2019 ML-MSM Speakers

Dr. Ilias Bilionis is an Assistant Professor of Mechanical Engineering at Purdue University and his research is motivated by energy and material science applications and it focuses on the development of generic methodologies for design and optimization under uncertainty, reliability analysis, model calibration and learning models out of data.

Dr. Kristofer Bouchard is PI of the Neural Systems and Data Science Lab at Lawrence Berkeley National Laboratory (LBNL) and UC Berkeley. He received his PhD in Neuroscience in 2010 from UC San Francisco and held postdoctoral fellow positions at UCSF Medical Center 2011-2014 and at LBNL 2014-2015. His interdisciplinary research focuses on understanding how distributed neural circuits give rise to coordinated behaviors and perception and approaches this problem by conducting in vivo neuroscience experiments and developing data science tools. His neuroscience research focuses on functional organization and dynamic coordination in the brain by combining in vivo multiscale electrophysiology and optogenetics in rodents with biophysically detailed simulations. On the data science side, he develops analysis tools for neuroscience, including statistical-machine learning algorithms, dynamic graphical models, and data standards and formats.

Prof. Gunnar Cedersund has his basic training in theoretical physics, but has been working for 20 years with mathematical modelling of biomedical systems, first in engineering departments, and then in cell biology, clinical, and biomedical engineering departments. The modeling projects has covered almost all of the main organs in human body: the liver, brain, fat tissue, pancreas, heart and blood circulation, muscle, spleen, etc. Lately, these have come together into a single interconnected multi-level and multi-timescale model for the whole-body. This model interconnects brain activity with inflammation, blood flow and pressure control, with fat and glucose metabolism, etc. This integrative work is possible via the joint and coordinated action of the 15 people strong research group called "Integrative Systems Biology", located in Linköping, Sweden. To help commercialize and productify the resulting digital twin technology, Cedersund has recently started the new spin-off company "SUND sound medical decisions".

Dr. David Craft is an Assistant Professor and the Head of the Optimization and Systems Biology Lab at Harvard Medical School and MGH. His current focus is on the development of machine learning approaches for personalized cancer treatment. The main research questions related to this line of work are: *what is the value of prior knowledge in this domain* and *how can we best incorporate such expert knowledge?*

Suvranu De is the J Erik Jonsson '22 Distinguished Professor of Engineering at Rensselaer Polytechnic Institute where he serves as Head of the Department of Mechanical, Aerospace and Nuclear Engineering (MANE) and Director of the Center for Modeling, Simulation and Imaging in Medicine (CeMSIM). He received his Sc.D. in Mechanical Engineering from MIT in 2001. His research interests include the development of novel, robust and reliable computational technology to solve challenging and high-impact problems in engineering, medicine and biology. He is the recipient of the ONR Young Investigator Award (2005), Rensselaer School of Engineering Research Excellence Award (2008), the James M. Tien '66 Early Career Award for Faculty (2009), the Rensselaer School of Engineering Outstanding Research Team Award (2012) and the J. Tinsley Oden Medal of the U.S. Association for Computational Mechanics (2019). He is Senior Member of IEEE and serves as Vice Chair (Awards) of the IEEE Technical Committee on Haptics, Chair of the Computational Bioengineering Committee of the US Association for Computational Mechanics and leads/co-leads several committees of the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES). He is a member of numerous editorial boards and national technical committees and is an elected Fellow of three professional societies: the American Institute for Medical and Biological Engineering, the International Association for Computational Mechanics and the United States Association for Computational Mechanics.

Dr. Alberto Figueroa received his PhD in Mechanical Engineering from Stanford University in 2006. In 2011, he was appointed Associate Professor in Biomedical Engineering at King's College London. He moved to the University of Michigan in 2014, where he is currently the Edward B. Diethrich M.D. Research Professor of Biomedical Engineering and Vascular Surgery. Dr. Figueroa's main expertise is image-based simulation of hemodynamics. His doctoral work focused on developing techniques for fluid-structure interaction and multi-scale modeling for subject-specific cardiovascular simulations. Dr. Figueroa's current research interests include: – Methods to predict the short-term response (auto-regulation) of the arterial system in response to changes in pressure and flow. – Pathophysiology and mechano-biology of arterial hypertension. – Methods to predict the growth & remodeling of blood vessels in response to changes in their biomechanical environment. – Computational tools to evaluate and predict the performance of abdominal and thoracic endografts. Dr. Figueroa's lab is currently developing the open-source software for patient-specific blood flow modeling "CRIMSON" (Cardiovascular Integrated Modeling and Simulation). This project is funded by the European Research Council via the "Starting Grant" mechanism, the most competitive in Europe. The

goal of this project is to develop software to perform "virtual surgical planning", a paradigm that will enable one day to test different approaches for a surgery and choose the optimal prior to the procedure. Dr. Figueroa has published extensively in the fields of Biomedical Engineering, Applied Mechanics, Life Sciences, and Vascular and Endovascular Surgery.

Dr. Susan K. Gregurick is the Associate Director for Data Science (ADDS) and the Director of the [NIH Office of Data Science Strategy (ODSS)](#). She replaces [Phillip E. Bourne, Ph.D., who departed in 2017](#) to the University of Virginia. During this interim period, NIH Principal Deputy Director Lawrence A. Tabak, D.D.S., Ph.D., has served as the acting ADDS. Dr. Gregurick has served as the senior advisor to ODSS since November 2018, and will begin her new role on Monday, September 16. Dr. Gregurick will help lead NIH efforts in coordinating and collaborating with appropriate government agencies, international funders, private organizations, and stakeholders engaged in scientific data generation, management, and analysis. As the ADDS, director of ODSS, and a co-chair of the trans-NIH Scientific Data Council, she is well positioned to lead the [NIH Strategic Plan for Data Science](#). She brings substantial experience in computational biology, high performance computing, and bioinformatics to this position. Additionally, she has worked across sectors, in the government at the NIH and the Department of Energy (DOE), on trans-government committees, and in academia, which is critical in the convening role that the ADDS plays. Since 2013, Dr. Gregurick has been Director of the Division of Biophysics, Biomedical Technology, and Computational Biosciences in the National Institute of General Medical Sciences (NIGMS). In this role, she has overseen programs that advance research in computational biology, biophysics and data sciences, mathematical and biostatistical methods, and biomedical technologies in support of the NIGMS mission to increase understanding of life processes. Prior to joining NIGMS, Dr. Gregurick was a program manager for the DOE from 2007-2013 where she oversaw the development and implementation of the DOE Systems Biology Knowledgebase, a framework to integrate data, models, and simulations for a better understanding of energy and environmental processes. Before then, Dr. Gregurick was Professor of Computational Biology at the University of Maryland, Baltimore County, from 2000-2007. Her research interests include dynamics of large biological macromolecules. She earned a B.S. in chemistry and mathematics from the University of Michigan, Ann Arbor, and a Ph.D. in computational chemistry from the University of Maryland, College Park.

Dr. Chinmay Hegde is an Assistant Professor in the Electrical and Computer Engineering Department at Iowa State University. His research group is interested broadly in problems related to data processing and machine learning. His group focuses on developing fast and robust algorithms for diverse problems in data sensing and inference.

George Karniadakis received his S.M. (1984) and Ph.D. (1987) from Massachusetts Institute of Technology. He was appointed Lecturer in the Department of Mechanical Engineering at MIT in 1987 and subsequently he joined the Center for Turbulence Research at Stanford / Nasa Ames. He joined Princeton University as Assistant Professor in the Department of Mechanical and Aerospace Engineering and as Associate Faculty in the Program of Applied and Computational Mathematics. He was a Visiting Professor at Caltech (1993) in the Aeronautics Department. He joined Brown University as Associate Professor of Applied Mathematics in the Center for Fluid Mechanics on January 1, 1994. He became a full professor on July 1, 1996. He has been a Visiting Professor and Senior Lecturer of Ocean/Mechanical Engineering at MIT since September 1, 2000. He was Visiting Professor at Peking University (Fall 2007 & 2013). He is a Fellow of the Society for Industrial and Applied Mathematics (SIAM, 2010-), Fellow of the American Physical Society (APS, 2004-), Fellow of the American Society of Mechanical Engineers (ASME, 2003-) and Associate Fellow of the American Institute of Aeronautics and Astronautics (AIAA, 2006-). He received the Ralf E Kleinman award from SIAM (2015), the (inaugural) J. Tinsley Oden Medal (2013), and the CFD award (2007) by the US Association in Computational Mechanics.

Ellen Kuhl is the Robert Bosch Chair of Mechanical Engineering at Stanford University. She is a Professor of Mechanical Engineering and, by courtesy, Bioengineering. She received her PhD from the University of Stuttgart in 2000 and her Habilitation from the University of Kaiserslautern in 2004. Her area of expertise is Living Matter Physics, the design of theoretical and computational models to simulate and predict the behavior of living structures. Ellen has published more than 200 peer-reviewed journal articles and edited two books; she is an active reviewer for more than 20 journals at the interface of engineering and medicine and an editorial board member of seven international journals in her field. She is a founding member of the Living Heart Project, a translational research initiative to revolutionize cardiovascular science through realistic simulation with 400 participants from research, industry, and medicine from 24 countries. Ellen is the current Chair of the US National Committee on Biomechanics, an Executive Member of the US Association for Computational Mechanics, and a Member-Elect of the World Council of Biomechanics. She is a Fellow of the American Society of Mechanical Engineers and of the American Institute for Mechanical and Biological Engineering. She received the National Science Foundation Career Award in 2010, was selected as Midwest Mechanics Seminar Speaker in 2014, and received the Humboldt Research Award in 2016. Ellen is an All-American triathlete on the Wattie Ink. Elite Team, a multiple Boston, Chicago, and New York marathon finisher, and a Kona Ironman World Championship qualifier.

Dr. Risi Kodor is an Associate Professor in the Departments of Computer Science and Statistics at the University of Chicago. His current research interests lie in the areas of machine learning, statistical learning theory, non-commutative harmonic analysis, computational group theory, harmonic analysis on graphs and networks, theoretical computer science, and applications in computational physics and biology.

Dr. Amanda J. Minnich is a Machine Learning Research Scientist and Molecular Data-Driven Modeling Team Lead at Lawrence Livermore National Laboratory (LLNL). At LLNL, she is part of the multi-institution ATOM Consortium, where she applies Machine Learning techniques to biological data for drug discovery purposes. Dr. Minnich received a BA in Integrative Biology from UC Berkeley (2009) and an MS (2014) and PhD with Distinction (2017) in Computer Science from the University of New Mexico. She has published her work at and served on Program Committees for top conferences including WWW, ASONAM, KDD, ICDM, SC, GTC, and ICWE, and has been issued a patent for her dissertation work.

Dr. Eric Mjolsness is a Professor in the Departments of Computer Science and Mathematics at University of California Irvine. His group is focused on mathematical AI/ML for multiscale science, with a strong emphasis on biology. Mathematical AI is Artificial Intelligence via high-level symbolic representations (such as computer algebra) of applied mathematical analysis, geometry, algebra, etc.; and ML is mathematical machine learning.

Mark Palmer, MD, PhD is a Distinguished Scientist in Strategic Scientific Operations at Medtronic, plc. He received his BS in Mechanical & Aerospace Engineering from Princeton University. Subsequently, Dr. Palmer attended the University of Michigan where he received an MSE in Mechanical Engineering, MS in Biomedical Engineering ultimately completing the Medical Scientist Training Program with an MD and PhD in Mechanical Engineering. Following graduation, Dr. Palmer spent three years as an entrepreneur before returning to the University of Michigan as a faculty member with appointments in both Biomedical Engineering and Kinesiology collaborating with the Chair of Orthopedic Surgery. In 2014, Dr Palmer was recruited to Medtronic where his current role within Corporate Core Technologies includes serving as an R&D Consultant and Technical Advisor for Medtronic Business Units world-wide, identifying and managing external collaborations, and leading the strategy for modeling and human simulation. Dr. Palmer also leads the Enterprise-wide Working Group for Modeling and Simulation where he regularly reports to the R&D Council, Clinical Research Council, Executive Committee and the Board of Directors on the long-range R&T Strategy for Modeling & Simulation. Dr. Palmer holds 2 patents in computational modeling, has 12 publications on the application of modeling and simulation in leading Biomechanics, Physiology, and Orthopedic journals, and he has served as an invited speaker or presenter at over 40 national and international conferences.

Dr. Bruce J. Tromberg, Ph.D., is Director of the National Institute of Biomedical Imaging and Bioengineering (NIBIB) at NIH, a post he assumed in January 2019. He is a pioneering leader in the field of biophotonics. Prior to his appointment at NIBIB, Dr. Tromberg held dual appointments as professor in the Departments of Biomedical Engineering and Surgery at the University of California at Irvine (UCI). He also directed UCI's Beckman Laser Institute and Medical Clinic, an interdisciplinary research, teaching and clinical center for optics and photonics in biology and medicine. In his 30-plus-year academic and scientific career, Dr. Tromberg conducted extensive NIH-supported research, and was the principal investigator (PI) for multiple NIH grants going back as far as 1994. This includes 20 years as PI for the Laser Microbeam and Medical Program (LAMMP), an NIH National Biomedical Technology Resource Center where several cutting-edge technologies have been developed and disseminated to laboratories and clinics around the world. In addition to advisory committee appointments with numerous national and international entities, Dr. Tromberg provided expertise on NIH working groups, review committees, and boards, including the NIBIB National Advisory Council from 2012-2016. Dr. Tromberg's research spans biophotonics and biomedical optics, two rapidly growing fields that use light to image and conduct therapy at the molecular, cellular and tissue levels. He has co-authored more than 450 publications and holds 18 patents for biophotonics technologies and their applications in areas such as cancer, neuroscience and vascular disease. He specializes in new technology development as well as the "bench to bedside" clinical translation, validation and commercialization of promising methods designed to improve human health.

Additional Speakers (from Pre-Meeting Webinars)

2019 ML-MSM Pre-meeting Webinar: Digital Twin
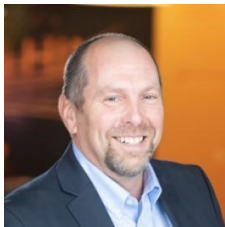
Rusty Irving has very recently retired as the Digital Twin Platform Leader and Chief Engineer at GE Research. A position he held since January 2016. In this capacity, he oversaw the development of Digital Twin technology. It is one of GE's newest products as featured in the company's 2015 and 2016 annual reports. Previous to this Rusty was the Services Technology Leader and Chief Engineer at GE Research. In this role he was responsible for the > $50M in service technology projects at GRC. These projects spanned inspection, repair, sensing systems, monitoring, diagnostics, prognostics, and lifing. He shaped the vision and roadmap for service technology capabilities in the company by analyzing the competitive landscape and communicating its implications for the businesses. Leading up to this Rusty had been in successive engineering roles of increasing technical contribution and organizational leadership. Rusty attended Siena College and graduated with a B.S. Degree in Computer Science in 1985 with a concentration in Math and Physics. Upon graduation he entered the Software Technology Training Program at GE Research in Schenectady, New York. In 1988 Rusty graduated from that program and also received his Master's Degree in Computer Science from Rensselaer Polytechnic Institute. **Dr. Marc Horner** is a principal engineer leading technical initiatives for the healthcare industry at ANSYS, Inc. Marc joined ANSYS after earning his Ph.D. in Chemical Engineering from Northwestern University in 2001. Marc currently holds a number of industry leadership positions, with a focus on model credibility frameworks,
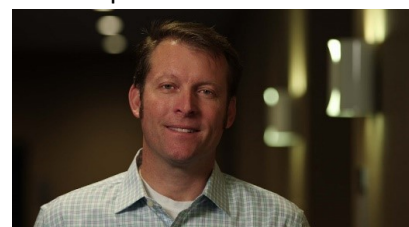
regulatory science, and clinical applications. These include Vice Chair of the ASME V&V40 Sub-Committee and Chair of the AAPS Process Modeling and Simulation Focus Group (PMSFG). Lastly, Marc is an Executive Committee Member of the IMAG/MSM Credible Practice of Modeling & Simulation in Healthcare project, which aims to establish a task-oriented collaborative platform that outlines credible practices of simulation-based medicine.

2019 ML-MSM Pre-meeting Webinar - Human Safety: Intro & Population Models

Dr. Eili Klein has been associated with the Center for Disease Dynamics Economics & Policy since its founding and is currently a fellow. Dr. Klein is a mathematical ecologist and epidemiologist whose research focuses on the role of behavior in the spread of infectious diseases. Examining how individuals respond to incentives for both healthy and unhealthy behavior – an area which economics has a lot to say – and how this then impacts the spread disease can improve policy responses to epidemic diseases by giving policymakers and health-care providers clear tools for thinking about how certain actions can influence the spread of disease transmission. Dr. Klein has authored numerous publications on the evolution and spread of antimicrobial drug-resistance, with particular reference to the emergence of antibiotic and antimalarial drug resistance. This has included descriptions of the burden and seasonality of methicillin-resistant Staphylococcus aureus (MRSA), as well as other pathogens including carbapenem-resistant enterococci. Dr. Klein has also looked at how patients view the prescribing of antibiotics and what relationship this holds to the primary messaging regarding the overuse of antibiotics. Dr. Klein is an assistant professor in the Department of Emergency Medicine at Johns Hopkins University. He joined the Hopkins faculty in 2012 after finishing his PhD in ecology and evolutionary biology from Princeton University.

2019 ML-MSM Pre-meeting Webinar- DARPA ASKE- COSMOS Platform **Theodoros (Theo) Rekatsinas** is an Assistant Professor in the Department of Computer Sciences at the University of Wisconsin-Madison. He is a member of the Database Group. He earned his Ph.D. in Computer Science from the University of Maryland and was a Moore Data Postdoctoral Fellow at Stanford University. His research interests are in data management, with a focus on data integration, data cleaning, and uncertain data. Theo's work has been recognized with an Amazon Research Award in 2018, a Best Paper Award at SDM 2015, and the Larry S. Davis Doctoral Dissertation award in 2015. **Shanan Peters** is the Dean L. Morgridge Professor in the Dept. of Geoscience at the University of Wisconsin-Madison. He earned his Ph.D. from the University of Chicago and was a University of Michigan Fellow. His research involves understanding the long-term coevolution of Earth and life, which requires compiling global databases of fossils and rocks. To this end, he has overseen technical development of manually-constructed databases, including the Paleobiology Database and Macrostrat, and has led the NSF EarthCube project called GeoDeepDive, now called xDD, a platform for text and data mining from scientific publications. **Miron Livny** received a B.Sc. degree in Physics and Mathematics from the Hebrew University and M.Sc. and Ph.D. degrees in Computer Science from the Weizmann Institute of Science. He is currently the John P. Morgridge Professor of Computer Science, the director of the Center for High Throughput Computing (CHTC), is leading the HTCondor project and serves as the principal investigator and technical director of the Open Science Grid (OSG). He is a member of the scientific leadership team of the Morgridge Institute of Research where he is leading the Software Assurance Market Place (SWAMP) project and is serving as the Chief Technology Officer of the Wisconsin Institutes of Discovery.

[2019 ML-MSM Pre-meeting Webinar - DARPA AutoMATES Project](#) **Dr. Clay Morrison's** research is in machine learning and artificial intelligence, where he designs computer algorithms that learn rich, structured representations from unstructured data, such as images, video and text. These representations can then be used in complex decision making. Through the support of NSF, DARPA, AFOSR, and ONR, Dr. Morrison has led research projects that have developed machine learning algorithms, implemented and evaluated computer systems, and conducted empirical studies with human subjects. These projects have included developing machine reading technology to read scientific literature and computer source code to. extract and assemble computational models, computer systems that can be taught through natural human instruction, machine learning algorithms for learning structured, latent representations of data, and modeling the relationship between human facial expressions, emotion, and decision-making.

[2019 ML-MSM Pre-meeting Webinar - DARPA EMMAA Project](#) **Dr. John Bachman** is a Fellow in Therapeutic Science at Harvard Medical School's Laboratory of Systems Pharmacology. His research focuses on the development of computational tools for understanding the behavior of complex biological systems, and the application of these tools to studying problems of cellular decision-making in health and disease. In his most recent work he co-developed the Integrated Network and Dynamical Reasoning Assembler (INDRA) to automate the construction of explanatory biological models from natural language and scientifc literature. John received his Ph.D. in Systems Biology from Harvard University working in the lab of Dr. Peter Sorger, where he combined wet-lab experimentation and computational modeling to address unresolved mechanistic questions in programmed cell death. Before obtaining his Ph.D. John worked as a scientist for four years at the Cambridge, MA, research software company Charles River Analytics. At CRA he worked on several projects for the Army and Air Force Research Labs using simulation and knowledge management tools to improve human decision making.

[2019 ML-MSM Pre-meeting Webinar - NASA Project](#) **Dr. Alexander Schepelmann** is a Robotics and Computational Modeling Engineer at ZIN Technologies, Inc. with over ten years of experience in designing and controlling robotic systems. He holds Bachelor of Science and a Master of Science degrees in Mechanical Engineering from Case Western Reserve University, as well as a Master of Science and a Doctor of Philosophy in Robotics from Carnegie Mellon University. At Case Western Reserve University, Dr. Schepelmann's work revolved around the development of computationally efficient, real-time probabilistic computer vision and control algorithms for autonomous lawnmowing applications, which allowed autonomous vehicles to dynamically react to and rapidly re-plan around obstacles. At Carnegie Mellon University, his work focused on the design and control of legged locomotion testbeds to evaluate decentralized swing-leg controllers, and the optimization-based design and control of compact nonlinear springs for series elastic actuators. Dr. Schepelmann also completed a post-doctoral fellowship at Carnegie Mellon University/HEBI Robotics, where he worked as a controls and state-estimation subject matter expert to help in the commercialization of modular robot actuator technologies. In his current role at ZIN, he supports NASA's Human Research Program to develop computational models of bone health and the cognitive impact of radiation and other stressors during long-duration spaceflight. He also supports the design and control of the "Advanced Twin Lifting and Aerobic System (ATLAS)," a human-in-the-loop robotic exercise device under development for use during long-duration space missions.