It's a Small World: Enhancing Human Cognition through Virtual Dioramas

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Abstract

Environmental science stands at the epicenter of a transformative wave reshaping the landscape of scientific discovery. Unprecedented access to environmental data from across the globe affords new opportunities for understanding complex natural phenomena and improving the health and welfare of the planet. Yet despite recent progress, significant obstacles impede the deployment and utilization of an ultra-dense earth monitoring fabric: (*O1*) Sensor platforms remain expensive. (*O2*) In situ networks are difficult to construct. (*O3*) Access portals provide insufficient analytical abstractions for target data consumers. (*O4*) Environmental models are fragmented and compartmentalized. These are the challenges addressed by the Small World project.

Our team is developing an end-to-end hardware/software infrastructure that complements Clemson's new data acquisition backbone to create additional opportunities for environmental discovery. The goal is to enable non-programmer scientists to deploy ultra-dense in situ networks that are inexpensive and reliable, and to convey the impact of aggregated data to policymakers, community leaders, and the public at large. The approach relies on the concept of a virtual diorama. Like its physical counterpart, a virtual diorama is a visual representation intended to distill the essential details of a larger physical scene. Each is backed by a remote sensor deployment and a corresponding data repository to enable real-time and historical visualizations depicting the microclimate under study. Integrated hydrological and ecological models support historical and prospective views of forest and landscape change. In effect, each diorama serves as a window into a miniaturized world that reflects our own — yesterday, today, and tomorrow. An example scene generated using rendering techniques developed as part of this project appears in Figure 1.

This project leverages collaborative work with colleagues from the Ohio State University, the University of Iowa, the University of Texas at Austin, and Cleveland State University. Portions of the work are supported by the National Science Foundation and Clemson PSA.

Fig. 1. A Generated Diorama Scene

Presenter Biography. Jason O. Hallstrom is an Assistant Professor in the School of Computing at Clemson University. He holds the B.S. and M.A. degrees from Miami University in Systems Analysis and Economics, respectively. He also holds the M.S. and Ph.D. degrees from Ohio State University in Computer and Information Science and has approximately 10 years of industry development experience. His research is at the intersection of embedded network design and software engineering. Specifically, he works to enable the reliable design, deployment, and maintenance of long-lived embedded network applications at scale. He has published numerous journal, conference, and workshop papers across these areas. He is currently supported by grants from the NSF (CNS[CAREER]-0745846, DUE[CCLI]-0633506) and was previously supported by the NASA Space Grant Consortium and Microsoft Research.

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