"The third pillar of science: predictive computing, from stars to organic molecules"

Dr. Amir Shahmoradi

Peter O'Donnell, Jr. Fellow, Adjunct Professor

Department of Aerospace Engineering and Engineering Mechanics

Institute for Computational Engineering and Sciences

The University of Texas at Austin

For centuries, scientific methodology has been founded on the two classical pillars of science: observation and theory. Over the past 50 years, however, technological breakthroughs have given rise to predictive computing as the third pillar of science: a new means of acquiring knowledge through computer simulations where experiments are impossible or inadequate. In this talk, I describe the connection between the three cornerstones of quantitative science: the collection of experimental data, the formation of hypotheses/theories, and the use of computer simulations, mathematical modeling, and model selection techniques to identify the simplest most-plausible scientific theory. I present a unified framework for scientific prediction and decision-making, with example applications to high energy astrophysics, molecular evolutionary biology, and computational oncology.

Dr. Amir Shahmoradi is currently a Peter O'Donnell, Jr. fellow at Institute for Computational Engineering and Sciences, an adjunct professor at the Department of Aerospace Engineering and Engineering Mechanics, and a member of the Center for Computational Oncology at the University of Texas at Austin. He completed his Ph.D. at the University of Texas in the field of Computational Physics and Bioinformatics. His research interests and expertise include computational physics, computational oncology, astronomy and astrophysics, bioinformatics, molecular evolutionary biology, molecular dynamics simulations, high performance computing and numerical algorithms for mathematical modeling. He also holds a M.Sc. degree in High Energy Astrophysics and Cosmology from Michigan Tech University. His current research focus is on mathematical and computational modeling of tumor growth.