Artificial Intelligence Strategy in the U.S. Geological Survey

USGCRP Fall Meeting, September 25, 2024

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U.S. Department of the Interior
U.S. Geological Survey

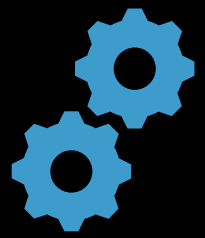
USGS AI Strategy Team Objectives

- Design USGS-specific goals consistent with the Department of Interior AI Strategy (released yesterday at https://www.doi.gov/ai/strategy)
- Recommend methods to *increase broad adoption of AI* in USGS, *support current and future science requirements*, and provide *appropriate sideboards* consistent with national policy

AI Use Case Categories

Hypothesis: each category has different top needs regarding risks and trustworthiness, infrastructure and acquisition, and monitoring and reporting

Research



Operations

Business & work productivity

Research AI Use Cases

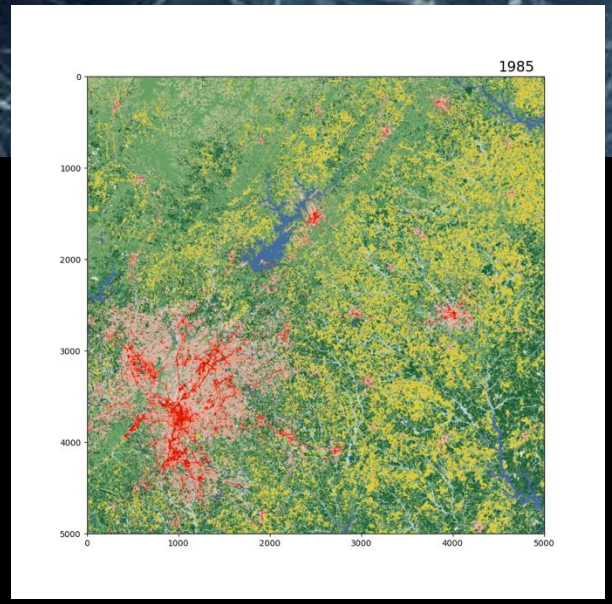
Exploring, expanding, and utilizing the capabilities of AI technology to analyze Earth observation data with a focus on methods innovation, knowledge generation, or environmental decision support.

Examples

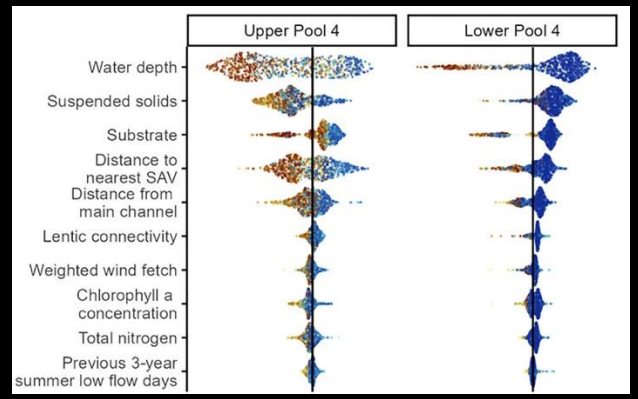
- Improved national land cover mapping
- Unmanned surveys of Great Lakes bottom communities
- Mineral prospectivity modeling
- Hypothesizing key drivers of aquatic vegetation
- Future projections of water quality

Risks: Biases in data or model performance could damage environmental management and stakeholder trust

Benefits: Improve natural resource understanding though predictions, hypothesis generation, and process discovery



AI for next generation of USGS land cover products: LCNext project



Input variables' contributions to AI-predicted presence of submersed aquatic vegetation → hypothesized key drivers
Delaney & Larsen 2023

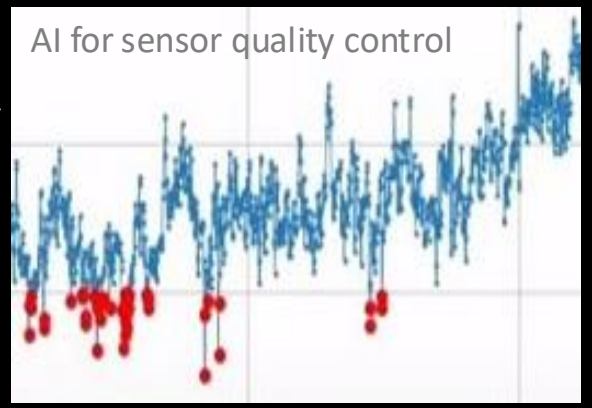
Operational AI Use Cases

Frequently repeated, often real-time production of AI model outputs that are disseminated promptly to the public.

AI links natural science & human behavior models to compute outputs that describe the concept of interest
https://aries.integratedmodelling.org

Examples

- Enhance ongoing USGS data collection and provision (e.g., remote sensing products, sensor data QC)
- On-demand AI to integrate data & knowledge to answer any science question a visitor asks (e.g., effects of a stressor on an endangered species)



Risks: Little to no opportunity to intervene before public access to model outputs

Benefits: Answer more user questions more quickly and accurately

Business & Work Productivity AI Use Cases

Uses of AI to enhance productivity and effectiveness of staff in conducting agency business, including preparing scientific products and managing human, financial, and other resources.

Examples

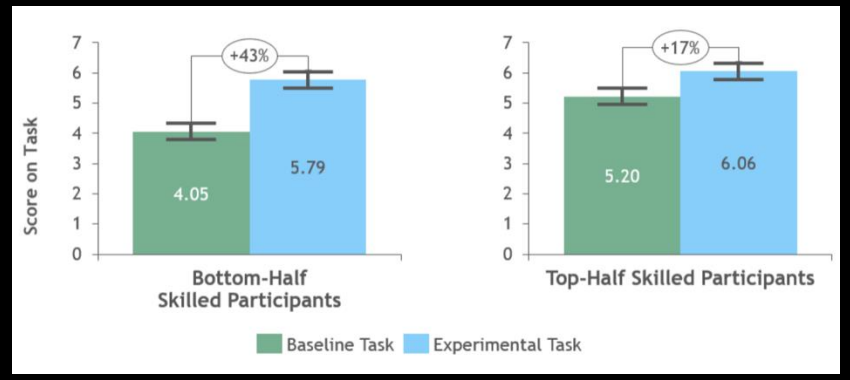
- Draft code, social media posts, or report text
- Summarize and analyze publications, data, maps, and images
- More quickly develop metadata, progress reports, and project docs

Risks: Potential for insufficient human review; reliance on external expertise and services

Benefits: Increased quality, reduced bias, and greater efficiency in delivering on our science mission

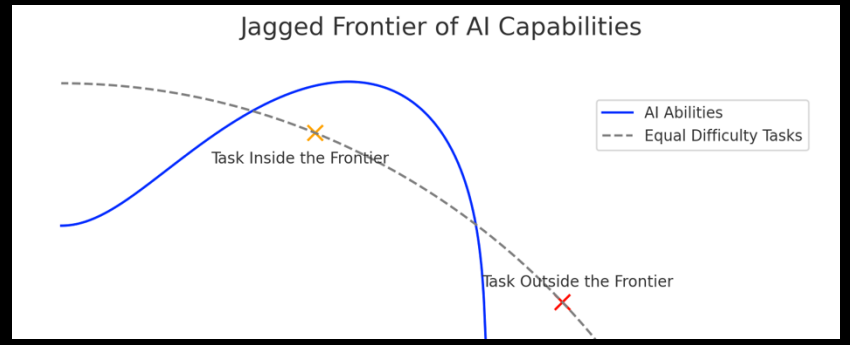
Biggest risk: *not* using AI to enhance our science & work

Dell'Acqua et al. 2023



17-43% performance gains when developing new product ideas with AI support

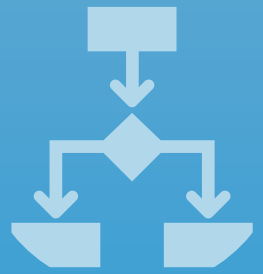
...sometimes!



AI Strategy Draft Goals and Objectives

Develop a Strong AI Workforce

- Attract & Hire New Talent
- Train the Current Workforce
- Retain Talent

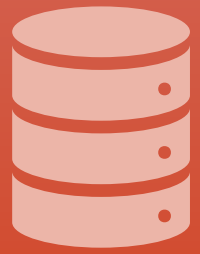


Optimize our Organizational Approach

- Adapt Policies & Procedures
- Communicate & Coordinate
- Govern Effectively

Ensure Responsible & Trustworthy AI

- Manage Risk Comprehensively
- Protect Scientific Integrity
- Ensure Equitable and Trustworthy AI



Modernize Technical Infrastructure

- Upgrade Foundational Infrastructure
- Facilitate Exploration & Discovery
- Share AI Advances

Accelerate AI Adoption & Innovation

- Prioritize and Incentivize AI Adoption
- Support AI Research & Development
- Collaborate with the AI Community

• Facilitate Exploration & Discovery

- Lower hurdles to adoption
- Keep up with rapid advances in AI methods and software
- Keep up with high-performance AI computing technologies

- Govern Effectively

- Promote innovation, provide guardrails
- Top-down policies, bottom-up choices

Blau et al. PNAS 2024

PNAS EDITORIAL

Check for updates

Protecting scientific integrity in an age of generative AI

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Revolutionary advances in AI have brought us to a transformative moment for science. AI is accelerating scientific discoveries and analyses. At the same time, its tools and processes chal

Five Principles of Human Accountability and Responsibility

1. Transparent disclosure and attribution
2. Verification of AI-generated content and analyses
3. Documentation of AI-generated data
4. A focus on ethics and equity
5. Continuous monitoring, oversight, and public engagement

- Adapt Policies & Procedures
- Protect Scientific Integrity

- Existing USGS policies are a strong start
  - Peer review, etc., already promote AI science quality
  - IT, procurement, and data policies already add security
- As AI evolves, additional guidance and policies will be needed

FSP Frequently Asked Questions

FSP: Fundamental Science Practices

Filter Total Items: 4

Year | Location | artificial intelligence

What is generative artificial intelligence (AI) and how can it be used in USGS scientific information products intended for public release? [209]

Generative AI refers to AI systems capable of generating text, images, or other media in response to prompts by the user. [Read more]

Are there any restrictions for using generative artificial intelligence (AI) outputs directly in USGS scientific information products? [210]

Yes, there are restrictions to consider including authorship, images, peer review, and information technology system security. [Read more]

How does USGS ensure the reliability and accuracy of artificial intelligence (AI)-generated outputs? [211]

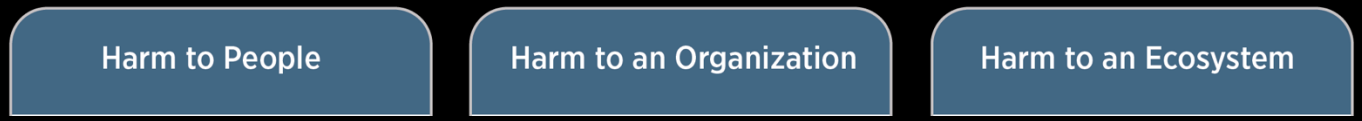
Adherence to FSP ensures all USGS scientific information, including AI-generated outputs, is reliable and accurate. [Read more]

How is unpublished, sensitive, and proprietary USGS information safeguarded when using generative artificial intelligence (AI)? [212]

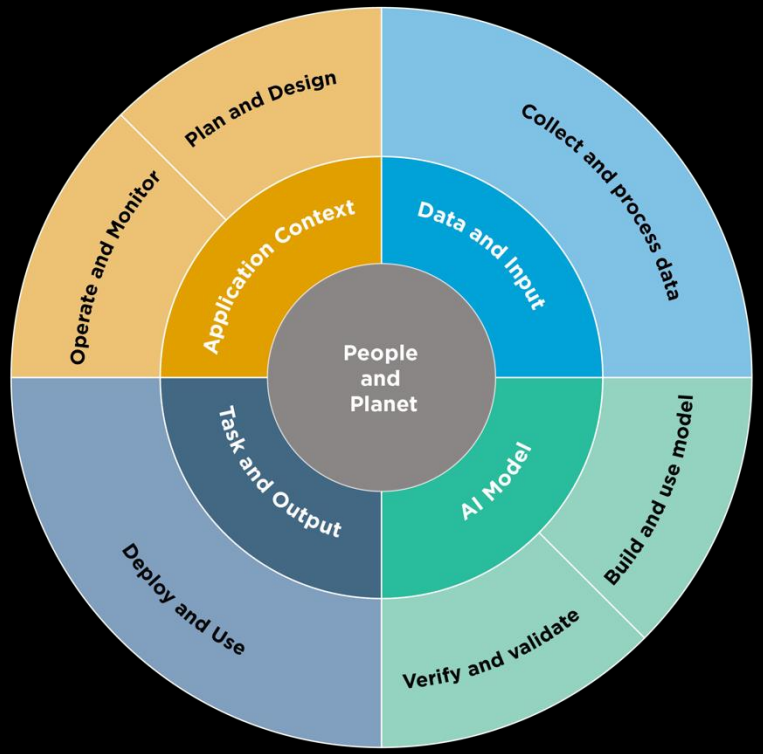
Authors must be aware of implications regarding privacy, confidentiality, and intellectual property rights before they consider using such information in AI applications. [Read more]

• Manage Risk Comprehensively

- Balance the risks and benefits of AI
- In mapping risks, consider:
  - Various harms
  - Full AI lifecycle



From NIST RMF Fig. 1: Types of potential harms related to AI systems



From NIST RMF Fig. 2: AI lifecycle stages

[NIST AI Risk Management Framework (RMF)]

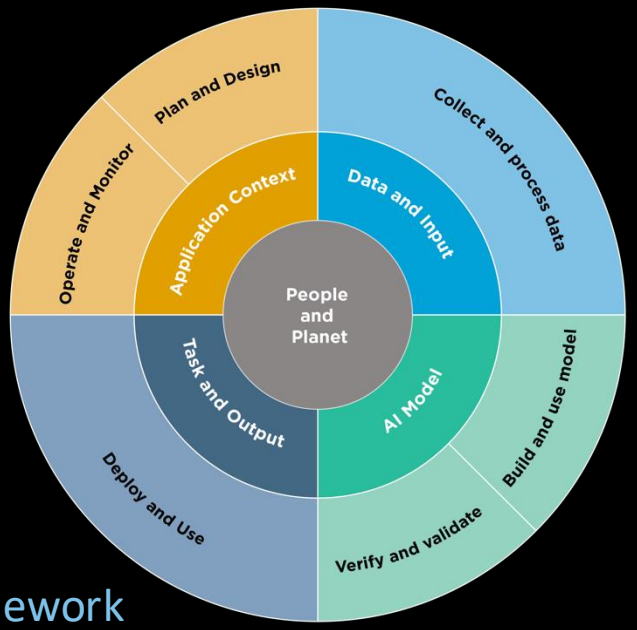
• Ensure Equitable and Trustworthy AI

- Acknowledge non-transparency
- Engage with stakeholders throughout
- Use AI model explanation
- Evaluate AI thoroughly

Take-home: *Engage AI comprehensively*

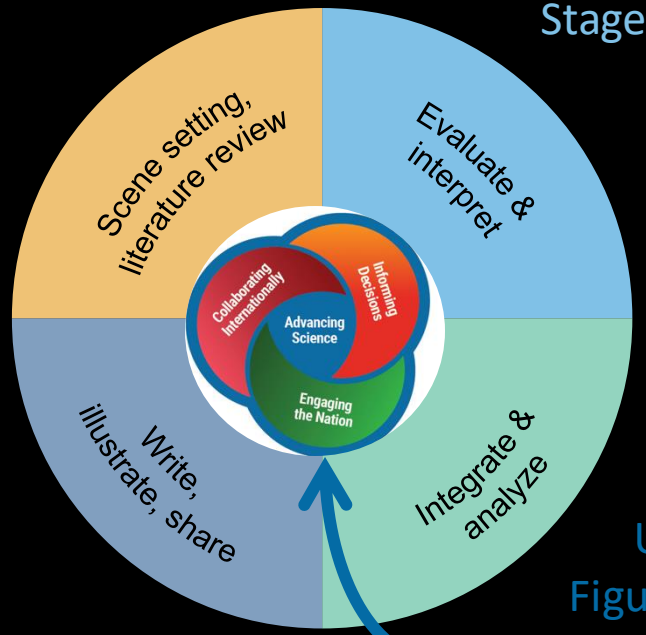
Thank you!

- AI may appear in all stages of the assessment process
- Thus, AI policies, training, and support may be valuable at all stages



NIST AI Risk Management Framework Figure 2: AI lifecycle stages

Stages of assessment



USGCRP 2022-31 Figure 2: Four pillars of USGCRP's Strategic Plan