



FOURTH ISC WORKSHOP ON HPC APPLICATIONS IN PRECISION MEDICINE

July 2, 2021

(8 a.m. – 12 noon, All times listed are Eastern Time)

Program

- 8:00 a.m.–8:05 a.m. **Welcome — Fourth ISC Workshop on HPC Applications in Precision Medicine (HAPM21)**
Eric Stahlberg, Frederick National Laboratory for Cancer Research
- 8:05 a.m.–8:45 a.m. **Keynote**
Collective effects in cancer invasion and progression: Insights from mathematical models and analysis
Andreas Deutsch, Technische Universität Dresden
- 8:45 a.m.–9:05 a.m. *Simulating evolution in heterogeneous tumors and the influence of the microenvironment*
Jakob Rosenbauer, Research Center Jülich; Marco Berghoff, Karlsruhe Institute of Technology; Alexander Schug, Research Center Jülich
Presenter: Jakob Rosenbauer
- 9:05 a.m.–9:25 a.m. *A digital twin dyad with deep Q-learning in head and neck cancer treatment*
Elisa Tardini, The University of Illinois at Chicago; Xinhua Zhang, The University of Illinois at Chicago; Guadalupe Canahuate, University of Iowa; Andrew Wentzel The University of Illinois at Chicago; Abdallah S. R. Mohamed, The University of Texas MD Anderson Cancer Center; Lisanne Van Dijk, The University of Texas MD Anderson Cancer Center;

Clifton D. Fuller, The University of Texas MD Anderson Cancer Center; G. Elisabeta Marai, The University of Illinois at Chicago

Presenter: Elisa Tardini

9:25 a.m.–9:45 a.m.

Leveraging a hybrid and multiscale model to assist androgen deprivation therapy in recurrent prostate cancer patients

Mengdi Tao, Alokendra Ghosh and Ravi Radhakrishnan, University of Pennsylvania

Presenter: Mengdi Tao

9:45 a.m.–10:05 a.m.

Quantifying vulnerability of privacy attacks on MT-CNN models for information extraction from cancer pathology reports

Hong-Jun Yoon, Hilda B. Klasky, Christopher Stanley and J. Blair Christian, Oak Ridge National Laboratory; Eric B. Durbin, University of Kentucky; Xiao-Cheng Wu, Louisiana State University Health Sciences Center School of Public Health; Antoinette Stroup, Rutgers Cancer Institute of New Jersey; Jennifer Doherty, University of Utah; Linda Coyle, Information Management Services, Inc.; Lynne Penberthy, National Cancer Institute; Georgia Tourassi, Oak Ridge National Laboratory

Presenter: Hong-Jun Yoon

10:05 a.m.–10:20 a.m.

Break

10:20 a.m.–10:55 a.m.

Panel: *Digital Twins for Cancer Care*

Moderator:

Eric Stahlberg, Frederick National Laboratory for Cancer Research

Panelists:

Anastasia Christianson, Johnson & Johnson

Tina Hernandez-Boussard, Stanford University

Emily Greenspan, National Cancer Institute

Marieke Kuijjer, Centre for Molecular Medicine Norway

10:55 a.m.–11:15 a.m.

Medical cybernetics for continuous risk assessment and value of information analysis of treatments

Zsolt Ori, Ori Diagnostic Instruments LLC

11:15 a.m.–11:35 a.m.

Security standards and ease of use of HPC systems by clinical researchers

Matthew R. Link, Anurag Shankar, David Hancock, Robert Henschel, Scott Michael and Craig A. Stewart, Indiana University

Presenter: Craig A. Stewart and Anurag Shankar

- 11:35 a.m.–11:55 a.m. *Longitudinal deep learning study on MIMIC-III dataset*
Xin Dai, Ji Hwan Park, Nicholas D'imperio, Shinjae Yoo, Brookhaven National Laboratory
Presenter: Nicholas D'imperio and Shinjae Yoo
- 11:55 a.m.–12:00 p.m. **HAPM21 Wrap-Up**

Keynote



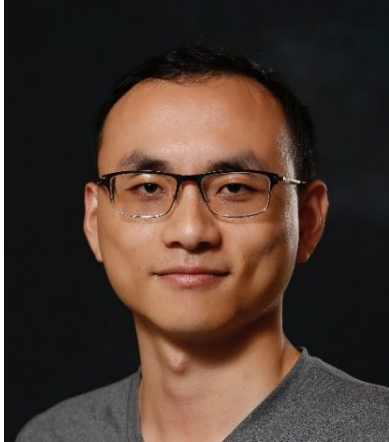
Andreas Deutsch, Dresden University of Technology

Andreas Deutsch is head of the department of Innovative Methods of Computing at the Centre for Information Services and High Performance Computing (Dresden University of Technology). His research is focused on mathematical biology, especially cellular automata and agent-based modelling, cancer invasion and collective phenomena in the life sciences.

Organizing Committee

- Marco Berghoff** – Karlsruhe Institute of Technology
Stephen Litster – Amazon Web Services
Jan Nygard – Cancer Registry of Norway
Eric Stahlberg – Frederick National Laboratory for Cancer Research
Thomas Steinke – Zuse Institute Berlin
Lynn Borkon – Frederick National Laboratory for Cancer Research
Petrina Hollingsworth – Frederick National Laboratory for Cancer Research

Presenters



Xin Dai, Brookhaven National Laboratory

Xin Dai is a Research Associate in the Computational Science Initiative, Brookhaven National Laboratory. His research focuses on applying machine learning methods to various domain scientific problems. Before joining BNL, he was a postdoc researcher at Ohio State University. He obtained a PhD in physics from Tsinghua University in 2018.

Emily Greenspan, National Cancer Institute

Dr. Emily Greenspan is a biomedical informatics program director in the Center for Biomedical Informatics and Information Technology (CBIIT) at the National Cancer Institute (NCI). She serves as the NCI federal program lead for the NCI-Department of Energy (DOE) Collaborations focused on applying advanced computing and artificial intelligence (AI) technologies to specific areas of cancer research. She has supported and promoted predictive oncology and AI strategies across NCI.



Tina Hernandez-Boussard, Stanford University

Dr. Hernandez-Boussard is an associate professor in medicine (biomedical informatics), biomedical data science and surgery at the Stanford University School of Medicine. Dr. Hernandez-Boussard's background and expertise is in the field of computational biology and epidemiology, with concentration on clinical informatics, population health and health policy. A key focus of her research is the application of novel methods and tools to large clinical datasets for hypothesis generation, comparative effectiveness research and the evaluation of quality healthcare delivery. (boussard@stanford.edu)



Marieke Kuijjer, Centre for Molecular Medicine Norway

Marieke Kuijjer is a Group Leader in Computational Biology and Systems Medicine at the Centre for Molecular Medicine Norway (NCMM), a Nordic EMBL partner, University of Oslo, Norway. She also has a 20% affiliation as Assistant Professor at the department of Pathology, Leiden University Medical Center, the Netherlands. Before starting her research group at the NCMM, she completed a postdoctoral fellowship in computational biology in the laboratory of John Quackenbush at the Department of

Biostatistics and Computational Biology of the Dana-Farber Cancer Institute and the Department of Biostatistics of Harvard T.H. Chan School of Public Health, Boston, MA. She obtained her PhD in 2013 from Leiden University, working at the Department of Pathology of Leiden University Medical Center in the field of cancer genomics. Dr. Kuijjer's research interests include computational tool development and their applications in personalized cancer network genomics. She serves on the editorial board of Cancer Research and is associate editor of Bioinformatics Advances.



Zsolt P. Ori, Ori Diagnostic Instruments LLC

Zsolt P. Ori is a practicing internist, primary physician and hospitalist with previous training in Bio-Medical Cybernetics (Ilmenau University of Technology, Germany) before entering medical school (Albert Szent-Györgyi Medical School, Szeged, Hungary) and post-doctoral research fellowship in non-invasive cardiology (Northwestern University, Chicago). His engineering training together with his experiences in primary care in academic and non-academic environments have inspired his vision for using Cybernetics to improve cardiometabolic health with result driven predictive feedback control. His patented inventions can build a bridge between sensory data from wearables

and plug the data into physiological process models and make the otherwise undetectable slow changes of the energy metabolism observable and derive easily readable trend indicators allowing for stepwise dynamic behavior control for reaching cardiometabolic health and mental resilience. CPS derived data can provide metrics facilitating education about metabolic health as well as to reach community health, corporate health and public health goals. Principles of continuous non-invasive risk assessment and management of health in the user's home environment could be followed realizing individualized "precision medicine."

Jakob Rosenbauer, Forschungszentrum Jülich

Jakob Rosenbauer works in the group of Alexander Schug at Forschungszentrum Jülich and graduated in May. He obtained his MSc at Karlsruhe Institute of Technology. He currently works on the implementation and application of large-scale tissue modeling using supercomputing architectures. His main research interests are the simulation of emergent behavior from single cell mechanical properties and the translation to findings in tumor development.



Anurag Shankar, Indiana University

Anurag Shankar manages a small group of cybersecurity professionals within Indiana University's Center for Applied Cybersecurity Research (CACR), a Pervasive Technology Institute unit. He oversees HIPAA compliance for IU's Office of the Vice President for IT and runs a campus-wide service that assists IU researchers with cybersecurity and compliance. Shankar is a computational astrophysicist by training. He was part of the inaugural batch of users at the newly established US supercomputer centers in the 80s such as NCSA, SDSC and PSC. After his research career, he transitioned to IT and research computing, spending nearly two decades developing, delivering, and managing IU's central research cyberinfrastructure, including services such as Unix support, distributed storage, computational grids, and HIPAA aligned solutions for clinical researchers. He switched to research cybersecurity and regulatory compliance in the late 2000s and developed IU's present, NIST-based Risk Management Framework and leveraging it to align central research systems with HIPAA. He routinely assists other institutions tackling HIPAA and other types of compliance and conducts compliance assessments.



Eric Stahlberg, Frederick National Laboratory for Cancer Research

Dr. Eric Stahlberg is the director of Biomedical Informatics and Data Science (BIDS) at the Frederick National Laboratory for Cancer Research. Dr. Stahlberg is a founding co-organizer of the Computational Approaches for Cancer Research Workshop (CAFCW), held in conjunction with the SC conference since 2015. He has been instrumental in establishing the Frederick National Laboratory's high-performance computing initiative and in assembling scientific

teams across multiple, complex organizations to advance predictive oncology. In 2017, he was recognized as one of FCW's Federal 100.

Craig A. Stewart, Indiana University

Craig A. Stewart has been a leading innovator and strategist in advanced computing and cyberinfrastructure for research and development for decades. He was the executive director of the Indiana University Pervasive Technology Institute from 2008 to 2020. IU PTI is Indiana University's flagship organization for research and development in cyberinfrastructure, informatics and computer science in support of science and engineering research, artistic creativity and cybersecurity. Stewart's group coined the now standard definition of



cyberinfrastructure – see hdl.handle.net/2022/21589. Stewart has been involved in research computing since writing Fortran-based statistical applications while completing his PhD in biology in the 1980s. Stewart was the founding PI of Jetstream, the first cloud computing system funded by the National Science Foundation for use by the science and engineering community of the US. In addition to his work at IU, Stewart has been a visiting faculty member in computer science at the Universität Stuttgart and a Fulbright Senior Scholar at the Technische Universität Dresden. Stewart has been on staff and on several committees for the National Science Foundation as well as on advisory committees and in leadership of a number of other organizations related to advanced computing. Stewart is a past chair of the Coalition for Advanced Scientific Computation and in this role testified before the House Science and Technology Committee.



Mengdi Tao, University of Pennsylvania

Mengdi Tao is a PhD student of Dr. Ravi Radhakrishnan's lab, in the department of bioengineering at the University of Pennsylvania. She received her BS and MS degrees in biomedical engineering from Drexel University. A major focus of her ongoing research is to understand quantitative mechanistic characterization of structural biology and systems biology. The ultimate aim is to build hybrid and multiscale quantitative models of signaling networks, while retaining sufficient molecular specificity, for predicting the interactions of therapeutic agents with biochemical signaling mechanisms.



Elisa Tardini, University of Illinois at Chicago

Elisa Tardini is a Research Specialist at the University of Illinois at Chicago, where she obtained her master's of science degree in computer science. She also obtained a bachelor's and master's of science degrees in computer science and engineering from Politecnico di Milano. Her research interests are in machine learning, reinforcement learning, and medical informatics.

Hong-Jun Yoon, Oak Ridge National Laboratory

Hong-Jun Yoon is a research scientist in the Computational Sciences and Engineering Division at Oak Ridge National Laboratory. He is involved in the Joint Design of Advanced Computing Solutions for Cancer (JDACS4C), a research collaboration between the Department of Energy (DOE) and National Cancer Institute (NCI).

