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VIRTUAL MEETING

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Understanding AI Bias

How It Arises and How to Respond



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Land acknowledgment

I performed the work for this program at Cornell University. Cornell University is located on the traditional homelands of the Gayogoḥó:nq' (the Cayuga Nation). The Gayogoḥó:nq' are members of the Haudenosaunee Confederacy, an alliance of six sovereign Nations with a historic and contemporary presence on this land. The Confederacy precedes the establishment of Cornell University, New York State, and the United States of America. We acknowledge the painful history of Gayogoḥó:nq' dispossession and honor the ongoing connection of Gayogoḥó:nq' people, past and present, to these lands and waters.



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Personal acknowledgment

I research and plan from the perspective of someone indigenous neither to lands on which I was raised nor to those where I now live; whose family had emigrated from homelands that were colonized by other peoples; and who has learned my heritage through written and oral histories, arts, foods, customs, and more. I reflect on my presence on these lands and my participation in this work from the intersection of these perspectives and from research and study of different writings and discussions about knowledge of communities globally.



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Outline: Scaffolded plan

- Introduction: AI in demand, in use, inequity
- AI concepts, technological primer
 - + Recap and reinforce
- AI bias, ethical issues
 - + Recap and reinforce
- Solution building together



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AI: in Demand, in Use, Inequity

We know:

- Depository and other research libraries are now exploring or implementing AI-enhanced processes (machine learning, natural language processing, large language models)

We will see:

- Embedded implicit bias persists in AI applications including tools that engage complex large language models, demonstrated in inequitable outputs



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AI: in Demand, in Use, Inequity

We can then foresee:

- Perpetuated, exacerbated disparities: Incautious AI implementation risks perpetuating human or data-embedded distorted decision-making

We can then foresee:

- Global AI and bias challenges: Those with access to better data, technologies, or algorithmic development, creating differential AI tool quality, perpetuating inequities.



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Seeking Solutions; Seeking Equity

We can ask:

- How can depository and other research libraries plan AI programs, implementations without causing or perpetuating ethical harm?

We can act:

- How can depository and other research libraries act to reduce disparities and build equity in AI solutions, their inputs, and their outputs?



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AI Concepts, Technological Primer

- Artificial Intelligence (AI)
- Expert systems
- Machine learning
- Big data
- Natural Language Processing
- Tokens and Vectors
- Training data
- Large Language Models (LLMs)
- Generative AI
- Transformers, e.g. GPT
- Foundation Models or General-Purpose Models
- AI and Implicit Bias



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AI Concepts, Technological Primer

Artificial Intelligence (AI)

- Decision-making or prediction done by computer algorithm.
- AI has been around for decades.
- Early AI tools largely focused on expert systems: algorithms modelled to replicate the supplied decision-making process of experts. Think automated decision trees, “if this, then that.”



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AI Concepts, Technological Primer

Expert Systems

- An early form of AI.
- Algorithms modelled to replicate the supplied decision-making process of experts. Think automated decision trees, “if this, then that.”
- These are programmed models and do not rely on training data.



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AI Concepts, Technological Primer

Machine Learning

- More recent AI algorithms use machine learning: The algorithm is trained to learn patterns discoverable in datasets (often big data sets).
- Recursive process: use of the algorithm generates more data, and the algorithm evolves as it learns from this data.
- Good machine learning requires regular attention to the quality of data.



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AI Concepts, Technological Primer

Big Data

- Datasets with massive amounts of data, often captured real-world and passively, without attention to contents and accuracy.
- Too big for local problem-solving applications or for humans to derive meaning from.
- Essential for discovering patterns for advanced AI applications.



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AI Concepts, Technological Primer

Natural Language Processing

- Computing processes of sophisticated algorithms trained with text-based big data
- Immense amounts of text data are used as training examples to learn natural language patterns and to be useful to process human text-based inputs.



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AI Concepts, Technological Primer

Tokens and Vectors

- Elements of newer natural language processing methods
- Individual words from input text are converted into tokens
- Tokens are mapped into numerical vectors using positional encoding
- Vectors reflect relevance, context, and import of words as they are used in the input text, or prompt



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AI Concepts, Technological Primer

Training Data

- Vast amounts of data used to develop AI models
- Training data can be captured from real-world use to provide examples of natural language patterns for AI generation of text outputs
- Specialized text data can be used to provide examples of language useful to generate text for specific subjects or uses



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AI Concepts, Technological Primer

Large Language Models (LLMs)

- Sophisticated algorithms that use natural language processing and neural networks to process human text-based inputs, or prompts
- Trained with big data to learn language patterns so they can perform tasks and generate language-like outputs



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AI Concepts, Technological Primer

Generative Artificial Intelligence (Generative AI)

- A sophisticated evolution from machine learning
- Process that allows computers to generate content or outputs in conjunction with user inputs and guidance
- Relies on carefully calibrated combinations of massive amounts of data to appear as if the AI is making (or generating) its own content in its outputs



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AI Concepts, Technological Primer

Transformers, e.g. Generative Pre-trained Transformer (GPT)

- Natural language processing methods that use vectors and immense amounts of training text
- These methods inform models that can predict and generate output text that matches patterns reflected in vectorized input text
- Form the basis of foundation models



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AI Concepts, Technological Primer

Foundation Models or General-Purpose Models

- Widely available and models (LLMs, GPTs) made available to other developers through APIs or open-source
- Trained on broad unlabelled big data
- Developers, platforms, product suppliers can use foundation models to underlie applications or tools for a range of purposes
- e.g., OpenAI's models, Anthropic's models



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AI Concepts, Technological Primer

Implicit Bias and AI

- ML, LLMs, Generative AI center on algorithms with massive data at their core
- ML, LLM models involve recursive learning and data synthesis and reuse
- Early on: academic and scientific research with protocols and ethics
- Embedded biases in data were recognized and techniques used to address potential bias in outputs



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AI Concepts, Technological Primer

Implicit Bias and AI

- More recently: developer philosophy of “move fast and break things”
- Foundation models have been built based on passively gathered real-world training data without attention to accuracy or representativeness
- First machine learning, now generative AI excitement brings wide and rapid adoption of foundation models
- This is despite that developers know little about underlying data and impact on underlying foundation models



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AI Concepts, Technological Primer

Implicit bias is embedded, endemic in widely used AI tools

How might AI implicit bias perpetuate error and inequity?



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Recap and reinforce

Consider:

- How implicit biases can be embedded in an ML process, an LLM, or a vendor- OR government-provided library collection or research database
- Why implicit biases can be intractable and how model use can unwittingly perpetuate them



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AI Bias, Ethical Issues for Depository Libraries

Implicit bias and inequities in AI implementations

- Unmitigated or indiscriminate AI implementations can exacerbate existing inequities
- We can see a potential for adverse ethical consequences from AI use in and by depository and research libraries and the public who rely on them



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AI Bias, Ethical Issues for Depository Libraries

Related global challenges to AI and equity

- More advantaged populations may have access to better quality government data, technologies, or algorithmic development
- This can create differential AI tool quality among different populations, even within a nation
- AI growth and implementations can in turn perpetuate global or inter-community inequities



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AI Bias, Ethical Issues for Depository Libraries

Disparate resources, disparate outcomes

- Disparities in AI processes and training exist in library ecosystems in different communities
- Disparate library resources (tools, people, instruction) can create disparate community information literacy outcomes
- Inequitable resource use and community growth opportunities can result and perpetuate



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AI Bias, Ethical Issues for Libraries

Knowing about the reality of implicit bias in AI

- Consider the tradeoffs
- Compare the promise of AI opportunities with ethical risks associated with rapid implementation of AI tools in depository and other research libraries



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Recap and reinforce

Consider:

- The value and promise of AI implementations in depository and other research libraries.
- How the steady but rapid development of newer AI processes reflects and can perpetuate inequities locally and globally.



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Seeking Solutions

How can libraries and governments act to reduce bias and disparities and build equity in AI solutions, their inputs, and their outputs?



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Seeking Solutions

Why libraries? → Why not libraries, and depository libraries?

- We can access knowledge and share knowledge with the public
- We hold and provide access to government information essential for an informed population
- We can access and apply professional and technical expertise to information
- We draw upon professional ethical standards



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Seeking Solutions–Together

To consider as we make decisions about AI

- How can depository and other research libraries ensure we do not perpetuate inequity from AI bias in our implementations?
- What skills should depository libraries emphasize to equip us to address inequities related to AI bias, and to help our communities to do the same?
- How can we address inequities in research communities, locally and globally, resulting from AI bias?



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Questions & Comments

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