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# SORS: Large-Scale Machine Learning in Cancer and Brain Research: New Applications That Will Drive Future Supercomputing Systems



**Speaker:** Rick Stevens, Argonne National Laboratory and University of Chicago

**Abstract:** In this talk I'll discuss the DOE/NCI cancer research co-design projects that are a key part of the Presidential Moonshot Cancer Initiative and the brain connectome project at the heart of the National Brain Observatory concept being developed at Argonne. These two projects are aimed at major problems in cancer and brain research and are emerging as major Exascale computing drivers that require the integration

of large-scale machine learning, data analytics and simulation.  I will also discuss our Argonne computing roadmap including the Athena, Theta and Aurora supercomputers and new directions we are investigating for hardware acceleration of deep learning applications in future large-scale platforms.

**Bio:** Rick L. Stevens is the Associate Laboratory Director of Computing, Environment, and Life Sciences (CELS) at Argonne National Laboratory, which is the U.S. Department of Energy's (DOE's) oldest lab for science and energy research.  The CELS directorate that he leads includes the Argonne Leadership Computing Facility, the Advanced Protein Characterization Facility and the DOE's Atmospheric Climate Research Facility Southern Great Plains Site. He leads Argonne's computational genomics program. He is a professor of computer science at the University of Chicago (UChicago) and is involved in interdisciplinary studies at the Computation Institute and at the Institute for Genomics and Systems Biology, where he holds senior fellow appointments.

Stevens is also Principle investigator for the NIAID Bioinformatics Resource Center program where his group has developed computational tools and genomics databases to support infectious disease research.  He is lead of the DOE/NCI pilot project for modeling cancer drug response for cell lines and patient derived xenografts, that combines machine learning, optimal experimental design and hybrid modeling that integrates statistical and mechanistic modeling approaches.   He also leads the multi laboratory DOE exascale applications project on scalable methods for predictive oncology. Stevens is co-principal investigator, chief technical officer, and chief architect of the DOE Systems Biology Knowledgebase project, an emerging software and data environment designed to enable researchers to collaboratively generate, test and share new hypotheses about gene and protein functions, perform large-scale analyses on a scalable computing infrastructure, and model interactions in microbes, plants, and their communities.

Stevens is interested in the development of innovative tools and techniques that enable computational scientists to solve important large-scale problems on advanced computers. His research focuses on two principal areas: high-performance computer architectures, and computational problems in the life sciences. In addition to his research work, Stevens teaches courses on computer architecture, collaboration technology, parallel computing, and computational science. He serves on many national and international advisory committees and still finds time to occasionally write code and play with his 3D printer.

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