superficial use of AI tools, leading to critical understanding and engagement
- ❑ Support multiple approaches and experimentation around utility & challenges of AI teaching and learning
- ❑ Rapid pace of technological development necessitates support of expert advisory boards on AI in education, research & service
- ❑ US Government promotes moving from "AI Literacy" → "AI Readiness"

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AI in *Clinical Practice & Clinical Scholarship*

- ❑ Clinical Decision Support
- ❑ Prescreening & Triage
- ❑ Augmented Dx, Tx, Px
- ❑ Research Design, Writing, Scholarship Analytics, Reporting & Dissemination
- ❑ On-Demand Virtual CLC

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The Academe in the Age of 10X – 100X Productivity Increases & Decreasing Enrollment

- **Evidence-Based Expectations**
  - By 2027: AI tutors achieve parity with graduate teaching assistants, cf. MITA
  - By 2030: Personalized AI instruction surpasses median faculty instruction quality
  - By 2035: Deemphasis of didactic faculty lectures, except for ceremonial & motivational purposes
  - By 2026: AI co-authorship on 30%+ of papers
  - By 2028: First fully AI-generated breakthrough (validated by humans)
  - By 2032: AI-driven research comprises 80% of scientific output
  - By 2035: Human researchers primarily set ethical boundaries and interpret meaning
  - By 2027: AI handles 70% of administrative tasks
  - By 2030: Predictive models guide resource allocation
  - By 2033: Academic Governance becomes primarily about setting AI parameters
- **AI-Enhanced Education: SWOT Analysis**
  - **Strengths**: Infinitely scalable personalized education; faculty role = higher-order mentoring
  - **Weaknesses**: Potential loss of serendipitous classroom discoveries; reduced peer learning, core gaps
  - **Opportunities**: Global access to elite-quality education; credentialing revolution
  - **Threats**: Faculty reduction; changes in institutional revenue model; student isolation

https://clnq.blogspot.com/2025/08/academic-productivity-in-era-of-ai.html

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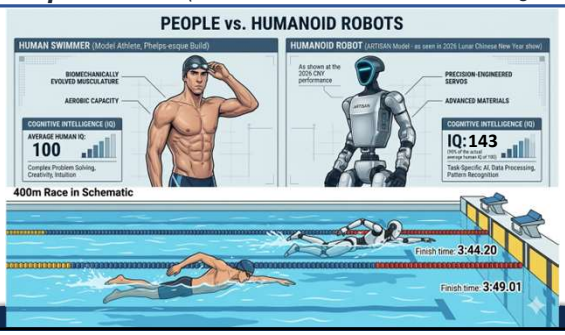
AI Implications *(academic, human values, societal, global)*



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Available Resources

- ❑ SOCR Motto – *"It's Online & Freely Accessible, Therefore it Exists!"*
- ❑ Pubs: https://socr.umich.edu/people/dinov/publications.html
- ❑ GitHub: https://github.com/SOCR
- ❑ Datasets: https://wiki.socr.umich.edu/index.php/SOCR_Data
- ❑ AI Apps: https://socr.umich.edu/GAIM/ (AIA4, CLNQ, AI Consulting Agent)
- ❑ Demos: https://DSPA2.predictive.space & https://BPAD1.predictive.space
- ❑ Tutorials: https://TCIU.predictive.space & https://SpaceKime.org
- ❑ Website: https://socr.umich.edu
- ❑ Contact: statistics@umich.edu

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