Cosmology of Artificial Intelligence Project: Libraries, Makerspaces, Community and AI literacy

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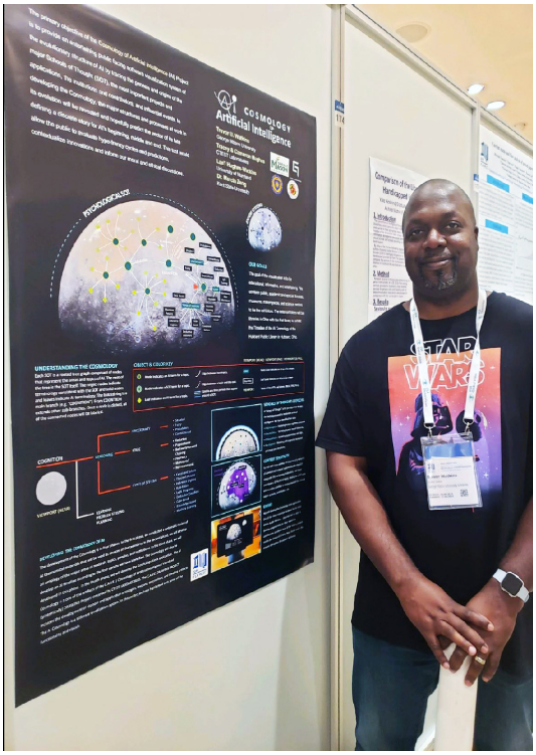

Figure 1: Trevor Watkins at Poster Session

Introduction

Artificial Intelligence (AI) has transcended beyond buzzwords, keywords or trends. The ubiquity of AI is so profound that it has managed to seep into popular culture. It breeds throughout social media platforms. It dominates the airwaves. It is impossible to watch television without mention of the acronym, the word, and how everyone is using it. However, if we look a little closer, take a deep dive into the AI pool where everyone seems to be swimming, we began to learn that AI has been misinterpreted, misrepresented, and incorrectly defined. "In the Laws of Thought and Thinking Machines," Hughes and Hughes (2019) talk about how uncovering the truth of the definition, meaning, applications, and implications of Artificial Intelligence would be a noteworthy goal. Today we are pursuing that goal.

The primary objective of the Cosmology of Artificial Intelligence Project (CAIP) is to develop and provide a friendly outward facing visualization of the evolutionary structure of the field of Artificial Intelligence by tracing the genesis and origins of the major Schools of Thought (SOT), their major influences, and its interactions with the subject matter, the most important institutions, people, and techniques. The project aims to elucidate the cosmology in the form of a visualization map of a solar system used as a reference map. The graphs of the major SOTs, its topics, methods, and key contributors will be visually represented as astronomical objects in a solar system (e.g., planets, moons, rings, etc.). Historical events in AI and other fields of science that has had significant influence will be visualized as meteors, asteroids, comets or eclipses. The goal of the visualization is to be educational, informative, and entertaining. The visualization will be a 3D interactive visualization map kiosk where users will be able to explore the driving paradigms throughout the history of AI from its origins to the present. Typically, the term 'Cosmology' is used in conjunction with the study of the Universe. One convenient definition for Cosmology is the study, origin, evolution and the eventual fate of the Universe". Any valid AI Cosmology would force us to define its origin, uncover the goals and the meaning of the term "Artificial Intelligence" within the context of that history. In developing the Cosmology, the major structures and processes at work in its evolution would be revealed and hopefully predict the vector of its fate revealing a discrete story for AI's beginning, middle, and end. This tool would allow the public and committed others in the field to evaluate hype-frenzy cycles and predictions, contextualize innovations and inform our moral and ethical discussions. Much of the content for the AI cosmology will be historical in nature. We rely on

materials from digital libraries such as seminal books, papers, journal articles, interviews, oral histories, taxonomies, etc., to discern and identify the concepts, topics, contributors and projects and their relationships. The development of the Cosmology is in 4 phases:

- Phase 1: Review of AI Taxonomical Materials and Development of Visual Taxonomy
- Phase 2: Development of an Ontology of the Major Areas of Research, Topics, Peoples and Institutions
- Phase 3: Development of the AI Cosmology Part 1: Development of Cosmology Graphs Part 2: Mapping to Reference Map
- Phase 4: Development of the Cosmology Kiosk Application

The project will produce six artifacts:

- A 2D Taxonomical Visualization (Phase 1)
- A Digital Ontology using ISO 24707 format (Phase 2)
- A 2D version of the Cosmological map appropriate for a high-resolution printed poster (Phase 4)
- A kiosk application for libraries (public and academic), makerspaces, universities, museums, and science center exhibits (Phase 4)
- An AI literacy Framework
- An AI Curation Framework

The CAIP project team consists of Trevor Watkins from George Mason University (information literacy, AI literacy, metadata, systems and software engineering), Cameron and Tracey Hughes from Ctest Laboratories (software and visualization epistemology, data visualization, and AI historians), University Archivist Lae'l Hughes-Watkins from the University of Maryland College Park (information literacy, information appraisal, curation) and Dr. Marcia Zeng from Kent State University's I-School (knowledge organization and representation, thesaurus, taxonomy and ontology, and linked data and metadata).

We are now in phase 2 of the project. In phase 1, we produced a digital visualization of a complete taxonomy of the major research areas of Artificial Intelligence in addition to a timeline. This digital representation will soon be available for display as an exhibit in libraries, makerspaces, science centers, high schools, and universities. From the digital representation, a full color 42" x 90" visual taxonomy poster mounted under 1/8" (14 mm) thick acrylic glass will be generated. We have also created a full color AI timeline poster as well. The Hubbard Public Library in Hubbard, Ohio, and the Oakhill Makerspace in Youngstown, Ohio are the first public library and community makerspace to agree to serve as the first test site for this project. George Mason University Libraries will be the first academic library to display the digital representation. The digital file containing the visualization will be made available to ACM and IEEE Computer Society digital libraries, as well as a general download for the public from Ctest labs next year. This project is especially important because of recent national plans to invest in AI.

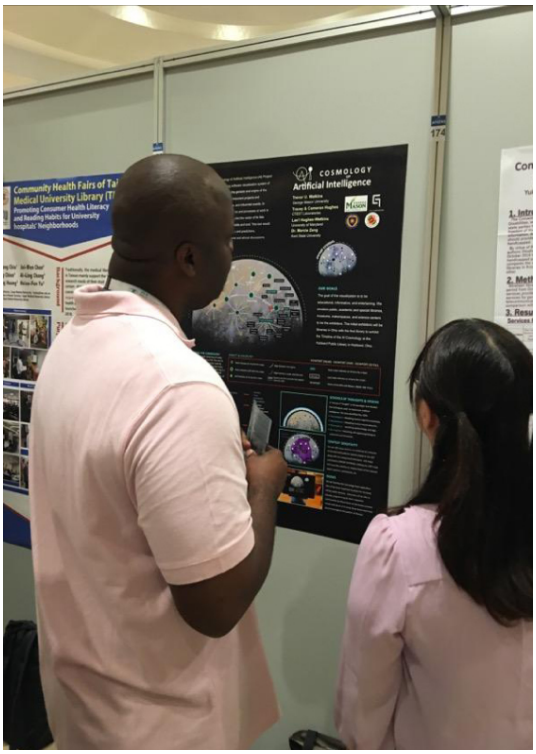

Figure 2: Poster Session

National AI Strategy

In an "AI Matters" blog post on September 9, 2019 titled "National AI Strategy," Larry Medsker (2019) provides references to the The National Artificial Intelligence Research

and Development Strategic Plan, the Computing Community Consortium's (CCC) Artificial Intelligence Roadmap Report, and Intel Corporation's recommendation for a National AI strategy, a white paper they released in March of 2019. Each of these resources respectively document and highlight strategies, recommendations, findings, and best practices regarding the future of the field of Artificial Intelligence.

In the National Artificial Intelligence Research and Development Strategic Plan (2019), the United States Government outlined eight strategic priorities:

- Make long-term investments in AI research.
- Develop effective methods for human-AI collaboration.
- Understand and address the ethical, legal, and societal implications of AI.
- Ensure the safety and security of AI systems.
- Develop shared public datasets and environments for AI training and testing.
- Measure and evaluate AI technologies through standards and benchmarks.
- Better understand the national AI Research and Development workforce needs.
- Expand public-private partnerships to accelerate advances in AI.

Intel Corporation described four responsibilities of governments initiating an AI strategy:

- Sustainable and funded government AI research and development
- Create new employment opportunities and protect people's welfare
- Liberate and share data responsibly
- Remove barriers and create a legal and policy environment that supports AI.

CCC (2019) has three core recommendations:

- Create and Operate a National AI Infrastructure
- Re-Conceptualize and Train an All-Encompassing Workforce
- Core Programs for AI Research (Increased Funding)

CCC's report was the only report that discussed the importance of creating an AI curricula, more specifically, "AI curricula guidelines should be developed to start at an early age to encourage interest in AI, understanding of the associated issues and implications, and curiosity to pursue careers in the field." We believe that AI literacy should be at the core of any AI curricula design. AI Literacy should be at the heart of any national AI strategy. Moreover, a national AI strategy should include an initiative to fund collaborations between libraries, school systems, makerspaces, etc. to serve as AI teaching and learning centers. The artifacts produced from CAIP, which includes the creation of an AI literacy framework, will serve as great tools for this type of initiative.

IFLA WLIC 2019 Greece

During the The International Federation of Library Associations and Institutions (IFLA) World Library and Information Congress (WLIC) 2019 held in Athens, Greece, we presented the Cosmology of AI project during a two-day poster session (See figure 1). In two days we had an accurate count of 367 visitors to our poster.

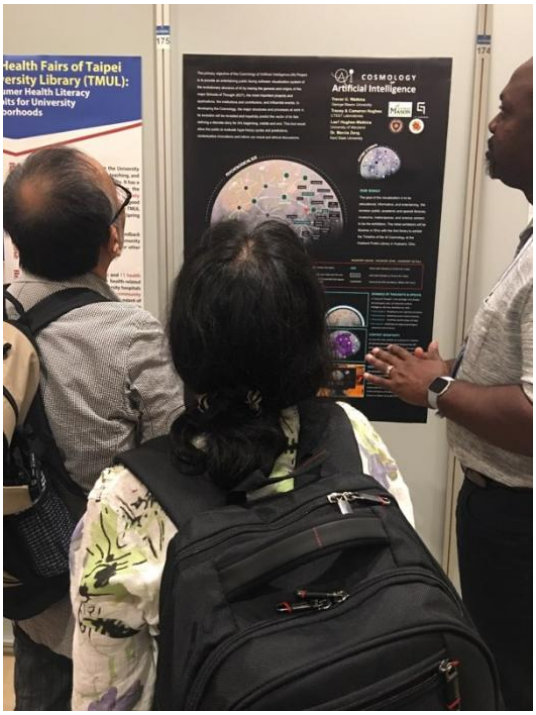

Figure 3: Poster Session Day 1

Some frequently asked questions and comments we received:

- When will this be available? Our library would be interested in having this.
- How much will it cost the library to have this?
- How will libraries use this as a tool?
- Why should libraries be concerned about AI?
- Will librarians be able to develop programming with this tool?
- Here is my contact information, let me know when this is available.
- This project may be too complex for the general public to understand.
- In what way do you think teens and younger children would benefit from this?
- We have a makerspace in our library, will there be different versions of this?
- Will it only be available in English?

The poster generated a lot interest from international public and academic libraries at the conference. Due to the feedback and questions we received, we plan to work with librarians to help develop content for AI specific events and programming, AI learning outcomes, and make it available in several languages.

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Trevor Watkins is the Teaching and Outreach Librarian on the Teaching and Learning Team (Gateway Library) at George Mason University. He previously served five years as the STEM Librarian at Kent State University Libraries. He has over eight years of experience in Library IT, having previously served as a Systems Engineer and a Systems Librarian in public libraries in Ohio. He consults with academic and public libraries, makerspaces, and researchers on issues concerning privacy, information security, penetration testing, forensics, vulnerability assessment, data management, data science, data security, software development, and knowledge acquisition and dissemination. His research interests include Artificial Intelligence (AI) Literacy, developing systems using autonomous software agents and bio-inspired algorithms, ethical hacking, and human AI interaction. He is currently completing work on a GNU/Linux operating system for libraries and museums called Black Squirrel. He is a professional member of ACM (SIGAI, SIGCSE), IEEE, ALA, and IFLA.