Future Directions in Computing

Frontiers of Predictive Oncology II
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Computing is emerging as an important integrating element leading to predictive biology.
Partnership between computation and experiment delivers believable codes and actionable simulations.
This is a time of rapid technological change in computing

Existing strategies for scaling are becoming unsustainable
  • Reaching limitations on Moore’s Law scaling
  • Limitations due to power requirements for data movement

Rise of data analytics applications
  • Reach of machine learning is expanding
  • Explosion (and availability!) of data
  • It’s where the money is—vendor roadmaps are focusing here

Can we leverage the data science advances that are proving to be game changers across the computing industry?
Addition of data analytics and machine learning tools can accelerate our ability to develop insight.
Two ways we envision using machine learning techniques along with predictive simulation

Machine learning “on the inside”

Machine learning to identify bottlenecks and optimize running simulations
Two ways we envision using machine learning techniques along with predictive simulation

Machine learning “on the outside”

Optimize solutions with significant reduction in compute requirements

Integrated workflows develop insight faster
Automated hypothesis generation and dynamic validation

Hypothesis generation – use the ML model to predict parameters for experimental data

High dimensional model parameters

Machine learning to train a reduced-order predictive model

Ensembles of simulation [parameter,output] sets

High-fidelity simulation
Many new technology directions are being explored for next generation computing

New memory technologies and architectures

Neuromorphic systems and accelerators

Quantum information systems

These technologies are beginning to show up in advanced architectures, and are harbingers of the complexity that will be future computing