

AI-MINDSET

Artificial Intelligence in Minnesota's Data Science and Emerging Technologies



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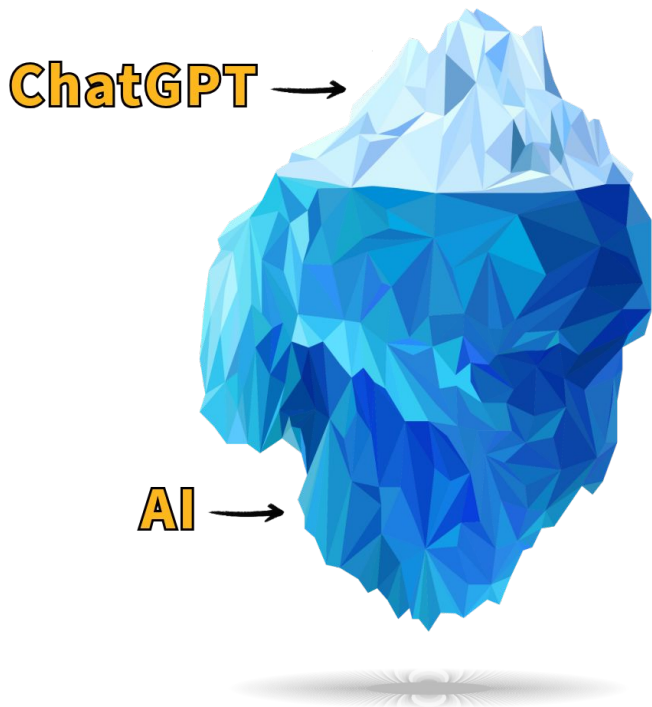


We are at a critical moment with AI

Why are we seeing so much AI now?

The computing power, scale of data, and algorithms developed by broad investment of the 2010's has enabled algorithms to tackle more ambitious problems.

AI will contribute as much as **\$15.7 trillion** to the world economy by 2030*

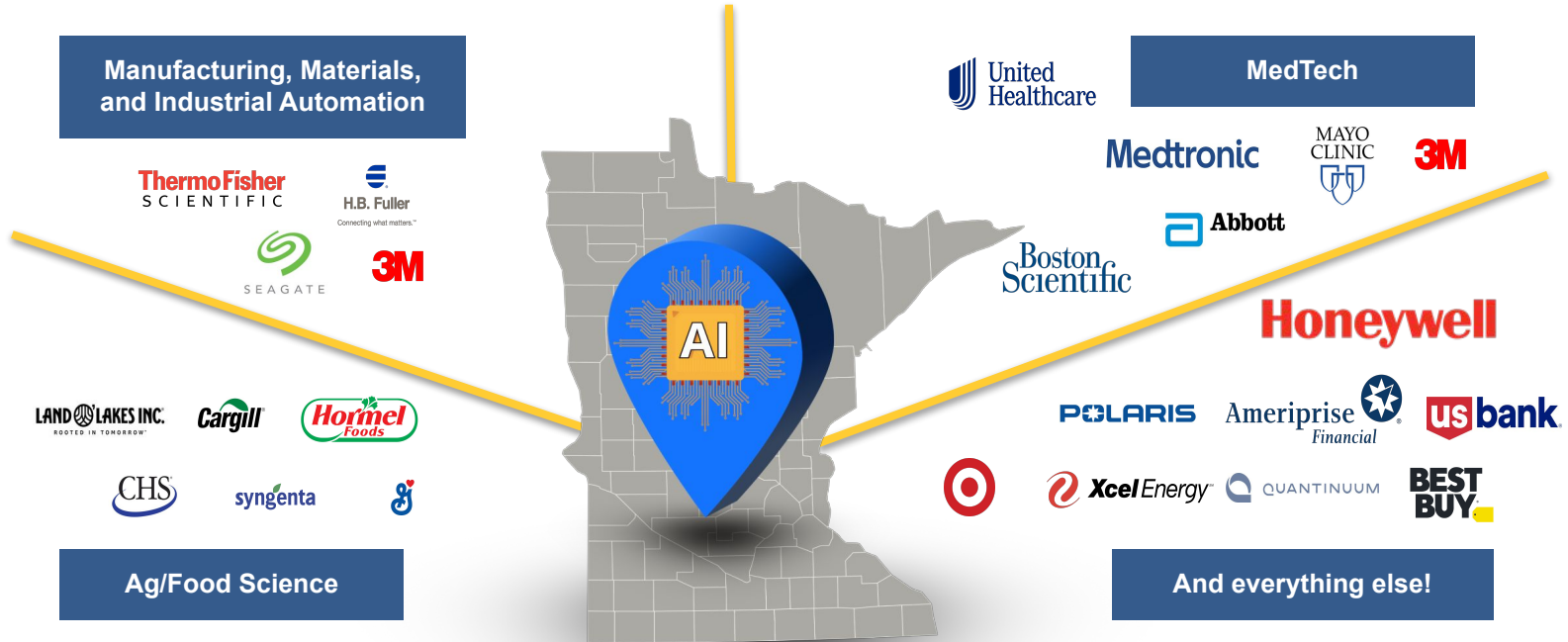


*<https://www.pwc.com/gx/en/issues/data-and-analytics/publications/artificial-intelligence-study.html>



AI will be the Cornerstone of the Economy

EVERY MN industry will be impacted by AI tools and methods



Minnesota Innovation Ecosystem



#1

- Fortune 500 companies per Capita
- Health Technology Cluster in the World

#2

- Medical Devices per Capita
- Best State for economic opportunity

#3

Small-Business
Job Growth
(Minneapolis
Market)

#4

Food Products
Patents Per
Capita

#7

Patents Per
Capita



AI will Level the Playing Field

AI has the potential to **reduce barriers** and expand access in the workforce by

- Reducing bias in hiring
- Making the workplace more accessible to those with disabilities
- Personalized training
- Enabling those with less formal training to take on increasingly complex tasks and meaningfully contribute to work that previously required advanced degrees.



AI will Open Pathways to New Career Options and Assist in Employee Training

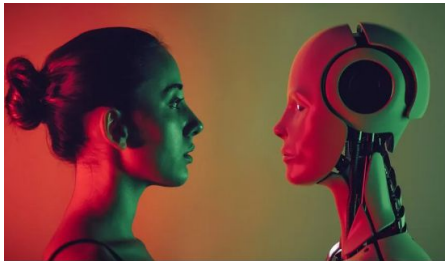
Training and Education

EDITORS' PICK

Mar 30, 2024, 11:44am EDT

5 Ways To Embrace AI To Help You Keep (And Do) Your Job

Forbes



Job transformation & growth



Veterinarian Technician

↑ 13% next decade*



Industrial Machinery Mechanics

↑ 19% next decade*

Complements Minnesota Drive for 5

What is AI?

- A breakthrough advancement that can accelerate human innovation and productivity by
 - ◆ delegating tedious parts of the work to computers
 - ◆ and enabling humans to focus on complex tasks that are beyond AI's current capabilities

“AI, if used well, can assist with restoring the middle-skill middle-class heart of the US labor market that has been hollowed out by automation and globalization”

Economist David Autor (considered as “the academic voice of the American worker”), Star Tribune, April 7, 2024.



AI in our Daily Lives Today

online shopping



intelligent planning assistant

You

My family of 2 adults, 2 kids under 5 are driving to Duluth for the weekend. I want to get a family photo at split rock lighthouse during sunset on one of the days. Could you create an itinerary for the weekend?

Helper not Hazard!

Ring Video Doorbell Wired
See, hear and talk to visitors from anywhere

HD video
Advanced Motion Detection
Real-time notifications

smart home devices



intelligent transportation



Afternoon Activities

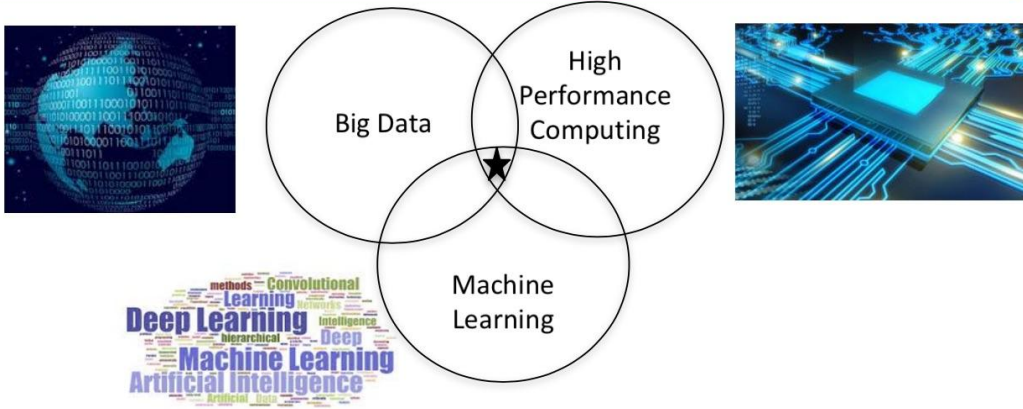
- Visit the Great Lakes Aquarium, which offers interactive exhibits suitable for all ages.
- Explore Canal Park, where you can stroll along the waterfront, watch ships pass through the canal, and visit shops and galleries.



We are at an *Inflection Point*

We are currently witnessing a major inflection point in terms of what AI can do for humans.

Simultaneous growth in three key areas has enabled this meteoric rise in AI capabilities
(Minnesotans have played a key role in all of these!)

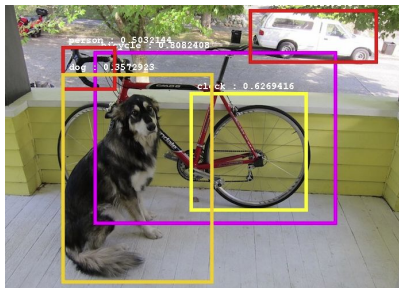


- 2012 White House “Big Data” initiative launched
- Major nations issued AI Initiatives
- Many game changing innovations made since 2012 have brought us to an inflection point
 - Chat-GPT was hard to imagine just 7 years ago



AI can now Emulate Multiple Aspects of Human Intelligence

Pattern Recognition



Reasoning and Planning



Creativity



AI has steadily gotten better at emulating all of these aspects, especially due to the advances made in the last 10-15 years:

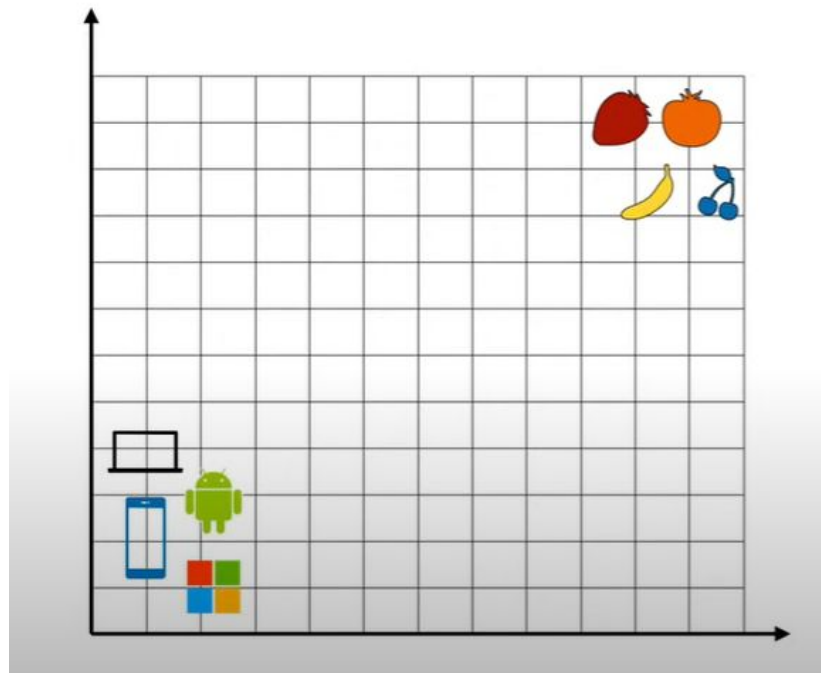
Handwriting recognition, speech synthesis, speech recognition, image recognition, natural language modeling, recommender systems - just to name a few.

AI Advance # 1: Representation Learning

Ability to represent concepts (words and images) as meaningful embeddings (i.e., numbers) that can be processed by computers

Related concepts need to be represented as similar embeddings.

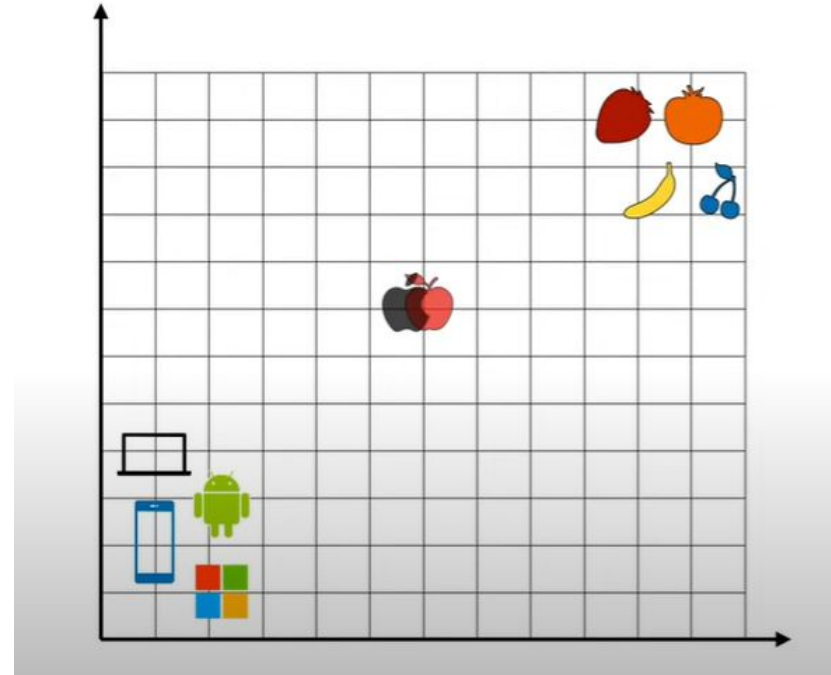
- Latent Semantic Indexing (LSI) 1988 → 1994 (www)
- Convolution Neural Networks (CNN) 1988 → 2012 (ImageNet)
- Word2Vec 2013 → 2016 (Language Translation)
 $V(\text{Paris}) - V(\text{France}) + V(\text{Italy}) \approx V(\text{Rome})$



AI Advance # 1: Representation Learning

The word “apple” can mean an iPhone or “fruit” depending on the context.

Humans are very good at capturing the context.

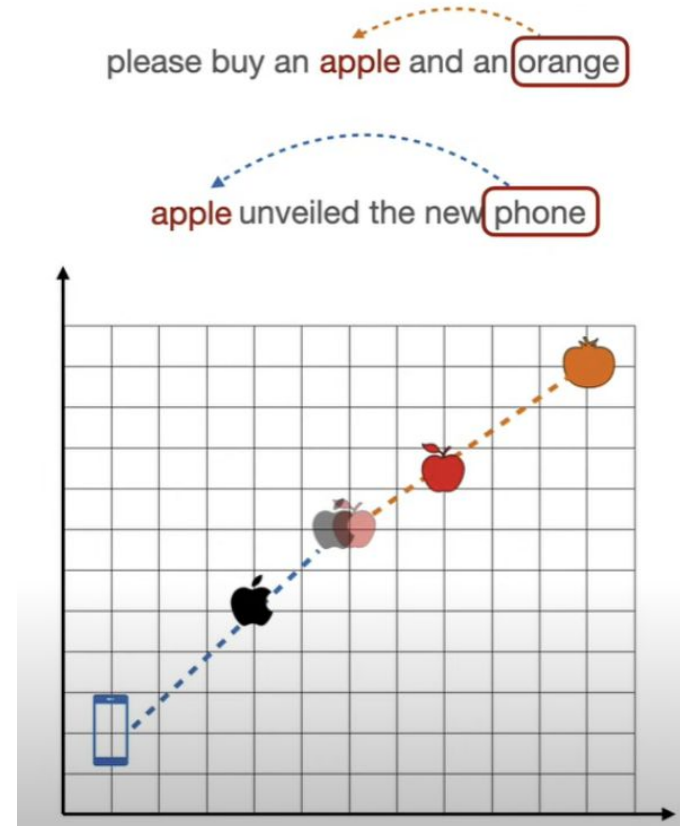


AI Advance # 1: Representation Learning

AI is now able to assign deeper meaning to words dynamically by pulling words based on the context.

This pulling is referred to as the “**attention mechanism**” and it is backbone of the **Transformers** architecture. (2017)

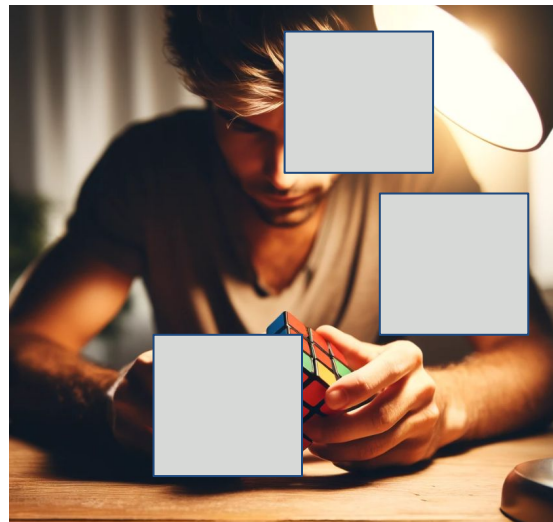
Transformers have dramatically advanced the ability of machines to understand text, images, speech, weather forecasting, and much more



AI Advance # 2: Self-Supervised Learning

Complex deep learning architectures (e.g., CNN, Word2Vec, Transformers) need a lot of data for training, that can be hard to come by.

Self-supervised learning is a new methodology that helps machine digest vast amounts of data (e.g. text, images, audio) without humans telling them what the data means.



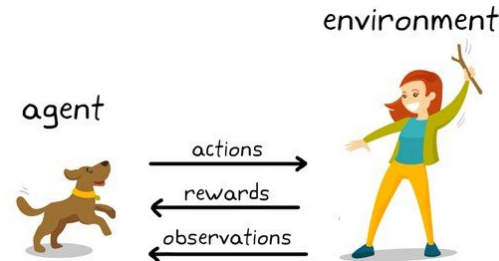
In Autumn the _____ fall
from the trees.



AI Advance # 3: Reinforcement Learning

Humans and animals are able to learn sequence of actions in complex settings to achieve desired objectives through trial and error.

Recent advances in Reinforcement Learning have enabled machines to emulate this human capability even for highly complex tasks.



NEWS THE INSTITUTE
How IBM's Deep Blue Beat World Champion Chess Player Garry Kasparov > The supercomputer could explore up to 200 million possible chess positions per second with its AI program IEEE Spectrum

BY JOANNA GOODRICH | 25 JAN 2021 | 3 MIN READ |

Before Reinforcement learning (1997)

Google's 'superhuman' DeepMind AI claims chess crown BBC

6 December 2017

After Reinforcement learning (2017)



The future has unlimited potential for Minnesota

AI will play a transformational role in ALL economic sectors



AI driving innovation in: MedTech

Today, our region produces roughly 3% to 5% of the global economic contribution to MedTech. However, we can increase that share to 8% to 10% over the next decade by becoming a Smart MedTech hub.

That would add nearly \$40 Billion to Minnesota's GDP – highly difficult without AI developments.

The future with AI

- AI and data will take us from an 'episodic, reactive healthcare model' to a 'continuous, proactive healthcare model'
- Addressing health disparities with more targeted and personalized culturally sensitive interventions
- Connecting the one-health paradigm – soil to food to animal protein to human diseases and cure
- Faster drug discoveries – design of the chemical molecules rapidly
- Faster drug discoveries – design of the chemical molecules rapidly

AI driving innovation in: Food, Ag, and Climate

Minnesota leads the nation in food patents per capita, is 4th in food-product- related patents per capita – and has long been at the forefront of research and innovation in agriculture, food production and food safety.

In 2023, the global Artificial Intelligence (AI) in Agriculture market revenue reached \$1.5 Billion*. By 2026 this is expected to double to \$3 Billion.* Ag and Food Science Jobs are expected to grow at twice the rate for all occupations in the US.**

The future with AI

- Real time prediction of water quality sensing pollutants in fresh and managed water
- Anticipatory weather forecasting for improved livestock or crop management
- Engineered seeds that can survive tough climate conditions and have resistance to insects and diseases
- Predict carbon emissions in individual fields using satellite imaging, speeding up the process by 10,000
- Ingredient replacement identification that avoids volatile supply chains

*Market.us Scoop

*U.S. Bureau of Labor Statistics

AI driving innovation in: Manufacturing & Materials

Manufacturing represents 13%* of Minnesota's GDP, contributing over \$58 billion to the state's economy. Nearly half of Minnesota's Fortune 500 companies are involved in manufacturing.

AI in Manufacturing will add \$1.1 Billion to the Minnesota economy by 2033

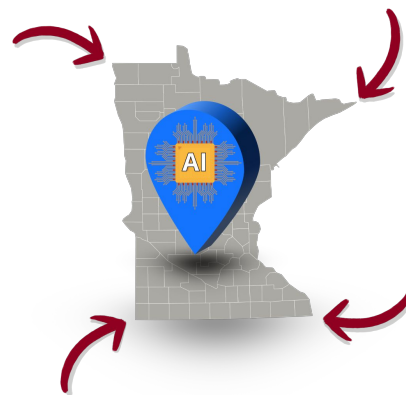
The future with AI

- Advancing automation and energy efficiency in manufacturing
- Microelectronic chip design using AI for platforms such med tech, food tech, clean tech and water tech
- Development of new materials for high temperatures, cement, fertilizers, green energy, batteries
- Revolutionizing cyber security across all platforms with AI and Quantum computing
- Smart Manufacturing monitoring for safety in real time

AI is the Future

Let's make MN a destination for the nation's top AI talent while developing a diverse workforce of the future.

- AI will contribute as much as **\$15.7 trillion** to the world economy by **2030**
- Other states are beginning to make major investments in AI
 - States that are left behind will have hard time competing for the jobs and wealth producing industries of the future.
 - Wisconsin -\$32 million
 - Empire AI in NY - \$400 million
 - AI University in FL - \$100 million
- Minnesota needs to develop an AI ecosystem.



Curbing Climate Change with AI

\$20M AI institute advances climate smart Ag. practices



Advancing Healthcare with AI

\$17.5M grant to help develop national outbreak response network



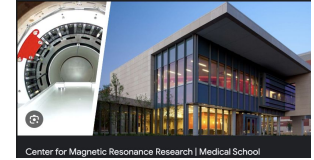
"One of America's leading technology hubs"

Leader in Data Science Education



Program Ranked **Third in Nation**. Fortune Magazine recently ranked the University of Minnesota's M.S. in Data Science the third best program in the nation. Read more about the value of a data science master's degree and learn more about our top-tier program.

Home to some of the world's biggest datasets



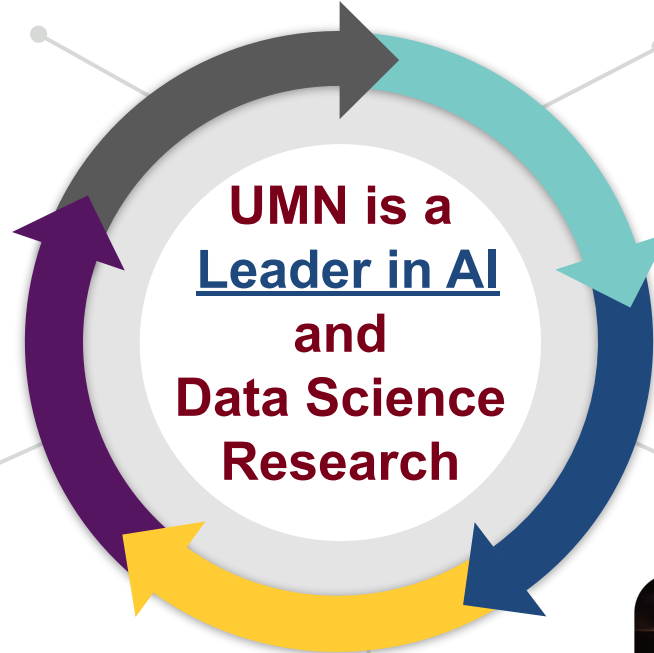
Leadership in AI for Science & Eng.

UMN Hosts NSF-Sponsored Workshop on AI-Enabled Scientific Revolution

NSF Sponsored Workshop on AI-Enabled Scientific Revolution



Second NSF-Sponsored Workshop on AI-Enabled Scientific Revolution
August 6, 2024

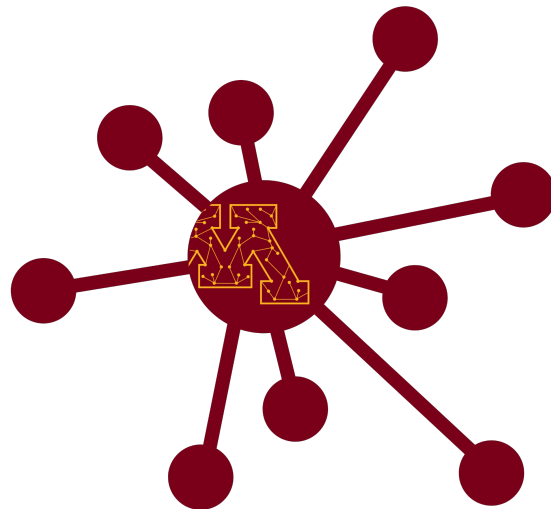


UMN Data Science and AI Hub

A Collaborative Future with Academia, Industry, and the State of Minnesota

By building a physical and virtual community around AI we will....

- Advance the frontiers of AI and DS together
- Produce the AI-ready workforce for the future
- Build an ecosystem and community of innovation
- Grows MN industries, attract new companies, and nurture startups
- Showcase MN as a leader in AI



Let's piece together Minnesota's AI-Innovation ecosystem



- Become global hub for AI & data oriented research across industries and academia
- Science backed public policy to address responsible use of AI
- A holistic, K-High Ed approach to attract, retain, and train a skilled and diverse workforce
- Public-Private partnership that drives responsible AI innovation and development

- UMN has the expertise and is invested in leading the way! -