2024 Optimization Workshop

Department of Mathematics
National Taiwan Normal University

August 19, 2024

Sponsored by

College of Science, National Taiwan Normal University
Department of Mathematics, National Taiwan Normal University

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Jein-Shan Chen

Table 1: Schedule on August 19, 2024. Place: E102, Natural Science Building Complex

	Speaker	Title
13:00 | 13:30	Jonathan Yu-Meng Li	On Generalization and Regularization via Wasserstein Distributionally Robust Optimization
13:30 | 14:00	Hoang Thi Cam Thach	New inertial proximal algorithms for solving multivalued variational inequalities
14:00 | 14:30	Le Thanh Hieu	On the "hard case" of the quadratically constrained quadratic programs with one constraint
14:30 | 15:00		*Tea Break*
15:00 | 15:30	Rabian Wangkeeree	The Regularized Stochastic Nesterov's Accelerated Quasi-Newton Method with Applications
15:30 | 16:00	Pham Duy Khanh	Inexact Reduced Gradient Methods in Nonconvex Optimization
16:00 | 17:00	Vo Minh Tam	A fractional-order dynamic approach to vector equilibrium problems with partial order constructed by a polyhedral cone
17:00 | 17:30		*Free Discussion*

On Generalization and Regularization via Wasserstein Distributionally Robust Optimization

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Abstract. Wasserstein distributionally robust optimization (DRO) has found success in operations research and machine learning applications as a powerful means to obtain solutions with favourable out-of-sample performances. Two compelling explanations for the success are the generalization bounds derived from Wasserstein DRO and the equivalency between Wasserstein DRO and the regularization scheme commonly applied in machine learning. We show that it is possible to obtain generalization bounds and the equivalency to regularization in a significantly broader setting where the Wasserstein ball can be of a general type and the decision criterion can be a general measure of risk, i.e., nonlinear in distributions. This allows for accommodating many important classification, regression, and risk minimization applications that have not been addressed to date using Wasserstein DRO. Our results are strong in that the generalization bounds do not suffer from the curse of dimensionality and the equivalency to regularization is exact. As a byproduct, our regularization results broaden considerably the class of Wasserstein DRO models that can be solved efficiently via regularization formulations.

The Regularized Stochastic Nesterov's Accelerated Quasi-Newton Method with Applications

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Abstract. The stochastic Broyden–Fletcher–Goldfarb–Shanno (BFGS) method has effectively solved strongly convex optimization problems. However, this method frequently encounters the near-singularity problem of the Hessian. Additionally, obtaining the optimal solution necessitates a long convergence time. In this talk, we present a regularized stochastic Nesterov's accelerated quasi-Newton method that combines Nesterov acceleration with a novel momentum coefficient to effectively accelerate convergence speed and avoid the near-singularity problem of the Hessian update in the stochastic BFGS method. Moreover, we show the almost sure convergence of the generated subsequence of iterates to an optimal solution of the strongly convex optimization problems. We examined our approach to real-world datasets. The experiment results confirmed the effectiveness and superiority of the proposed method compared with other methods in solving classification problems.

Keyword: Strongly convex optimization, Nesterov's accelerated gradient, Quasi-Newton method, Momentum coefficient, Support vector machine.

New inertial proximal algorithms for solving multivalued variational inequalities

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Abstract. This presentation presents two new algorithms for solving multivalued variational inequality problems in a real Hilbert space. By combining the nonexpansiveness of proximal operators associated with the proper lower semicontinuous convex function of the problems and inertial techniques, we demonstrate the weak convergence of the iteration sequences generated by our first algorithm under monotone and Lipschitz continuous assumptions of the cost mappings. Next, we use Mann iteration technique to obtain the second algorithm and show its strong convergence. Finally, we give some numerical results for the proposed algorithms and compare with some other known algorithms.

Keyword: Multivalued variational inequality, proximal operator, Lipschitz continuous, inertial technique.

On the "hard case" of the quadratically constrained quadratic programs with one constraint

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Abstract. In this talk, we will discuss the "hard case" of the quadratically constrained quadratic program (QCQP) with one constraint: The interior of the spectrahedron spanned by the two matrices of the quadratically objective and constraint functions does not contain any nonnegative number. After recalling some important properties of the simultaneous diagonalization via congruence of two matrices, their spectrahedron is completely described and applied to solve our QCQP problem.

Keyword: simultaneous diagonalization via congruence (SDC), quadratically constrained quadratic program (QCQP).

Inexact Reduced Gradient Methods in Nonconvex Optimization

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Abstract. This talk proposes and develops new linesearch methods with inexact gradient in- formation for finding stationary points of nonconvex continuously differentiable functions on finite-dimensional spaces. Some abstract convergence results for a broad class of linesearch methods are established. A general scheme for inexact reduced gradient (IRG) methods is proposed, where the errors in the gradient approximation automatically adapt with the mag- nitudes of the exact gradients. The sequences of iterations are shown to obtain stationary accumulation points when different stepsize selections are employed. Convergence results with constructive convergencerates for the developed IRG methods are established under the Kurdyka-Lojasiewicz property.The obtained results for the IRG methods are confirmed by encouraging numerical experiments, which demonstrate advantages of automatically con- trolled errors in IRG methods over other frequently used error selections.

A fractional-order dynamic approach to vector equilibrium problems with partial order constructed by a polyhedral cone

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Abstract. In this talk, we propose a dynamical system for solving a class of vector equilibrium problems with partial order constructed by a polyhedral cone which is generated by some matrix. Unlike the traditional dynamical models, it particularly possesses the feature of fractional-order system. The so-called Mittag-Leffler stability of the dynamical system is investigated, which verifies the convergence to the solution of the corresponding vector equilibrium problems. This result is established by applying the techniques involving Caputo fractional derivatives, strong pseudo-monotonicity and Lipschitz-type continuity assumptions with partial ordering based on a polyhedral cone. We also give numerical implementations to illustrate the proposed approach.