On the Convergence of Medicine and Space Exploration with Computing

Alain T. Rappaport
NASA Center of Excellence for IT, Office of the Director
NASA Ames Research Center
Moffett Field, CA

Biomedical research, drug discovery and development and clinical sciences are undergoing a major revolution driven by information-intensive processes, or the "info lab", complementary to the well known "wet lab". At the core of this transformation are fields such as genomics, which increasingly rely on the use of computing solutions to gather, model and interprete data from new technologies (e.g. DNA chips, Combinatorial Chemistry, High-Throughput Screening). Furthermore, the computing solutions in question require complex knowledge-level integration capabilities, to discover, analyze, synthesize and transform information. The computing requirements of molecular medicine are not only data- but also logic-intensive, involving heuristics from many different disciplines; they will motivate new and powerful computer science research initiatives and approaches to life sciences.

NASA's Center of Excellence for Information Technology, based at the NASA Ames Research Center, focuses on three fundamental dimensions of computing: high-performance computing and networking, autonomy and reasoning, and human-centered computing. Much like the new medicine, space exploration is critically linked to or sometimes even defined by information processes rather than the better known physical artifacts. Areas such as Earth Observing Systems require data-intensive computational solutions to make sense of large amounts of information, and the use of powerful heuristics generated by higher-level models of what "logic" we know of climatic and other phenomena. High- but also smart-resolution imaging is necessary to efficiently view images from planetary probes. Research on new materials, new sensors, space-based sensory imaging, autonomy and other fundamental areas all involve innovative computing solutions.

We will explore in more details this convergence of computing with both medicine and space exploration, and the potential opportunities for a cross-fertilization of ideas and research topics between the three fields.