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Section 4: September 2020

<table>
<tr><td colspan="4">Time: September 10, 15:00-16:00 PM (Beijing time) Lecture No. 20200910-14</td></tr>
<tr><td colspan="4">Lecture website (zoom): https://zoom.com.cn/j/64691294982
ID: 64691294982 Password: 20200910</td></tr>
<tr><td>Speaker</td><td>Roland Potthast</td><td>Affiliation</td><td>DWD/BMVI, Germany,
University of Reading, UK</td></tr>
<tr><td colspan="4">Title: Nonlinear methods for data assimilation and reconstruction</td></tr>
<tr><td colspan="4">Abstract: We discuss the development of non-linear filtering methods for very high-dimensional systems. In this talk, non-linear filtering is developed in the framework of the ensemble data assimilation system of the German Weather Service DWD, both for the global forecasting model and convective scale atmospheric forecasting. We will discuss the role of covariance information for reconstruction of states or parameter functions, and the need and importance of using non-Gaussian distributions within the reconstruction algorithms.
In a broader framework, we discuss ongoing research and results on the localized adaptive particle filter (LAPF) and a Localized Mixture Coefficient Particle Filter (LMCPF). We discuss how to overcome filter collapse or divergence by adaptive rejuvenation by mapping into ensemble space and by using adaptive spread estimators. Recent progress is shown on the LMCPF particle filters for Lorenz 63 and 96 models, where now with Gaussian mixture particles and proper covariance inflation the particle filter usually shows comparable or better o-b statistics than the LETKF.</td></tr>
<tr><td colspan="4">Short Bio: Prof. Roland Potthast is currently the director and professor for data assimilation at DWD/BMVI, Germany, and full professor for applied mathematics, University of Reading, UK. Prof. Potthast received his PhD from University of Gottingen, Germany in 1994. Then he worked two years (1995-1996) in University of Delaware as s post-doctoral fellow. He got his Habilitation in Mathematics from University of Gottingen in 1999. His research interests include inverse problems and data assimilation. He has done significant research works and</td></tr>
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published many research papers in top quality international journals, plus three books. Prof. Potthast is heading the data assimilation division of DWD with 38 researchers, working on data assimilation for the atmosphere and the earth system on both regional and global scale.

Time: September 17, 8:00-9:00 AM (Beijing time) Lecture No. 20200917-15			
Lecture website (zoom): https://zoom.com.cn/j/68053997286 **ID:** 68053997286 **Password:** 20200917			
Speaker	Ren-Cang Li	**Affiliation**	University of Texas at Arlington, USA
Title: SCF Iteration for Orthogonal Canonical Correlation Analysis			
Abstract: Canonical Correlation analysis (CCA) is a standard statistical technique and widely-used feature extraction paradigm for two sets of multidimensional variables. It finds basis vectors for the two sets of variables such that the correlations between the projections of the variables onto these basis vectors are mutually maximized. Mathematically, CCA is an optimization problem that can be turned into a singular value problem. Orthogonal CCA (OCCA) is a term that was coined broadly as a collection of variants of CCA imposing orthogonality among basis vectors. The most simple variant is the plain CCA followed by performing the Gram-Schmidt orthgonalization process on the two sets of basis vectors. A more straightforward way is to impose orthogonality while optimizing the same objective function as CCA. It has been observed that orthonormal bases by the latter are more effective than the most simple way in data science applications. However, directly optimizing the objective function with orthogonality constraints on the basis vectors is nontrivial. In the data science community, today it is solved most by generic optimization methods. In this talk, we will present an alternating numerical scheme whose core is a customized self-consistent-field (SCF) iteration for a maximization problem on the Stiefel manifold. Along the line, an orthogonal multiset CCA (OMCCA) will be discussed. Extensive experiments are conducted to evaluate the proposed algorithms against existing methods including two real world data science applications: multi-label classification and multi-view feature extraction. This talk is based a recent joint work with Lei-hong Zhang (Soochow University), Li Wang (UT Arlington), and Zhaojun Bai (UC Davis).			
Short Bio: Ren-Cang Li is a professor with the Department of Mathematics, University of Texas at Arlington, Texas. He received his BS from Xiamen University in 1985, his MS from the Chinese Academy of Science in 1988, and his PhD from University of California at Berkeley in 1995. He was awarded the 1995 Householder Fellowship in Scientific Computing by Oak Ridge National Laboratory, a Friedman memorial prize in Applied Mathematics from the University of California at Berkeley in 1996, and CAREER award from NSF in 1999. His research interest includes floating-point support for scientific computing, large and sparse linear systems, eigenvalue problems, and model reduction, machine learning, and unconventional schemes for differential equations.			

Time: September 24, 8:00-9:00 (Beijing time) Lecture No. 20200924-16			
Lecture website (zoom): https://zoom.com.cn/j/64609873723 **ID:** 64609873723 **Password:** 20200924			
Speaker	Jian-Guo Liu	**Affiliation**	Duke University, USA

Title: Data-driven solvers and optimal control for conformational transitions based on high dimensional point clouds with manifold structure
Abstract: Consider Langevin dynamics with collected dataset that distributed on a manifold M in a high dimensional Euclidean space. Through the diffusion map, we learn the reaction coordinates for N which is a manifold isometrically embedded into a low dimensional Euclidean space. This enables us to efficiently approximate the dynamics described by a Fokker-Planck equation on the manifold N. Based on this, we propose an implementable, unconditionally stable, data-driven upwind scheme which automatically incorporates the manifold structure of N and enjoys the weighted l^2 convergence to the Fokker-Planck equation. The proposed upwind scheme leads to a Markov chain with transition probability between the nearest neighbor points, which enables us to directly conduct manifold-related computations such as finding the minimal energy path via optimal control that represents chemical reactions or conformational changes. This is a joint work with Yuan GAO and Nan WU.
Short Bio: Jian-Guo Liu is a Professor of Mathematics and Physics at Duke University. He received a BS and MS from Fudan University in 1982 and 1985 respectively, and a PhD from UCLA in 1990. His research focuses on analysis of numerical methods for fluid dynamics, kinetic theory, and nonlinear partial differential equations, and applied mathematics in general. He is an AMS Fellow 2017.