

Welcome to the 48th year of Northwestern University's Learning for Life Series!

Founded in 1975 by Shirley Welsh Ryan, the series aims to educate participants on important technological advances and current events. This year's program is focused on Artificial Intelligence.

Artificial Intelligence and Its Many Implications

Artificial intelligence (AI) has taken our society by storm. With the grand promise of reproducing human intelligence within machines, the implications of this rapidly advancing technology are broad. In this lecture series, we'll start with a broad overview of AI, its capabilities and limitations, and then look at its applications in healthcare and education. We'll end with a discussion of the importance of creativity to understand why artificial intelligence may always remain "artificial."

Summary from Tuesday, October 10, 2023's session.

Introduction by Dean Chris Schuh

***Christopher Schuh** is the dean of the Robert R. McCormick School of Engineering and Applied Sciences at Northwestern University where he holds the title of John G. Searle Professor of Materials Science and Engineering. Schuh, who began his tenure as dean of Northwestern Engineering on August 1, 2023, was previously POSCO Professor of Materials Science and Engineering at the Massachusetts Institute of Technology (MIT), where he served as Head of the Department of Materials Science and Engineering from 2011 to 2020. A seasoned entrepreneur, Schuh has cofounded a number of companies. His first spin-out company, Xtalic Corporation produced coatings that are widely used in enterprise and personal electronic devices. Schuh also cofounded Desktop Metal, an additive manufacturing company producing 3D metal printers that address a range of markets with an emphasis on production scale. Schuh earned his bachelor's degree in materials science and engineering at the University of Illinois at Urbana-Champaign in 1997 and PhD in materials science and engineering from Northwestern in 2001. He is a member of both the National Academy of Engineering and the National Academy of Inventors.*



Dean Chris Schuh began with an overview of how artificial Intelligence (AI), machine learning, data science and computation have been central to the disciplines of engineering. Starting with computation and its evolution into data science, machine learning and then artificial intelligence, advances in engineering are intertwined with the growth of these fields.

Likening AI to a new type of calculator that starts as a tool for engineering, Dean Schuh emphasized how it has become a universal tool for areas such as medicine, journalism, and education. Faculty at

McCormick such as Kris Hammond are essential to developing these new tools and teaching our students to use and further develop what they learn.

An example of AI intersecting with computer science and mechanical engineering is Professor Sam Kriegman's work where he has developed the *first functional robot to be designed by AI*. A second example involves Professors Maia Jacobs and Nabil Alsharufa who focus on predicting stress in women who are pregnant. They use AI to analyze vital signs of the mother and fetus to identify triggers of stress. Here the patient is in the loop with the machine learning and the patient is learning along with the AI.

McCormick and Northwestern at large are filled with faculty who inventing the tools of AI and using it to impact every other domain of engineering and indeed of human endeavor.

Kris Hammond is the Bill and Cathy Osborn Professor of Computer Science and the co-founder of the Artificial Intelligence company Narrative Science, recently acquired by Salesforce. He is the faculty lead of Northwestern's CS + X initiative, exploring how computational thinking can be used to transform fields such as the law, medicine, education, and business. He is director of Northwestern's Master of Science in Artificial Intelligence (MSAI). Most recently, he founded the Center for Advancing Safety in Machine Intelligence (CASMI), a research hub funded by Underwriter's Laboratories. CASMI is focused on operationalizing the design and evaluation of AI systems from the perspective of their impact on human life and safety. His research is at the intersection of data analytics and human/machine communication. His vision is to bridge the gap between the data that serves us and the language we need to understand it. He believes in humanizing computers with the aim of stopping the process of mechanizing people.



Professor Kris Hammond began by asking what is intelligent about artificial intelligence. If artificial intelligence is a system designed to perform actions that if performed by people would be considered intelligent, what is it that makes people smart? People make decisions, understand language, draw conclusions, recognize situations, can explain the past, understand the present, and plan and predict for the future. As a computer scientist, he seeks to bring these features to machines.

Professor Hammond highlighted how everyone in the audience had interacted with AI at least two to three times that day from features in their automobile to using Siri or Alexa to using Google.

November 30, 2022 was a momentous day in the history of AI – it was the day ChatGPT was publicly launched. The underlying technology had existed for a number of years, but its launch as a consumer product was a turning point. Within one week, it had a million users, by the end of January it had 100 million uses, and it now has a billion monthly users. It is the *fastest growing, fastest adopted technology* in history.

Pundits from the political writer David Brooks to the AI pioneer Geoff Hinton have weighed in on the dangers of the field, but the truth is more nuanced. ChatGPT is an incredibly useful language tool and can be a powerful tool for those who understand it.

For example, ChatGPT is not a search engine and is not a research tool. It is a language generation tool. This new transformative technology of generative AI or large language models can help us become more efficient and let us do more with what we have. Machines can amplify us, amplify our thinking, amplify our skills, and amplify our reach.

Professor Hammond shared several examples. One example is a large set of Salesforce data entered into a spreadsheet. The data is too big for standard analysis. But in a vivid demonstration, AI transformed the data into simple charts and graphs and then communicated the information through a machine-created video of a machine-created woman speaking through a machine-created script. Another example was the translation of the massive amounts of data collected from waterfront sensors distributed along Chicago beaches, delivering personalized, scientifically-grounded recommendations.

The most dramatic example was “Elizabeth,” a conversational AI model developed by undergraduates at Northwestern University as part of a theatre project. Elizabeth can be integrated as an active participant in Zoom and other online meetings and acts as a “conduit between intricate data sets and actionable insights . . . [acting as] a multifunctional assistant that can help businesses innovate and stay agile.” Students brought together half a dozen different technologies to create Elizabeth.

Admittedly, there are problematic issues. We build models to recognize faces that do not recognize the faces of African American men or women in general. Because of social media, we have seen a rise in depression of young women between the ages of 13-23, primarily due to digital addiction. Systems that exploit human decision-making architectures such as job recommendation systems that are gender, biased and racially biased, resume review systems that are gender, biased, or ethnically biased parole systems all rely on dark patterns and can lead to the information vulcanization previously mentioned. Finally, there’s the problem of loss of agency. If we are constantly relying on recommendations, our ability to make decision on our own is eroded. To address these types of issues, Professor Hammond is leading the [Center for Advancing Safety of Machine Intelligence \(CASMI\)](#) at Northwestern.

Professor Hammond ended by emphasizing Northwestern’s responsibilities regarding AI. First and foremost is our responsibility to educate students in these technologies. Second is the opportunity to create new research, to discover new things to amplify with the technologies that are in our hands. Finally, the third is to our community that surrounds us to communicate the impacts - positive and negative.

(Professor Hammond reminded us of the definition of an algorithm as a plan of action or recipe. And as with all plans and recipes, people focus on making the better, faster, and smarter.)

Duri Long is Assistant Professor in the School of Communication and is a human-centered AI researcher interested in issues surrounding AI literacy and human-AI interaction. Increasing public interest in and use of AI demands improved resources for aiding in public understanding of AI as well as developments in technology that allow AI to interact comfortably with humans in complex social settings. Dr. Long's research looks to how humans interact and learn as a way of informing the design of public AI literacy interventions as well as the development of AI that can interact naturally and improvise creatively with people in complex social environments.



Dr. Long employs a variety of methodologies and theoretical frameworks in her research, drawing on the learning sciences, design research, and cognitive science. She has experience working with artists and museums around the country to develop co-creative, embodied exhibits and art installations involving AI and technology. Dr. Long holds a Ph.D. in Human-Centered Computing from Georgia Tech and a BS in Computer Science with a second major in Dramatic Art from the University of North Carolina at Chapel Hill.

Professor Duri Long's research focuses on how humans make sense of and learn about AI systems, how they interact with AI systems and how to develop AI systems that are better able to communicate and collaborate with people. AI literacy is crucial for the public considering the rapid transformations catalyzed by this technology.

The topics central to AI literacy are

- Recognizing AI and how to distinguish between technological artifacts that do/do not use AI
- Understanding intelligence and how to distinguish between human, animal, and machine intelligence
- Knowing AI's strengths and weaknesses to determine when it is appropriate to use AI versus human skills
- Imagining or projecting future applications for AI
- Understanding human roles in AI to recognize the unintentional and intentional effects of bias and error

And woven into the above topics are the abilities to critically interpret data, understand decision making, and better examine the ethical issues brought about by uses of AI. Professor Long emphasized that AI is distinctly different from other technologies in that it is making critical decisions for and with us.

Professor Long's group has been developing learning experiences for young people in terms of curriculum for K-12 and designing intergenerational learning opportunities for parents and kids to learn

together. And there are many opportunities to develop AI literacy learning interventions for adults as well thinking about college courses for non-computer science non-data science majors.

One example of Professor Long's work is a set of at home activity boxes where families can engage together in tangible play with game board like activities to learn about concepts like the idea that computers learn from data and that data sets can be biased. Another is a project with the Museum of Science and Industry here in Chicago to develop a set of exhibits to foster family group understanding about AI. Her group has also been exploring different adult learning experience. One of the great potentials of AI is to augment and enhance our own human creativity - engaging people in learning about AI through dance or music.

Professor Long ended by emphasizing means to enhance AI literacy through tangible interactions, creativity, and centering on personal identity and expression.