Pre-workshop Position Statement - IS-GEO workshop March 2015

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Computing innovations in recent years that impact the field- Include computing software and hardware

- The **data and high performance infrastructure advances** are pivotal. For example, open and available GIS data models, files, and standards and the public availability of science-vetted numerical simulation models. Speed increases via HPC and, most recently, rapid file transfer and storage through cloud-based science portals

- **Natural language processing** and techniques that can leverage our understanding of learning through cognitive and STEM Ed sciences, such as the lower cost availability of infrared cameras and eye-tracking technologies

-tangible objects and near field communication tags open up new approaches to field work and education

- **Ubiquitous presence of computing in everyday life**. Children start learning and building computing knowledge immediately. Educational platforms, like Scratch, Kodu, Minecraft, etc. expose youth to programming logic through gaming and game creation. As well as asynchronous education platforms like Lynda.com and Singularity University that open classrooms globally.

- **Open source computing revolution** has changed the way software is developed, shared and distributed forever. Libraries for scientific applications that merge easily with existing models/programs. And the power that anyone can harness through access to community-created, freely available, evergreen applications is incredible and growing .

Science challenges that could benefit from innovations in intelligent/information systems

Many advances will come through creative and synergistic combinations of emerging technologies

- **Semantic and natural language analysis** for the production of knowledge maps that can be used to visualize and explore the structure of large datasets, while also linking topically to policy and other relevant areas of need. When we can map across information spaces, we will be able to link across stakeholder groups. These same tools should be useful for fluid interface design.

-Everything is built on data or models for science. We need the transformative promise of digital tools and libraries that can aid **seamless sharing**, access, and assurance of quality.

-Educational advances and uses for transfer of science information to build capacity, inform policy, and inspire business innovation include 1) tools/methods for automatic assessment of learning and embedded systems, such as vision, audio, or other **techniques to aid with the automated 'testing' of social and individual learning**. Practice and project-based teaching that **ties science content to 3D tangible objects, immersive games, or cyberinfrastructure (CI) systems** can merge real data with real learning applications will accelerate and advance a science literate citizenry. Certainly, drones or robots that auto-collect and feed data/information to CI systems.

-**Transforming the culture and practice of science** is the grandest challenge. Applications that can assist with the transition to New Science Practices may help the rate of evolution within research/academic circles. As a group, we have to adapt our academic reality to fit within a new era of openness and sharing. This means that adapting workflows and documenting for reproducibility involve skills that have not been taught to date. The adjustment will also necessitate a relaxation of the existing social hierarchy in academe. Power may not come from harboring great knowledge, but rather from distributing your knowledge and sharing with others openly. Assessment of success

must evolve to reflect a multi-attributed and more diverse reality. Science will happen, but the linearity of the current process is untenable. Non-linear approaches and credit for alternative mechanisms will be needed while assuring validity of results.