Algorithms and Analytics: Connecting the Learner and the Learning

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CERAS 101, Stanford University

Welcome: The Human Code for Learning

Martha Russell, Executive Director, mediaX at Stanford University

mediaX co-creation of insights relies on industry-facing, faculty-inspired, inquiry-driven research, funded by mediaX members, conducted at Stanford.

1. The human experience is built around sharing information between people and among groups; understanding learning is fundamental to creating successful user experiences.
2. Learning analytics is much more than "analyzing learning data"—it is about deeply understanding what learning activities work well, for whom, and when.
3. We recognize Roy Pea, a pioneer and leading authority in learning sciences, recently inducted into the National Academy of Arts & Sciences.
4. The field of learning analytics has the potential to dramatically increase learner success through deeper understanding of the academic, social-emotional, motivational, identity and meta-cognitive context that each learner uniquely brings to learning. These insights can be applicatied in business, entertainment, and wellness as well.

Connecting the Learner with Learning in Learning Management Systems

Ajay Madhok: Founding Partner, Reboot Digital, Advisor to Playground Global

We designed a digital Learning management System as the learning environment to deliver Learning Experiences that learners value. The goal was to engage the learners (students) in directing their own learning by helping them set goals, track progress through their dashboard, select materials and challenges that matched to their current capacities.

1. Effective learning depends on understanding Learner's prior knowledge, experiences, motivations, interests, language and cognitive skills.
2. Connecting (engaging) learners in an emotionally supportive (non-threatening) learning environment promotes learners sense of belonging, adaptability, agency and learner outcomes.
3. Personalizing the Learning Experience Layer, by orchestrating interconnected concepts (and networks) Connect the Learner with the Learning.

Teaching Algorithms How to Teach

Emma Brunskill, Assistant Professor, Computer Science Department, Stanford University

Three Algorithmists Meet Robin Hood

Bruce Cahan, Consulting Professor, Stanford's School of Engineering

Looking back from 2050, imagine three tribes of AI practitioners evolve: Receivers gathering and selling all-purpose "big data", Amplifiers using AI to broadcast and seek conformity to any behavioral action or opinion that government or commercial parties want to fund, and Tuners who ask whether with all the Receivers and Amplifiers actions the result benefits the common man, woman, child or small business affected and manipulated by them. Bruce will explain these Algorithmists' Dilemma and propose a Robin Hood Clinic to research, teach and clinically practice AI in service to humankind.

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Teaching AI - How should Stanford organize research, teaching and practicums (labs) to make sure we have a healthy mix of Receivers, Amplifiers and Tuners applying AI to commercial and social causes?

1. Ethically Testing and Challenging AI - Medical schools use teaching hospitals and law schools use law clinics to check that the diagnostic and treatment options their students and faculty learn and practice actually help real human beings. Does AI need a Robin Hood AI Clinic to perform a similar pedagogical function that iterates and improves the likelihood that real human issues and opportunities are addressed holistically by AI?
2. Identity Ownership and Control - Ultimately, the "big data" that AI depends on, homogenizes, recombines, authenticates as reusable and shares references an individual, organization or asset owned or used by an individual or organization. How should such data and the rights to control, sell, correct and challenge all of the uses of it be monitored through AI built for that purpose, as augmenting regulatory technologies?
3. Researchers' Access to Big Data - Too often, academic and other research papers rely on datasets that are not shared and often as regards personally identifying information, cannot be shared. However, through corporate arrangements with government and intergovernmental data sharing arrangements, the data is available to a subset of researchers who build hypotheses, public policies and corporate products in reliance on such data, and in pursuit of pre-ordained outcomes. How can AI be made a tool for anonymized data access, and tracking which research relied on which data?

Panel: Initiatives by mediaX Members
Karen Wang, Co-founder, Wisdom Academy

1. We can change the future through changing the "mind".
2. Social Emotional skill is not a "soft skill".
3. Combine ancient wisdom with current science and technology.

Richard Tong, Chief Architect, GM of US Operations, Squirrel AI Learning by Yixue Group

1. Use deep learning to enhance BKT, KST, etc.
2. Use SimStudent and Apprentice Learner to build enhanced recommendation policies through Reinforcement Learning.
3. Keep the human-in-the-loop for machine learning.

A Conversation-First Approach to Design
Robert Moore, Research Scientist, IBM Research-Almaden

Conversational interfaces require a new approach to user experience design, one that is informed by conversation science.

1. The difference between natural language and natural conversation.
2. Concepts and principles for conversational UX design.
3. A pattern language of 100 conversational interaction patterns.

Measuring What Matters
Dan Schwartz, Dean, Stanford Graduate School of Education

Given a dynamic future, it is important measure whether and how people choose to learn outside the strict guidance of classrooms.

1. It is now possible to measure the process of learning, and not only the outcome. This is important because we need people to learn how to learn.
2. People often know lots of good learning strategies. The key question is whether they choose to use them.
3. A core tenant of design thinking is to avoid early closure (e.g., do not commit to one's first idea). It turns out this is good for learning, and it is possible to teach strategies that students will adopt.

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Panel: Processed-based Assessments: Analyzing Critical Thinking, Decision Making, Collaboration

Nick Haber, Postdoctoral Fellow Stanford University, Assistant Professor, Stanford Graduate School of Education (Winter 2020)

1. I see great promise in AI-enabled learning tools that augment our learning processes. In designing these, we need to understand, in a computationally precise way, the learning processes we are trying to aid.
2. In designing AI-powered learning tools, embrace the human-in-the-loop: by capturing data from device interaction, we can both better understand the learning process and use that data to adapt the learning tool to the user's needs.
3. By studying the early learning processes of children, we stand to make AI tools that learn more like we do. In turn, by making AI tools that learn like we do, we stand to learn more about human learning.
4. These AI-powered cognitive models of learning may someday allow us to better understand how different children learn differently, and how to better tailor learning experiences to individual needs.

Dan Schwartz, Dean, Stanford Graduate School of Education

Chris Piech, Assistant Professor, Computer Science Education, Stanford University

1. AI understanding open-ended work is one of the grand challenges of education.
2. We are at the point where we can recreate the human task of grading open ended assignments up to the complexity of intro programming.
3. The first impact of this work will be to augment teachers and give feedback on process.

Intelligent Agents, the Knowledge Graph and Open Data for Learning

Mark Musen, Professor of Biomedical Informatics, Stanford University)

Knowledge graphs offer formal representations of human knowledge with the ability to link concepts in those graphs to relevant datasets and structures that people and intelligent agents can search to discover new relationships between the things that we know and the data that may support those conclusions. Technology such as CEDAR, which can make the metadata that describe experimental datasets more findable and reusable, offers the opportunity to "publish" data that are linked to knowledge graphs in a manner that can enhance the way that we learn from scientific results.

1. Scientists are learning that the real outcome of their work is not the papers that they publish, but the data that their experiments generate.
2. Current technology is making scientific data more Findable, Accessible, Interoperable, and Reusable (FAIR).
3. Future technology will allow intelligent agents to assist scientists in making sense out of data, planning new investigations, and making new discoveries.

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mediaX at Stanford University is a forum, an incubator of ideas, and a programmatic framework to encourage and support multi-disciplinary research initiatives. Our initiatives explore how understanding people can improve the design of technologies – in the areas of learning, mobility, collaboration, entertainment and commerce.

As the affiliate program to Stanford's H-STAR Institute (Human Science and Technology Advanced Research) in the Graduate School of Education at Stanford University, mediaX programs are grounded on respect for different approaches to discovery and centered on our belief in the power of collaboration – between business and academic researchers, on campus and around the world.

In trusted relationships, aligned on questions that are important for the future, mediaX collaborations seed campus-wide research and coordinate industry interest. Through dialogue and collaboration, university and industry researchers challenge what we know now and stretch intellectual resources to gain new insights relevant to academic and business collaborators.

Together, we pursue new insights on how information technology affects people's lives, how to better design products and services to make them more usable, and the innovative use of communication technologies to improve the human experience.

To become a member of the mediaX Community, please talk to or email Martha Russell martha.russell@stanford.edu

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