

Hardware and Software Enhancements: Conversational Computer Agents with Initiative

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ABSTRACT

This paper presents several innovative approaches to creating a more human-like computer agent that is capable of not only responding to live-user questions, but can also formulate and convey appropriate questions and comments. The paper begins with recounting the need for such agents and the current paucity of both utilities for and research into this challenging field. Data and analysis from the authors' work in virtual human agents are adduced to further identify and characterize the current state of the art. Further, anecdotal examples are given as to the impact of having a computer agent capable of only responding to direct and germane questions. This is contrasted with a live human who would not only respond to questions, but would conceptualize potential impacts, comment on inputs, and then request information or suggest future courses of discourse. To implement a virtual equivalent, several alternative algorithms and approaches are reviewed, with the varying features of each being evaluated. The use of Artificial Intelligence (A/I) is considered, as are the potential hardware suites and long-haul digital communications necessary for the success of the system. Potential misfeasance by the A/I functions is considered and an Ethical A/I approach is recommended. An outline is given and justified for the appropriate metrics for such an effort and the best way to measure and evaluate the data against goals of the project. Additional research and probable impacts are considered and resolved. The implementation and exploitation of emerging hardware capabilities, *e.g.* quantum computing and software advances, *e.g.* Deep Learning in big data sets are considered. Future research directions are identified and justified. Analysis of the needs for these emerging capabilities and the opportunities for extensibility into other initiatives are set forth and implementation implications are discussed to benefit the readers who may want to pursue these approaches.

ABOUT THE AUTHORS

Dan M. Davis is active as a consultant at the Institute for Creative Technologies, University of Southern California (USC), focusing on large-scale DoD simulations and avatar uses. Prior to retirement, he was the Director of the JESPP project at USC for a decade. As the Assistant Director of Advanced Computing Research at Caltech, he ran Synthetic Forces Express, bringing HPC to DoD simulations. He also served as a Director at the Maui High Performance Computing Center and in computer research roles at the Jet Propulsion Laboratory and Martin Marietta. He was the Chairman of the Coalition of Academic Supercomputing Centers and has taught at the undergraduate and graduate levels. As early as 2071, Dan was writing programs in FORTRAN on one of Seymour Cray's CDC 6500's. While in the Marine Corps, he saw duty in Vietnam as a Cryptologist and retired in 2002 as a Commander, U.S.N. He received B.A. and J.D. degrees from the University of Colorado in Boulder.

Evan Jaksha is studying Computer Science and currently focusing in the use of virtual humans as an effective interface to address a range of critical issues in the military. He comes from a military family with both his father and two siblings currently serving in the US Armed forces. His research interests include cyber warfare and national security. Growing up in San Diego, he is a long-time resident in Southern California. He is scheduled to graduate in 2022 with a degree in computer science from the United States Military Academy in West Point, New York.

Skander Guizani is studying Electrical Engineering and currently focuses his research efforts on hardware, infrastructure, and operations of long range secure communications systems. Skander is from Tunisia and is a foreign exchange student at the United States Military Academy at West Point, New York. Back in Tunisia, his father is a Colonel and commands a unit in that country. While at the Institute for Creative Technologies, Skander will be working with the MentorPal team to enhance the virtual human conversations for advising high school seniors. He anticipates receiving a degree in Electrical Engineering in the spring of 2022 from USMA, West Point.