Introducing a New Paradigm for Human-Machine Collaborative Computing

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Introduction

The goal of my project is to fundamentally reimagine a computer as an information interface between human and machine intelligence. To this end, I present three contributions: firstly, I describe and critique the existing framework of computing; secondly, I introduce a novel ontology for an abstract collaborative computational interface, titled the 'user-world' ontology. Finally, I describe the system architecture for a human-machine collaborative workspace built on this novel ontology, which enables human users to interact with AI agents called 'micropeers'.

The Existing Paradigm: Critiquing the App-World Model

The current paradigm, which I call the *App-World Ontology*, sees a human-computer interactive loop as composed of the following basic entities: the human user, the user's data, and computer applications which help the user to view and manipulate data.

Notice that this ontology does not include any provisions for a non-human agent—agency is granted only to the human user, who is seen as the sole driver of the system.

Notice also that the entire system is *fragmented* between applications; each application needs to implement its own collaboration features, its own intelligence, its own interface layout and so on. Between any two applications, there is no guarantee of coherence in any of the above aspects.

The incoherence/fragmentation/disunity of user experience has many explanations, most of them historio-economic in nature and unique to the prevailing technological and political conditions of the 1970's-80's era.

An important consequence of this fragmentation is that each application inhabits what I call an *app-world*. An app-world is the set of vocabularies, visual UI elements, menu layouts, keyboard shortcuts, mouse/touch gestures, visualizations—in one word, the *language*—that surrounds the application. A human user's experience of carrying out a multi-app workflow in such a system is akin to a traveller who is continuously forced to learn new languages, switch between them frequently, and modify their original intent to fit into the constraints and idioms unique to each language.

This is responsible for creating steep 'learning curves' for applications by forcing the user to familiarize themselves with a new app-world and its idiosyncrasies every time they want to use a new application. Even for experienced human users, switching between app-worlds incurs a significant mental overhead. Overall, the currently prevailing app-world paradigm inevitably obscures and dilutes the intent and expressivity of humans.

The User-World Ontology for Collaborative Human-Machine Computing

As I discussed above, the existing paradigm is based on an ontology which evolved out of technological and commercial constraints extant during the computing revolution of the 1980's. Since then, many of the constraints have become obsolete and new modes of computation, especially autonomous computation, have become popular and practically useful in real-world applications. The app-world paradigm does not see machine intelligence as a native entity, only as an add-on at a per-application level. It does not allow for the kind of system-level holistic intelligence that is needed for real human-machine collaboration across applications.

In light of these limitations of the current ontology, I go back to first principles and build a new ontology for computing: the user-world ontology.

This new ontology recognizes the following basic entities: human users, AI users (also called *micropeers*), user intentions (for both AI and humans), user preferences (for both AI and humans), action functions, and data atoms.

Action functions are atomic-level features/algorithms/modules that can be composed together to build what we call an 'application' in the app-world ontology. Instead of having pre-packaged applications that bundle a limited set of functionalities, in the user-world paradigm, the human user and AI agent work together to assemble functions into applications in real time, such that each application is ultra-customized and ultra-personalized to fulfil a *specific intent* of a *specific user*. I call these bundles of functions 'superfunctions.'

Data atoms are raw blocks of data of a particular type: text, image, URL etc. Data blocks can be composed together into what I call a 'superfile', which is different from a traditional file in that it has an arbitrary format and can include any kind of data atom within it. This allows web-native content such as Tweets, music streams, YouTube videos etc. to be included in a superfile, unlike files in the app-world paradigm which don't include web content as first-class members of files.

The distinguishing feature of the user-world ontology is that it is centered on human experience rather than machine convenience. I center the experience and intent of the human as central, such that every part of the system works to fulfil that intent in its pure form, without requiring the user to customize their behavior to fit the expectations of the application. Instead, each component of the system customizes itself to fit the expectations of the user.

Earlier, I characterized the human user's experience in the app-world paradigm as similar to a traveler who is forced to travel to different places and learn their language. The user-world paradigm can be described by an inversion of that metaphor: the user stays in one place, expresses their intent in their preferred 'language', and the *system* learns the user's language and idiosyncrasies, shaping its visual interface, vocabulary, menu layouts, data visualizations etc. across the system to match the preferences of the user.

User-Worlds in Action: Introducing the Human-Machine Collaborative Workspace

I model the human-machine collaborative workspace as an infinite canvas which can house data atoms and superfiles, action functions and superfunctions, and a large number of human users and AI micropeers. The canvas itself can live in the cloud along with the micropeers, and the computing power for action functions can also be supplied from cloud infrastructure. This makes the workspace more amenable to large-scale collaboration between groups of humans and machines.

To shed light on the dynamics of the collaboration, let us consider just two users on the canvas: a human and micropeer. The micropeer is treated as a true peer of the human: it is granted mostly similar privileges to manipulate data and actions on the canvas. From the point of view of the system, the micropeer is a regular user who just happens to be an AI.

The micropeers are in constant communication with the human and each other, using verbal cues and also by reading the 'digital body language' of their peers. They can communicate confidence, skepticism, and basic emotive behaviors like curiosity and surprise. Each of these behaviors can be customized manually by the user, and they are also updated automatically in real time based on how well the user is responding to the behavior of the micropeer.

Conclusion

A system built under the user-world paradigm would: allow AI agents to make granular recommendations (by suggesting relevant data atoms), contribute effectively to subtasks which machines are better at (by taking responsibility for suitable functions in a superfunction), and provide a hyper-personalized user experience (by tailoring its behavior and personality parameters).

Acknowledgements

The Research team consists of Professor Bill Seaman, PhD, Computational Media, Arts and Cultures, Duke University; John Herr, Duke Office of Information Technology; Dev Seth, Computer Science student, Duke University; Ashley Kwon, Computer Science student Duke University, Quran Karriem, PhD student, CMAC, Duke University.