International Conference of Kernel-Based Approximation Methods in Machine Learning

May 19-21, 2017

South China Normal University

Guangzhou, Guangdong, China

Information for Participants

Sponsors

Organizers

Conference Schedule

Abstracts

Introductions of Invited Speakers

List of Participants

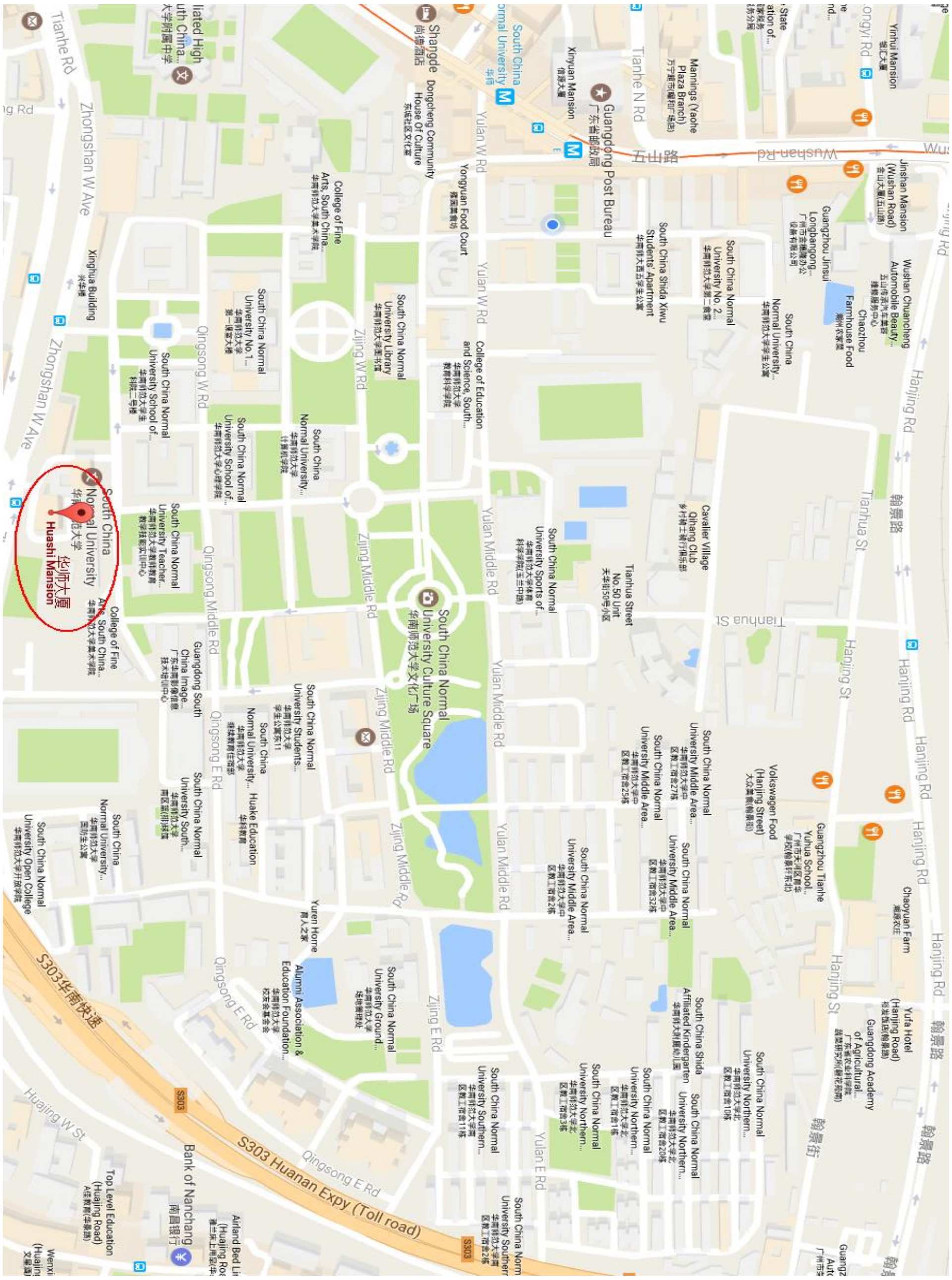
Notes

Information for Participants

Address

Huashi Mansion (Huashi GDH Hotel), 3rd Floor, Xingzhi Hall (华师大厦，三楼行知厅), South China Normal University, Guangzhou, Guangdong, China, 510631

Map



Notes

1. We will only provide lunch and dinner during the conference, except breakfast.
2. The formal dinner (in the evening of May 19) will be held in the 2nd floor of Huashi Mansion.
3. Please have lunch and dinner in the cafeteria on the first floor of Huashi Mansion.
4. Dinner is not available on May 21.
5. Telephone helpline
    a) Health Center : 020-85211120
    b) Security Office: 020-85211100
    c) Huashi Mansion: 020-38939305
    d) Contact staffs if necessary:
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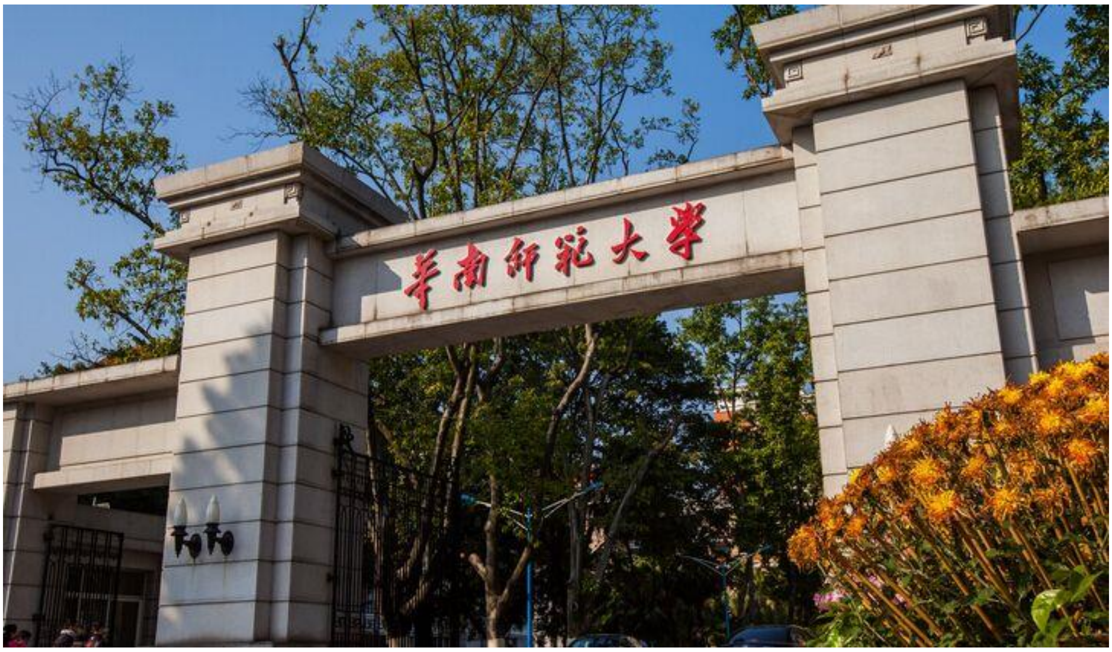
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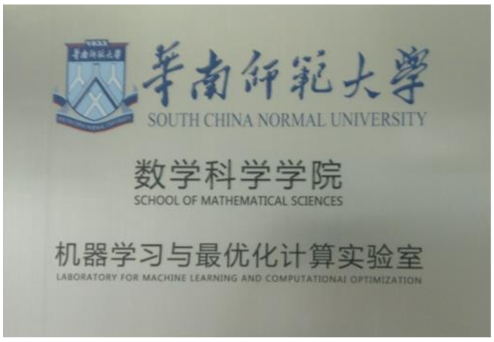
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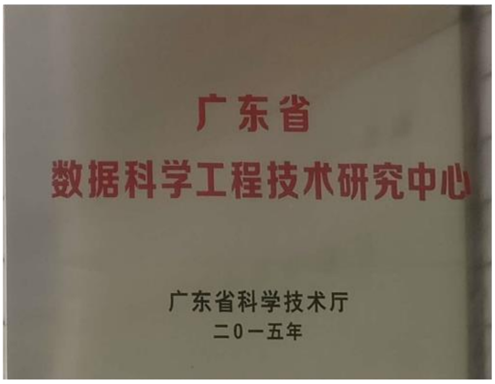
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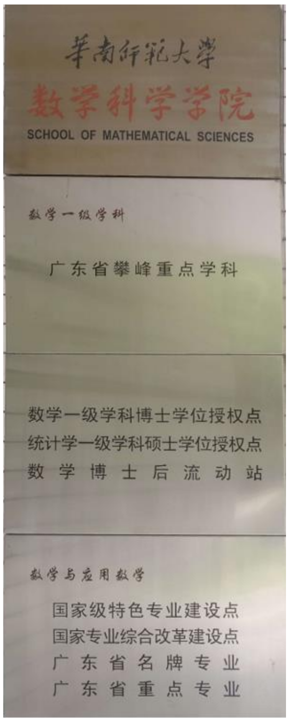
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Conference Schedule

May 18, Thursday

14:00-19:00 Registration

May 19, Friday

07:30-08:00 Registration

08:00-08:15 Opening Ceremony

Chair: Qi Ye

08:00-08:05 Hong Zhu A Welcome Speech

08:05-08:10 Wen Li A Welcome Speech

08:10-08:15 Yuesheng Xu A Welcome Speech

08:15-09:55 Section 1

Chair: Ian H. Sloan

08:15-09:05 Gregory E. Fasshauer Some Benefits of Taking Complementary Viewpoints for Positive Definite Kernels

09:05-09:55 Charles A. Micchelli Interpolation by Radial Functions

09:55-10:00 Group Photo

10:00-10:20 Tea Break

10:20-12:00 Section 2

Chair: Gregory E. Fasshauer

10:20-11:10 Ian H. Sloan Sometimes Scale Matters

Zooming-in Using Multiscale Versions of Wendland RBFs

11:10-12:00 Song Li A Few Basic Problems in Compressed Sensing

12:00-13:30 Lunch

14:00-15:40 Section 3

Chair: Lixin Shen

14:00-14:50 Yang Wang Signal Recover on A Manifold

14:50-15:40 Jian-Feng Cai Non-Convex Methods for Low-Rank Matrix Reconstruction

15:40-16:00 Tea Break

16:00-17:40 Section 4

Chair: Jian-Feng Cai

16:00-16:50 Lixin Shen Proximity Algorithms and Its Applications to Image Processing

16:50-17:40 Feng Dai Chebyshev-type Cubature Formulas for Doubling Weights on Spheres, Balls and Simplexes

19:00-21:00 Formal Dinner

May 20, Saturday

08:00-09:40 Section 5

Chair: Xiaosheng Zhuang

08:00-08:50 Ingo Steinwart Approximation Properties of Reproducing Kernels

08:50-09:40 Ding-Xuan Zhou Theory of Distributed Learning

09:40-10:00 Tea Break

10:00-11:40 Section 6

Chair: Shengxin Zhu

10:00-10:50 Dirong Chen The Optimal Estimation of Covariance Operators in Reproducing Kernel Hilbert Spaces

10:50-11:40 Jun Zhang Regularized Learning under Reproducing Kernel Banach Spaces: Similarity and Feature Representations

11:40-13:00 Lunch

14:00-15:40 Section 7

Chair: Michael McCourt

14:00-14:50 Benny Y. C. Hon Global-Local-Integration-based Kernel Approximation Methods for Inverse Problems

14:50-15:40 Leevan Ling Adaptive Algorithms for Kernel-based Collocation Methods

15:40-16:00 Tea Break

16:00-17:40 Section 8

Chair: Guohui Song

16:00-16:50 Michael McCourt Introduction to Sequential Kriging Optimization

16:50-17:40 Shengxin Zhu Heterogeneous Hierarchical Approximation with Compactly Supported Basis Functions

17:40-19:00 Dinner

May 21, Sunday

08:00-09:40 Section 9

Chair: Xin Guo

08:00-08:50 Ming-Jun Lai Bivariate Splines for De-Convolution

08:50-09:40 Guohui Song Exponential Fourier Reconstruction of Piece-wise Smooth Functions

09:40-10:00 Tea Break

10:00-11:40 Section 10

Chair: Shengxin Zhu

10:00-10:50 Zhuo-Jia Fu Recent Advances in Problem-dependent Kernel RBF Collocation Methods for Solving PDEs

10:50-11:40 Christian Rieger Kernel Methods and Parametric PDEs

11:40-13:00 Lunch

14:00-17:00 Section 11

Chair: Qi Ye, Lulin Tan, Chun-guang Liu

Introduction of Laboratory for Machine Learning and Computational Optimization, Discussion of Collaborative Research

Abstracts

Some Benefits of Taking Complementary Viewpoints for Positive Definite Kernels

Gregory E. Fasshauer

Colorado School of Mines

Positive definite kernels play an important role in many different fields, including approximation theory, the numerical solution of PDEs, spatial statistics, and statistical learning. Some of the important issues associated with positive definite kernels are (1) how to choose a “good” kernel for a given problem, and (2) how to do so in a computationally stable and efficient way. Question (1) can, e.g., be addressed with a combination of so-called “designer kernels” and appropriate parametrizations of families of kernels, while currently popular approaches to (2) are given by the use of stable (global) bases or by localization techniques such as kernel-based finite difference methods or kernel-based partition of unity methods.

Interpolation by Radial Functions

Charles A. Micchelli

State University of New York at Albany

We review why Hardy's multiquadratics can be used for interpolation, then present some results about radial interpolation on infinite lattice points and end with "Flat" interpolation for radial functions.

Sometimes Scale Matters-zooming-in using Multiscale Versions of Wendland RBFs

Ian H. Sloan

University of New South Wales

The scale of a locally supported radial basis function (such as a Wendland RBF) clearly matters. The scale can be exploited, given that physical phenomena on the earth's surface, for example, occur on many different length scales. It makes sense when seeking an efficient approximation of global terrestrial phenomena to start with a crude approximation, and then make a sequence of corrections on finer and finer scales, using more localised RBFs. It also makes sense for fine-scale approximations to be computed locally, rather than through a large global computation. In the present talk, de-scribing recent joint work with Q. Thong Le Gia and Holger Wendland, we start with our global multiscale radial basis function (RBF) approximation scheme (SIAM J. Numer. Anal. 2010), based on a sequence of point sets with decreasing mesh norm, and a sequence of associated (spherical) radial basis functions with proportionally decreasing scale. We then prove (in Adv. Comp. Math., to appear) that we can “zoom in” on a region of particular interest, by carrying out further stages of multiscale refinement on a local region. The process can be continued indefinitely, since the condition numbers of the matrices for different scales are shown to remain bounded. Colorful numerical experiments illustrate the possibilities.

A Few Basic Problems in Compressed Sensing

Song Li

Zhejiang University

In my talk, I shall investigate some problems in Compressed sensing. First of all, we will confirm a conjecture on RIP which was proposed by T.Cai and A.Zhang. Secondly, we will discuss compressed data separation problem, as a results, we answer an open problem as proposed by E.Candes, Y.Eldar, D.Needell and P.Randall. Final, we introduce RE conditions adapted to frame D (called D-RE condition), which was really extension of the famous RE condition proposed by P.Bickel, Y.Ritovusing and A. Tsybakov. By using D-RE condition, we investigate two models called ALASSO and ADS (introduced by Junhong.Lin and Song Li).

Signal Recover on A Manifold

Yang Wang

Hong Kong University of Science and Technology

Many well known problems today, such as phase retrieval and low rank matrix recovery, can be viewed as a signal recovery problem on a manifold. In this talk I'll discuss, from mostly a theoretical point of view, a framework for understanding such problems. As it turns out, there is a rather elegant unified theory that covers most such problems.

Non-Convex Methods for Low-Rank Matrix Reconstruction

Jian-Feng Cai

Hong Kong University of Science and Technology

We present a framework of non-convex methods for reconstructing a low rank matrix from its limited information, which arises from numerous practical applications in machine learning, imaging, signal processing, computer vision, etc. Our methods will be applied to several concrete example problems such as matrix completion, phase retrieval, and spectral compressed sensing with super resolution. We will also provide theoretical guarantee of our methods for the convergence to the correct low-rank matrix.

Proximity Algorithms and Its Applications to Image Processing

Lixin Shen

Syracuse University

Proximity operator proposed by Moreau is a generalization of the notion of projection onto a convex set. Proximity operators have become central tools in the numerical solutions of a wide range of problems in data sciences. In this talk, an overview of proximity operators and their essential properties will be provided. Applications of proximity operators in image processing will be presented.

Chebyshev-type Cubature Formulas for Doubling Weights on Spheres, Balls and simplexes

Feng Dai

University of Alberta

The main purpose of this talk is to present my recent joint work with Han Feng on strict Chebyshev-type cubature formulas (CF) for doubling weigths w on $\mathbb{S}^{\mathrm{d}-1}$ of $\mathbb{R}^{\mathrm{d}}$ equipped with the usual surface Lebesgue measure $\mathrm{d}\sigma_{\mathrm{d}}$ and geodesic distance $\mathrm{d}(\cdot,\cdot)$.

A strict Chebyshev-type CF of degree w on $\mathbb{S}^{\mathrm{d}-1}$ is a numerical intergration formula that takes the following form for a set $\{\mathrm{z}_1, \ldots, \mathrm{z}_{\mathrm{N}}\}$ of distinct nodes on $\mathbb{S}^{\mathrm{d}-1}$, and all spherical polynomials f of degree at most n:

$$\frac{1}{\mathrm{w}(\mathbb{S}^{\mathrm{d}-1})}\int_{\mathbb{S}^{d-1}} f(x)w(x)d\sigma_d(x) = \frac{1}{N}\sum_{j=1}^{N} f(z_j),$$

Where the integers *n* and *N* are called the degree and the size of the CF respectively, and we write $\mathrm{w}(\mathrm{E}) = \int_{\mathrm{E}} w(x)d\sigma_d(x)$ for $\mathrm{E} \subset \mathbb{S}^{\mathrm{d}-1}$.

We are mainly interested in the minimal size $N_n(wd\sigma_d)$ of strict Chebyshev-type CFs of degree n for a doubling weight w on $\mathbb{S}^{\mathrm{d}-1}$, aiming to establish the sharp asymptotic estimates of the quantity $N_{\mathrm{n}}(\mathrm{wd}\sigma_{\mathrm{d}})$ as $\mathrm{n} \to \infty$. Our main result state that for a doubling weight w on $\mathbb{S}^{\mathrm{d}-1}$,

$$N_{\mathrm{n}}(\mathrm{wd}\sigma_{\mathrm{d}}) \sim \mu_{\mathrm{n,w}} := \max_{x\in\mathbb{S}^{d-1}} \frac{1}{w\big(B(x, n^{-1})\big)},$$

Where the constants of equivalence are independent of n, and $\mathrm{B(x, r)}$ denotes the spherical cap with center $\mathrm{x} \in \mathbb{S}^{\mathrm{d}-1}$ and radius $\mathrm{r} > 0$. Furthermore, we also prove that given a doubling weight w on $\mathbb{S}^{d-1}$, there exists a positive constant K_w depending only on the doubling constant of w such that for each positive integer n and each integer $N \geq K_w \mu_{n,w}$, there exists a set of N distinct nodes $z_1, \dots, z_N$ on $\mathbb{S}^{d-1}$ which admits a strict Chebyshev-type cubature formula (CF) of degree n for the measure $w(x)d\sigma d(x)$, and which satisfies

$$\min_{1\leq i\neq j\leq N} d(z_i, z_j) \geq c_* N^{-\frac{1}{d-1}}$$

if in addition $w \in L^\infty(\mathbb{S}^{d-1})$. The proofs of these results rely on new convex partitions of $\mathbb{S}^{d-1}$ that are regular with respect to the weight w.

The weighted results on the sphere also allow us to establish similar results on strict Chebyshev-type CFs on the unit ball and the standard simplex of $\mathbb{R}^d$.

Our results extend the recent results of Bondarenko, Radchenko, and Viazovska on spherical designs (*Ann. of Math. (2)* **178**(2013), no. 2, 443–452, & *Constr. Approx*. **41**(2015), no. 1, 93–112).

Approximation Properties of Reproducing Kernels

Ingo Steinwart

Universitat Stuttgart

Reproducing kernel Hilbert spaces (RKHSs) play an important role in machine learning methods such as kernel-mean-embeddings and regularized-kernel-learning including support vector machines (SVMs). A key aspect for understanding these methods are approximation properties of RKHSs. In the first part of this talk I will review some approximation result for generic kernels, illustrate them for the special case of Sobolev kernels, and finally discuss the case of Gaussian RBF kernels. In the second part, I will try to explore the so far mostly unexploited flexibility of kernels: Here, I will show that using a simple sum construction for locally defined kernels makes it possible to quickly train SVMs even on millions of samples. Furthermore, I discuss a class of kernels whose structure mimics parts of deep neural network architectures.

Theory of Distributed Learning

Ding-Xuan Zhou

City University of Hong Kong

Analyzing and processing big data has been an important and challenging task in various fields of science and technology. Distributed learning provides powerful methods for handling big data and forms an important topic in learning theory. It is based on a divide-and-conquer approach and consists of three steps: first we divide oversized data into subsets and each data subset is distributed to one individual machine, then each machine processes the distributed data subset to produce one output, finally the outputs from individual machines are combined to generate an output of the distributed learning algorithm. It is expected that a distributed learning algorithm can perform as efficiently as one big machine which could process the whole oversized data, in addition to the advantages of reducing storage and computing costs. This talk describes mathematical analysis of distributed learning.

The Optimal Estimation of Covariance Operators in Reproducing Kernel Hilbert Spaces

Dirong Chen

Beihang University

The covariance operators in reproducing kernel Hilbert spaces play an important role in the kernel methods. This talk discusses the optimal estimation of covariance operators. We construct a class of shrinkage estimators. These shrinkage estimators are $\sqrt{n}$-consistent and have a good empirical performance. In addition, when the reproducing kernel K is translation invariant, the optimal rate of order $n^{-\frac{1}{2}}$ is established for some classes of probability measures.

Regularized Learning under Reproducing Kernel Banach Spaces: Similarity and Feature Representations

Jun Zhang

University of Michigan, Ann Arbor

Motivated by human categorization research, we extend the standard RKHS framework to Reproducing Kernel Banach Spaces with non-symmetric kernels. In place of the inner product operator for a Hilbert space, the semi-inner product operator of a Banach space is used, so that key ingredients of the regularization framework (reproducing kernel, representer theorem, feature map) remain valid for a Banach space that is uniformly convex and uniformly Frechet differentiable. Semi-inner product also provides an improved definition of frames. The RKBS framework provides a unified treatment of similarity and feature learning, originally modeled as separate cognitive processes in humans. (Work reported is in collaboration with Haizhang Zhang, Yuesheng Xu, and Matt Jones, and supported by ARO and AFOSR grants.)

Global-Local-Integration-based Kernel Approximation Methods for Inverse Problems

Benny Y. C. Hon

City University of Hong Kong

In this talk, the recent development in global, local, and integration-based meshless computational methods via the use of kernels will be presented. The local kernel approximation method is an extension to solve large scale problems which has hindered the practical application of the global method for years due to the ill-conditioning of the resultant full coefficient matrix. Because of the intrinsic stable and accurate advantages of numerical integration and spectral convergence of kernels approximation, the kernel-based methods can solve multi-dimensional boundary value problems (BVPs) under irregular domain with certain kinds of stiffness. The main idea of the integration-based method is to transform the original partial differential equation into an equivalent integral equation whose approximation can be sought by standard numerical integration techniques. Unlike the use of finite quotient formula in the classical finite difference method (FDM), the integration-based method uses numerical quadrature formula to approximate the unknown solution and its derivatives and hence avoids the well-known optimal round off-discretization tradeoff error in FDM. The kernel-based methods have successfully applied to solve classical inverse problems of time-space-fractional order PDEs. Numerical examples in both 1D and 2D will be given to verify the efficiency and effectiveness of the proposed methods.

Adaptive Algorithms for Kernel-based Collocation Methods

Leevan Ling

Hong Kong Baptist University

By exploiting the meshless property of kernel-based collocation methods, we propose a fully automatic numerical recipe for solving for boundary value problems adaptively. The proposed algorithm is built upon a least-squares collocation formulation on some quasi-random point sets with low discrepancy. A novel strategy is proposed to ensure that the fill distances in the domain and on the boundary are in the same order of magnitude. To circumvent the potential problem of ill-conditioning due to extremely small separation distance in the point sets, we propose a strategy to generate quasi-random shape parameters with the point sets in order to ensure that nearby kernels are of

distinctive shape. This effectively eliminates the needs of shape parameter identification. Resulting linear systems were then solve by a greedy trial space algorithm to improve the robustness of the algorithm.

Introduction to Sequential Kriging Optimization

Michael McCourt

SigOpt

The optimal choice of hyperparameters in a machine learning application is often an expensive, gradient-free and black-box optimization problem; this model tuning is necessary for production level machine learning systems. In this talk, we introduce a popular strategy for efficiently tuning machine learning models: sequential kriging optimization. Also sometimes referred to under the umbrella of Bayesian optimization or efficient global optimization, this method consists of designing a kernel-based approximation to the hyperparameter response surface (e.g., the cross-validated accuracy of the model) and using the kriging predictions from that approximation to inform the efficient search for optimal hyperparameters. We will review standard practices and discuss recent research advances, including some specific to designing neural network architecture.

Heterogeneous Hierarchical Approximation with Compactly Supported Basis Functions

Shengxin Zhu

Xi'an Jiaotong-Liverpool University

It is known that stationary interpolation with positive definite compactly supported basis function have a good scalability, but it does not converge. Non-stationary interpolation with positive definite compactly supported radial basis functions can converge, but the benefit of sparsity will be lost as the size of the data set increase. In this talk, we will discuss trade-offs to balance the scalability and convergence with a heterogeneous hierarchical approaches. We can use compactly supported radial basis functions with different shapes on each level. First order convergence of the heterogeneous hierarchical n ℓ_∞ norm and second order convergence in ℓ_2 norm are observed on hierarchical regular grids. It seems that theoretical analysis on the convergence is much harder than the usual multilevel approach and it is not available at current stage.

Bivariate Splines for De-Convolution

Ming-Jun Lai

University of Georgia

We study how to de-convolution over arbitrary polygonal domain $\Omega \subset \mathrm{R}^2$.
This approximation is motivated by many applications in learning theory, image

analysis, integral equations of second kind, boundary element methods, and etc. It is often an ill-posed problems when a kernel function is weakly singular. There are many approaches available in the literature to numerically compute the deconvolution functions. However, the problem remains a challenge. Mainly, when discretizing the problem, the matrix associated with the linear system for any conventional approach, Galerkin methods, collocation methods, and etc. is dense and the solution takes a long time to find, in particular when $\Omega \subset \mathrm{R}^{\mathrm{d}}$ for $\mathrm{d} \geq 2$. The multi-scale methods proposed by Y.Xu and his collaborators (cf. [Chen, Micchelli, and Xu, 2015]) are very promising. These require a construction of multi-scale basis over Ω which is not easy in general. In particular, smooth multi-scale basis when $\Omega \subset \mathrm{R}^{\mathrm{d}}$ for $\mathrm{d} \geq 2$ are difficult to construct. I shall explain an approach to use multivariate splines to do such a construction. After explaining several motivations and some approximation properties of bivariate splines, I shall report some preliminary results how to use bivariate spline solutions to find de-convolution functions efficiently and effectively.

Exponential Fourier Reconstruction of Piece-wise Smooth Functions

Guohui Song

Clarkson University

It is well known that we could obtain exponential convergence in reconstructing (1) analytic and periodic functions from Fourier measurements, and (2) analytic functions from Chebyshev measurements. However, reconstructing piece-wise smooth functions from Fourier measurements suffers from the Gibbs phenomenon (O(1) oscillations in the neighborhood of edges). We will discuss in this talk a hybrid method of exponential reconstruction of piece-wise smooth functions from Fourier measurements. This method would leverage both the Fourier reconstruction and the Chebyshev reconstruction.

Recent Advances in Problem-dependent Kernel RBF Collocation Methods for Solving PDEs

Zhuo-Jia Fu

Hohai University

Radial basis functions (RBFs) are constructed in terms of 1D distance variable and appear to have certain advantages over the traditional coordinates-based functions. In contrast to the traditional meshed-based methods, the RBF collocation methods are mathematically simple and truly meshless, which avoid troublesome mesh generation for high-dimensional problems involving irregular geometries or infinite domains. As the RBF collocation methods attract growing attention in the field of numerical PDEs in the recent two decades, various solutions of PDEs and their variants emerge to be a powerful approach in the construction of the problem-dependent kernel RBFs. This talk will introduce several problem-dependent kernel RBF collocation methods, and then present their applications to the numerical solutions of PDEs.

Kernel Methods and Parametric PDES

Christian Rieger

Bonn University

The field of parametric pdes provides plenty of applications of kernel based methods. A parametric pde is often used to account for some unknown material properties of a physical process modeled by the pde. There are two common observations for those parametric pdes. The first one is that the solution of the parametric pde depends smoothly on the parameters. The next observation is that one usually needs a large amount of parameters to model realistic processes. Viewing the solution of the parametric pde (or a derived quantity of interest) as a function of the parameters hence leads to a high dimensional reconstruction problem for a smooth function. This is a setting which is very favorable for kernel based methods. A further motivation for kernel methods is, that regular grids in the parameter space are sometimes counter-intuitive. There are, however, also some issues remaining with kernel based methods which I will partially address in this talk.

The first issue is the choice of the kernel function depending on the smoothness of the function which is to be reconstructed. The next issue is the high dimension which (even after careful inspection of the importance of certain dimensions) leads to a large amount of data, and hence suitable numerical algorithms have to be used. The final issue addresses the error analysis. Since the model already contains several influences of errors (model error, numerical error in solving the pde, etc) which define a fixed error threshold, we have to design an a priori error analysis which allows us to cut the amount of numerical work we spend to that error threshold.

Introductions of Invited Speakers

Gregory E. Fasshauer

Colorado School of Mines

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Gregory E. Fasshauer is a professor in the Department of Applied Mathematics and Statistics at Colorado School of Mines. He obtained a Ph.D. in 1995 from Vanderbilt University under the supervision of Prof. Larry L. Schumaker. His research interests include meshfree approximation methods, radial basis functions, approximation theory, numerical solution of PDEs, spline theory, and computer-aided geometric design.

He organized over 10 international conferences. He already published serval mathematical books, such as Kernel-based Approximation Methods using MATLAB, and Meshfree Approximation with MATLAB.

Charles A. Micchelli

State University of New York at Albany

charles_micchelli@hotmail.com

Prof. Charles A. Micchelli is a worldly famous mathematician. He has made outstanding contributions in many fields of mathematics. He is an expert on multivariate splines and the theory of approximation. He served as a chief editor of the Advances in Computational Mathematics. He made a 45-minute report at International Congress of Mathematicians in 1983. He worked at Watson Research Center of IBM before he is a professor at State University of New York at Albany.

Ian H. Sloan

The University of New South Wales

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After schooling in Ballarat in Victoria, Australia, Ian Sloan completed physics and mathematics degrees at Melbourne University, a Master's degree in mathematical physics at Adelaide, and a Ph.D. in theoretical atomic physics (under the supervision of HSW Massey) at the University of London, finishing in 1964.

After a decade of research on few-body collision problems in nuclear physics, and publishing some 35 papers in the physics literature, his main research interests shifted to computational mathematics. Since making that change he has published 200 papers on the numerical solution of integral equations, numerical integration and interpolation, boundary integral equations, approximation theory, multiple integration, continuous complexity theory and other parts of numerical analysis and approximation theory.

He was elected a Fellow of the Australian Academy of Science in 1993. In 1997 he was awarded the ANZIAM Medal by Australian and New Zealand Industrial and Applied Mathematics (ANZIAM), and in 2001 was awarded the Thomas Ranken Lyle Medal of the Australian Academy of Science. In 2002 he was awarded the Szekeres Medal of the Australian Mathematical Society, and in 2005 was awarded the Information Based Complexity Prize. In 2008 he was appointed an Officer of the Order of Australia (AO).

Song Li

Zhejiang University

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Song Li graduated from Inner Mongolia University and received his master degree in July 1990. In 1994 he received his doctorate at Zhejiang University. In April 1994 to June 1996, he was engage in postdoctoral research at Wuhan University. Li became a professor in 2001 and Ph.D. supervisor in 2002.

Now, his mainly research are about compressive sensing theory and application, low-rank matrix recovery theory, high dimensional data processing, and research on wavelets analysis and sampling theory. So far, Song Li has published more than 70 academic articles on famous journals, such as Science China, Chinese Annals of Mathematics, Applied Computational and Harmonic Analysis, Journal of Fourier Analysis and Its Application, Advance in Computational Mathematics, IEEE. Transcations on Signal Processing, IEEE. Transcations on Information Theory, Journal of Approximation Theory, Inverse Problem and Imaging, and Acta Mathematical Sinica.

Yang Wang

Hong Kong University of Science and Technology

yangwang@ust.hk

Yang Wang is a chair professor and head department of Mathematics at the Hong Kong University of Science and Technology. He completed mathematics degrees at University of Science and Technology of China, master's degree in Mathematics at Harvard University, and a Ph.D. in Mathematics at Harvard University under the supervision of Prof. David Mumford.

He is an associate editor for three journals including Journal of Fourier Analysis and Applications， Journal of Fractal Geometry, and Advances in Computational Mathematics. He is also a member of the advisory board for Applied and Numerical Harmonic Analysis Book Series published by Birkhauser. He was nominated for the “W. Roane Beard Outstanding Teacher Award” at Georgia Institute of Technology in 1994, and nominated for the “Best Paper Award” at Georgia Institute of Technology in 1996. His research interest is about quite diverse, which include topics both in pure and applied mathematics such as tiling, fractal geometry, wavelets and frames, signal processing (image, audio and communication), data analysis using machine learning.

Jian-Feng Cai

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Ding-Xuan Zhou joined City University of Hong Kong as a research assistant professor in 1996. His research interests include learning theory, wavelet analysis and approximation theory. He has published over 100 research papers and is serving on editorial board of the international journals like Advances in Computational Mathematics, Analysis and Applications, Complex Analysis and Operator Theory and Journal of Computational Analysis and Applications.

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In January 1982, Dirong Chen received the bachelor's degree from the department of mathematics of Central China Normal University. He received doctorate from department of mathematics in Beijing Normal University in July 1992. During July 1992 to July 1994, he was a postdoctoral researcher in Academy of Mathematics of Chinese Academy of Science. And to date, Chen works in Beihang University. He became a professor in July 1997 and a Ph.D. supervisor in May 2002. In 2006, Chen became a distinguished professor of Blue Sky Scholars Program of Beihang University.

Chen was a PI of five programs of National Natural Foundation until 2013. He was invited to give a speech on International Conferences many times, and was invited to visit universities in Canada, Hong Kong and other countries. His researches on Wavelets Analysis and Statistical Learning Theory stand on a leading level domestically, also enjoy high reputation internationally.

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Prof. Benny Y. C. Hon's major research interests include meshless computation using radial basis functions for solving various types of partial differential equations and numerical methods for solving inverse problems based on fundamental solutions and reproducing kernels. He is particularly keen in promoting the meshless radial basis functions method for solving real physical problems such as simulations of tides and waves; multiphasic fluid flows; micro-electro-mechanical systems; inverse heat conduction; and image reconstruction.

He is now serving as an Associate Editor for the Journal of Inverse Problems in Science and Engineering (IPSE) and member on the editorial board for seven international journals including the Journals of Advances in Computational Mathematics and Engineering Analysis with Boundary Elements with recent emphasis on meshless and mesh reduction methods. He has also co-edited several special issues on meshless computations and inverse problems for the Journals of Computers and Mathematics with Applications and Advances in Computational Mathematics.

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His main interest lies in the theory and application of multivariate splines. Larry Schumaker and he wrote a monograph "*Spline Functions on Triangulations*" together which was published by Cambridge University Press in 2007. An application of multivariate splines for Fluid Flow Simulation won him a research medal for Creative Research from the University of Georgia in 2002.

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His research interest lies in the interdisciplinary area of computational mathematics and statistics. Specifically, He has been working in the fields of approximation theory, statistical machine learning, sampling theory, signal processing, and image processing. Moreover, He is also interested in the regularization methods and optimization algorithms arising in these fields.

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His mainly researches are about methods in computational mechanics, the numerical simulation on wave propagation and vibration of engineering structures, and method of scattered data processing. Fu published 15 articles in indexed journals (SCI), and attended more than 10 related academic conferences both at home and abroad. He was hired by Computer Aided Engineering as an invited editor. Fu once worked for Engineering Analysis with Boundary Elements (SCI), AJME: Australian Journal of Mechanical Engineering (EI), Academia Journal of Scientific Research as a reviewer.

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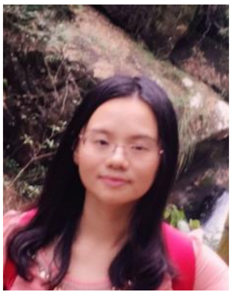

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