International Workshop on

Optimization, Variational Analysis, and Control Theory

WORKSHOP BOOKLET

October 13-15, 2026

Hanoi, Vietnam

Sponsors

- International Centre of Research and Postgraduate Training in Mathematics (ICRTM), Institute of Mathematics (IM), Vietnam Academy of Science and Technology (VAST), Hanoi, Vietnam
- Phenikaa University, Hanoi, Vietnam

Co-host Institutions

- International Centre of Research and Postgraduate Training in Mathematics, Institute of Mathematics, Vietnam Academy of Science and Technology, Hanoi, Vietnam
- Phenikaa University, Hanoi, Vietnam

Venue

Onsite: Phenikaa University
(Nguyen Trac street, Duong Noi ward, Hanoi, Vietnam,
`https://maps.app.goo.gl/fS3vvjj3Zego6skd6`)
and
Institute of Mathematics, Vietnam Academy of Science and Technology
(18 Hoang Quoc Viet road, Nghia Do ward, Hanoi, Vietnam,
`https://maps.app.goo.gl/v7kS2gCsEKBNkK6M7`)

Website: `https://math.ac.vn/conference/OVACT2026#`

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- **Lê Hải Yến** (IM, VAST, Hanoi, Vietnam)

TENTATIVE PROGRAM

Tuesday, October 13, 2026, *Morning*

09:00 – 09:30 **Registration**
(at the lobby beside Hall 102 Bulding A8, Phenikaa University)

Hall 1
(Hall 102 Bulding A8, Phenikaa University)

09:30 – 10:00 **Opening ceremony**

10:00 – 10:15 **Workshop photo**

Hall 1
(Hall 102 Bulding A8, Phenikaa University)
Chair: **Samir Adly**

10:15 – 11:00 **Ralph Tyrrell Rockafellar**
Variational stability and sufficient conditions for local optimality

11:00 – 11:45 **Boris Sholimovich Mordukhovich**
Generalized metric subregularity with applications to high-order regularized Newton methods

11:45 – 14:00 **Lunch**
(2nd floor, Building D6, Phenikaa University)

Tuesday, October 13, 2026, *Afternoon*

Hall 1
(Hall 102 Bulding A8, Phenikaa University)
Chair: **Boris Sholimovich Mordukhovich**

14:00 – 14:45 **Samir Adly**
Support profiles and exact capacities of Pareto spectra in orders three and four

14:45 – 15:15 **Coffee break**

Parallel session 1 - Hall 1
(Hall 102 Bulding A8, Phenikaa University)
Chair: **Nguyễn Định**

15:15 – 15:40 **Zhou Wei, Michel Théra, Jen-Chih Yao**
Subtransversality and strong CHIP for finitely many closed subsets

15:40 – 16:05 **Marius Durea**
Properties of cones and sets via positive functionals and applications

16:05 – 16:30 **Marius Durea, Nguyễn Hữu Trọn, Michel Théra**
Nonlinear and orbital directional regularities for set-valued mappings and applications to fixed points

16:30 – 16:55 **Milen Ivanov, Detelina Kamburova, Nadia Zlateva**
On long orbit empty value principle

Tuesday, October 13, 2026, *Afternoon*

Parallel session 2 - Hall 2
(Meeting Room 3 on the 2nd floor, Building A10, Phenikaa University)
Chair: **Trần Văn Nghị**

15:15 – 15:40 **Lê Minh Thùy**
Optimization challenges in intelligent autonomous sensing systems: From energy autonomy to adaptive sensing and communication

15:40 – 16:05 **Chu Thị Mai Hồng**
Time-integrated optimal transport and applications

16:05 – 16:30 **Dương Thị Kim Huyền**
Minimax S-Lemma and applications

16:30 – 16:55 **Đặng Thị Ngoan**
Scalarization in vector optimization with two-variable domination structures

18:00 – 21:00 **Banquet**
(2nd floor, Building D6, Phenikaa University)

Wednesday, October 14, 2026, *Morning*

Hall 1
(Hall 102 Bulding A8, Phenikaa University)
Chair: **Christiane Tammer**

09:00 – 09:45 **Arnd Rösch**
Fast optimization methods in infinite dimensions

09:45 – 10:15 **Coffee break**

Parallel session 1 - Hall 1
(Hall 102 Bulding A8, Phenikaa University)
Chair: **Nguyễn Đông Yên**

10:15 – 10:45 **Nguyễn Định, Đào Hải Long**
From robust to adjustable robust optimization problems

10:45 – 11:15 **Lê Dũng Mưu**
Methods for solving equilibrium problems involving convex and quasiconvex bifunctions

11:15 – 11:45 **Lê Bá Khiết, Boris Mordukhovich, Michel Théra**
Inexact proximal point and Tseng algorithms with nonsummable errors to solve monotone inclusions

Parallel session 2 - Hall 2
(Meeting Room 3 on the 2nd floor, Building A10, Phenikaa University)
Chair: **Bùi Trọng Kiên**

10:15 – 10:45 **Cung Thế Anh**
Analysis of 3D Navier-Stokes-Voigt velocity tracking problem with bang-bang controls

10:45 – 11:15 **Vũ Hữu Nhự**
Second-order necessary optimality conditions for an elliptic optimal control problem with exponential nonlinearity and discrete measures

11:15 – 11:45 **Jia Chen, Võ Thành Phát, Shengda Zeng**
A coupled nonsmooth dynamical system: Global well-posedness, stability and sensitivity analysis

11:45 – 14:00 **Lunch**
(2nd floor, Building D6, Phenikaa University)

Wednesday, October 14, 2026, *Afternoon*

Hall 1
(Hall 102 Bulding A8, Phenikaa University)
Chair: **Huỳnh Văn Ngãi**

14:00 – 14:45 **Abdessamad Barbara, Abderrahim Jourani**
Error bound characterizations of the conical constraint qualification in convex programming

14:45 – 15:15 **Coffee break**

Parallel session 1 - Hall 1
(Hall 102 Bulding A8, Phenikaa University)
Chair: **Phạm Duy Khánh**

15:15 – 15:40 **Liguo Jiao, Lưu Thị Thu Huyền, Nguyễn Văn Tuyên**
Second-order optimality conditions for $C^{1,1}$ sparsity constrained optimization problems via disjunctive programming

15:40 – 16:05 **Bùi Văn Định, Trần Thị Huyền Thanh, Biện Thanh Tuyền, Jein Shan Chen**
The variants of projection extragradient algorithms for nonmonotone equilibrium problems in Hilbert spaces

16:05 – 16:30 **Trần Thanh Nam, Tạ Quang Sơn**
Solution mappings and directional derivatives of convex infimal convolutions

16:30 – 16:55 **Paul Armand, Trần Ngọc Nguyên**
On the boundedness of inverses of regularized Jacobian matrices in nonlinear optimization and applications

Wednesday, October 14, 2026, *Afternoon*

Parallel session 2 - Hall 2
(Meeting Room 3 on the 2nd floor, Building A10, Phenikaa University)
Chair: **Lê Hải Yến**

15:15 – 15:40 **Syed Rabbani, Imran Ali**
Neural network-based solution of extended random inverse quasi-variational inequalities with stability and convergence analysis

15:40 – 16:05 **Kanchan Mittal, Habib ur Rehman, Elisabeth Köbis, Jen-Chih Yao, Xiaopeng Zhao**
Golden ratio splitting algorithm for equilibrium problems

16:05 – 16:30 **Soumya Rath, Shashi Kant Mishra**
A variable step size inertial forward-backward algorithm for monotone variational inclusions

16:30 – 16:55 **Nguyễn Thị Thu Thủy, Nguyễn Quốc Anh**
An accelerated relaxed algorithm for the split feasibility problem with multiple output sets in Hilbert spaces

Thursday, October 15, 2026, *Morning*

Hall 1
(Hall 301 Bulding A5, IM, VAST)
Chair: **Alexander Kruger**

09:00 – 09:45 **Juan Enrique Martínez-Legaz, Christiane Tammer**
Surrogate duality for quasiconvex vector optimization problems

09:45 – 10:15 **Coffee break**

Parallel session 1 - Hall 1
(Hall 301 Bulding A5, IM, VAST)
Chair: **Nguyễn Văn Tuyên**

10:15 – 10:45 **Pascal Bégout, Jérôme Bolte, Thomas Mariotti, Francisco José Silva Álvarez**
Gradient extremals, talwegs, valleys, and directional alignment for generic gradient descent

10:45 – 11:15 **Phạm Duy Khánh, Phạm Hữu Dư, Huỳnh Lai Bách Tỷ**
Approximately scalable sets in normed spaces

11:15 – 11:45 **Shiva Shankar**
Control of the Maxwell equations in the framework of J.C. Willems' theory of behaviours

Parallel session 2 - Hall 2
(Hall 301 Bulding A5, IM, VAST)
Chair: **Tạ Quang Sơn**

10:15 – 10:45 **Swapnil Verma**
New fixed point results on interpolative metric spaces

10:45 – 11:15 **Kuldip Singh Sangwan, Rakhee Kulshrestha, Paras, Vijaypal Poonia**
Stochastic modelling and performance analysis of a circular supply chain

11:15 – 11:45 **Dhananjay Gopal**
On the problem of Cauchyness of fuzzy contractive sequences

11:45 – 14:00 **Lunch**
(3rd floor, Building A14, VAST)

Thursday, October 15, 2026, *Afternoon*

Hall 1
(Hall 301 Bulding A5, IM, VAST)

Chair: **Marius Durea**

14:00 – 14:45 **Asen Dontchev, Helmut Gfrerer, Alexander Kruger, Jiří Outrata**
Radius of metric subregularity

14:45 – 15:15 **Coffee break**

Parallel session 1 - Hall 1
(Hall 301 Bulding A5, IM, VAST)

Chair: **Bùi Trọng Kiên**

15:15 – 15:40 **Đỗ Đức Thuận**
Stability radius and dichotomy radius of infinite-dimensional linear systems under unbounded perturbations via Yosida distance

15:40 – 16:05 **Samir Adly, Nguyễn Trọng Đoàn, Bùi Trọng Kiên, Nguyễn Quốc Tuấn**
Second-order sufficient optimality conditions for multiobjective time-optimal control problems with endpoint and mixed constraints

16:05 – 16:30 **Trương Xuân Đức Hà**
On strict efficiency and strict weak efficiency in set optimization

16:30 – 16:55 **Phạm Duy Khánh, Bùi Huỳnh Trâm, Trần Bá Đạt**
Derivative-free trust-region methods for noisy functions

Thursday, October 15, 2026, *Afternoon*

Parallel session 2 - Hall 2
(Hall 302, Building A5, IM, VAST)

Chair: **Nguyễn Năng Thiều**

15:15 – 15:40 **Umashankar Bajpei, Shashi Kant Mishra, Dhruv Singh**
Multiobjective bilevel optimization problem with switching constraints

15:40 – 16:05 **Rattanaporn Wangkeeree, Rabian Wangkeeree, Yirga Abebe Belay, Kasamsuk Ungchittrakool**
Optimization aspect of machine learning: Neurodynamical neural network approach for solving support vector machines with generalized pinball loss function via hyperbolic tangent smoothing function

16:05 – 16:30 **Izhar Uddin**
A simpler and more efficient iterative scheme for image restoration

16:30 – 16:55 **Đinh Văn Tiệp, Nguyễn Thanh Sơn**
Some vector transports for nonlinear conjugate gradient optimization schemes on the indefinite Stiefel manifold

16:55 – 17:00 **Closing ceremony**
(Hall 301, Building A5, IM, VAST)

ABSTRACTS

Error bound characterizations of the conical constraint qualification in convex programming

A. Barbara[1] **and A. Jourani**[1]

Abstract: This talk deals with error bound characterizations of the conical constraint qualification (CCQ) for convex inequality systems in a Banach space X. We establish necessary and sufficient conditions for a closed convex set S defined by a convex function g to have CCQ. Our results show that these characterizations hold in very special situations. We construct technical examples showing that these characterizations are limited to these situations. We introduce a new condition in terms of the gauge function which allows us to give an error bound characterization of convex nondifferentiable systems and to obtain as a direct consequence different characterizations of the concept of the strong conical hull intersection property (CHIP) for a finite collection of convex sets.

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Radius of metric subregularity

A. Dontchev[1], H. Gfrerer[2], A. Kruger[3], and J. Outrata[4]

Abstract: The topic of radius of "good behaviour" quantifying the "distance" of a given well-posed problem to the set of ill-posed problems of the same kind was initiated by Dontchev, Lewis and Rockafellar in 2003. The authors studied the "good behaviour" of generalised equations characterised by regularity properties of set-valued mappings and established in finite dimensions exact formulas for the radii for the three fundamental properties: *metric regularity, strong metric regularity* and *strong metric subregularity* with respect to *calm, Lipschitz continuous* and *linear* perturbations in terms of the *modulus* of the respective property.

In infinite dimensions, they obtained certain lower estimates for the radii. They also showed that for the (not strong) *metric subregularity* the analogues of the mentioned formulas and estimates fail.

We are going to discuss recent developments around estimating the radius of metric subregularity.

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Analysis of 3D Navier-Stokes-Voigt velocity tracking problem with bang-bang controls

C. T. Anh[1]

Abstract: We study the 3D Navier-Stokes-Voigt velocity tracking problem in bounded domains with distributed controls. The optimal control problem does not possess any regularizer in the cost, and hence the resulting controls can be of bang-bang type. We first establish first-order necessary optimality conditions and second-order sufficient optimality conditions. Then we investigate perturbations that account for uncertainty in the tracking data and the initial condition of the state.

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An accelerated relaxed algorithm for the split feasibility problem with multiple output sets in Hilbert spaces

N. T. T.Thuy[1] **and N. Q. Anh**[1]

Abstract: In this talk, we propose a novel alternating inertial iterative algorithm for the split feasibility problem with multiple output sets (SFP-MOS) in real Hilbert spaces. The method is equipped with a self-adaptive step size rule for approximating its solutions, while avoiding the use of exact projections by employing half-space approximations, thereby significantly reducing the per-iteration computational cost.

In addition, a conjugate-gradient-like search direction is incorporated to accelerate convergence and improve the search trajectory. The self-adaptive step size mechanism eliminates the need for operator norm estimation and backtracking line search, making the algorithm particularly suitable for large-scale problems. Under mild assumptions, including weak lower semi-continuity of the involved operators, we establish the strong convergence of the proposed method.

Finally, numerical experiments are conducted on benchmark problems, with applications to Elastic Net regularization in signal processing and image classification tasks. The results demonstrate that the proposed method achieves improved convergence behavior and competitive performance compared to several existing projection-type algorithms for SFP-MOS.

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Fast optimization methods in infinite dimensions

A. Rösch[1]

Abstract: In this talk we study semi-smooth Newtons methods and SQP-methods in infinite dimensional spaces. Convergence in infinite dimensions results typically in a mesh independent behavior after discretization. That means that the number of iterations of such methods does not depend on the discretization.

At the beginning we present assumptions and known results from finite-dimensional optimization. In the main part of the talk we explain the theory for infinite-dimensional problems. This theory can be applied to optimal control problems governed by partial differential equations. We analyze advantages and disadvantages of different approaches.

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Generalized metric subregularity with applications to high-order regularized Newton methods

B. S. Mordukhovich[1]

Abstract: This talk pursues a twofold goal. First we introduce and study in detail a new notion of variational analysis called generalized metric subregularity. which is a far-going extension of the conventional metric subregularity conditions. Our primary focus is on examining this concept concerning first-order and second-order stationary points. We develop an extended convergence framework that enables us to derive superlinear and quadratic convergence under the generalized metric subregularity condition, broadening the widely used Polyak-Lojasiewicz-Kurdyka (PLK) convergence analysis framework. We present verifiable sufficient conditions to ensure the proposed generalized metric subregularity condition and provide examples demonstrating that the derived convergence rates are sharp. Second, we design a new high-order regularized Newton method with momentum steps, and apply the generalized metric subregularity to establish its superlinear convergence. Quadratic convergence is obtained under additional assumptions.

Based on joint work with Guoyin Li (University of New South Wales, Australia) and Jiangxing Zhu (Yunnan University, China).

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Surrogate duality for quasiconvex vector optimization problems

J. E. Martínez-Legaz[1] and C. Tammer[2]

Abstract: It is well-known that duality theory is a fundamental tool in various areas of mathematics. There are great advantages to including or using the dual problem and duality statements. Especially, solving the dual problem can be done using other methods of analysis or numerical mathematics.

We consider a primal vector optimization problem with an objective function acting between a linear topological space X and a linear topological space Y equipped with a pointed closed convex cone $D \subset Y$ with nonempty interior. The feasible set is supposed to be a closed convex cone. The aim of this talk is to construct a simple and easy-to-handle dual problem by exploiting the special structure of the primal problem and using a suitable nonlinear scalarization. The computation of the dual image set involves the minimization of a nonlinear scalarization of the primal vector-valued objective function subject to only one linear inequality constraint. In this talk, we derive (weak and strong) duality statements under the assumption that the primal vector-valued objective function is D-quasiconvex and D-upper semicontinuous. Furthermore, we discuss the duality statement for special scalarizing functionals involved in the construction of the dual problem.

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On the problem of Cauchyness of fuzzy contractive sequences

D. Gopal[1]

Abstract: The first attempt to extend the well known Banach contraction theorem to KM fuzzy metric space was done by Grabiec (1986). However, his method was not suitable to retrieve classical Banach contraction theorem. Later, Gregori and Sapena (2002) gave notion of fuzzy contractive mapping and studied its applicability to fixed point theory in KM as well as GV fuzzy metric spaces. In their study, the authors need to demand additional condition to the completeness of the fuzzy metric in order to obtain a fixed point theorem, which constitutes a significant difference with classical theeory. So, in Gregori and Sapena (2002), the question was formulated: Is a fuzzy contractive sequence a cauchy sequence (in the sense of GV fuzzy metric)? So far, there is no answer to this question. Indeed, D. Mihet (2008) shown that the answer of this question in KM fuzzy metric is negative. In this talk, we will discuss on this problem and give a partial answer to the question.

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The variants of projection extragradient algorithms for nonmonotone equilibrium problems in Hilbert spaces

B. V. Dinh[1], T. T. H. Thanh[1], B. T . Tuyen[1], and J. S. Chen[2]

Abstract: We introduce three novel variants of the projection extragradient algorithm for solving equilibrium problems in real Hilbert spaces, without imposing any generalized monotonicity assumptions on the bifunctions involved. The proposed approach replaces the traditional shrinking projection step with a projection onto the intersection of the feasible set and a suitably chosen half-space, offering a more flexible and effective strategy. To address cases where the bifunctions do not satisfy a Lipschitz-type condition, we incorporate a general linesearch mechanism for determining the step size. When the bifunctions are of Lipschitz-type with known constants, this linesearch is rendered unnecessary; in the absence of such constants, we propose an adaptive step size rule. All three algorithms are rigorously proven to converge strongly to a solution, even without assuming the joint weak continuity of the bifunction-an assumption often required in existing literature. Numerical examples are presented to illustrate the efficiency and practical performance of the proposed methods.

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From robust to adjustable robust optimization problems

N. Dinh[1] **and D. H. Long**[2]

Abstract: Starting with a general adjustable robust optimization problem, denoted by (GAP), in which both the first-stage (here-and-now) and the second-stage (wait-and-see) decision variables are defined in locally convex Hausdorff topological vector spaces, we employ distinct perturbation strategies to reformulate (GAP) as a general robust optimization model, referred to as (GRP). This transformation enables the application of an abstract duality framework developed for robust optimization problems of the model (GRP). As results, several robust dual formulations for the mentioned general adjustable robust optimization problem (GRP) are derived and corresponding $\mathcal{V}$-stable strong duality results for each primal-dual pair under appropriate closedness-convexity qualification conditions are established.

Using this perturbation approach, we also derive variants of the Karush-Kuhn-Tucker optimality conditions for the general adjustable robust optimization problem (GAP). In addition, as by-products, we obtain several adjustable robust Farkas-type Lemmas associated with the constraint system of (GAP). The theoretical findings are illustrated through applications to important special cases, including adjustable problems with separable constraints, affinely adjustable robust optimization problems, and general robust optimization problems. In each of these cases, our results either are novel or extend and unify existing results from the literature.

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Gradient extremals, talwegs, valleys, and directional alignment for generic gradient descent

P. Bégout[1], J. Bolte[1], T. Mariotti[1], and F. J. Silva[2]

Abstract:

For Morse functions, we study gradient extremals, namely curves along which the slope is critical on each level set. This framework unifies several notions from the literature, such as valleys and talwegs, and allows for a variational analysis. In the generic case, we show that gradient descent trajectories, both continuous and discrete, asymptotically align with the tangent to the associated talweg. We also prove a concentration phenomenon: at large times, images of sets of initial conditions become concentrated inside valleys and asymptotically near talwegs.

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On strict efficiency and strict weak efficiency in set optimization

T. X. D. Ha[1]

Abstract: The talk is devoted to strict efficiency and strict weak efficiency in set optimization studied with the vector approach or with the set aporoach. Some optimality conditions expressed in terms of the high-order directional derivative or the convex/limiting coderivatives and the convex/limiting normal cones are presented.

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Time-integrated optimal transport and applications

C. T. M. Hong[1]

Abstract: Comparing time series in a principled manner requires capturing both temporal alignment and distributional similarity of features. Optimal transport (OT) has recently emerged as a powerful tool for this task, but existing OT-based approaches often depend on manually selected balancing parameters and can be computationally intensive. In this talk, we introduce the time-integrated optimal transport (TiOT) framework, which integrates temporal and feature components into a unified objective and yields a well-defined metric on the space of probability measures. This metric preserves fundamental properties of the Wasserstein distance, while avoiding the need for parameter tuning. To address the corresponding computational challenges, we introduce an entropic regularized approximation of TiOT, which can be efficiently solved using a block coordinate descent algorithm. Extensive experiments on both synthetic and real-world time series datasets demonstrate that our approach achieves improved accuracy and stability while maintaining comparable efficiency. This is based on a joint work with Nguyen Pham Duy Thai and Kim-Chuan Toh (National University of Singapore).

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Minimax S-Lemma and applications

D. T. K. Huyen[1]

Abstract: This talk presents a generalization of the classical S-lemma to the setting of minimax quadratic functions. Remarkably, the proposed framework does not require convexity of the underlying functions; instead, it relies on the convexifiability of the associated quadratic systems. By combining the new minimax S-lemma with the simultaneous diagonalization property, we establish exact second-order cone programming (SOCP) reformulations for a class of distributionally robust optimization problems involving minimax quadratic functions. These reformulations attain the same optimal value as the original problems while offering computationally tractable formulations that can be solved efficiently. Finally, we demonstrate the practical relevance of the proposed framework through several applications arising in risk theory.

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Neural network-based solution of extended random inverse quasi-variational inequalities with stability and convergence analysis

S. Rabbani[1] **and I. Ali**[1]

Abstract: In this talk, we investigate a class of extended random inverse quasi-variational inequalities (ERIQVIs) defined in a real separable Hilbert space. Under appropriate assumptions, we establish the existence and uniqueness of random solutions to ERIQVIs. Inspired by the novel approach introduced by [X. Zou, D. Gong, L. Wang, and Z. Chen. A novel method to solve inverse variational inequality problems based on neural networks, *Neurocomputing*, 173:1163–1168, 2016], we propose a neural network model for computing the solution of the ERIQVI. We demonstrate that every trajectory of the proposed neural network converges to the unique solution of the ERIQVI and establish its global asymptotic stability. Subsequently, by discretizing the associated dynamical system, we prove that the sequence generated by the resulting discrete-time scheme converges strongly to the unique solution of the ERIQVI problem under suitable conditions on the parameters. Finally, several numerical examples are provided to demonstrate the effectiveness of the proposed approach and to illustrate the theoretical findings.

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A simpler and more efficient iterative scheme for image restoration

I. Uddin[1]

Abstract: Fixed point iterative methods are very applicable to solve nonlinear problems appears in different branches of mathematics. This work presents a new iterative scheme and an analysis of fixed point approximation with respect to nonexpansive mapping. A comparative analysis reveals that proposed scheme not only converges faster than some classical iterative processes but also achieves good restoration quality when it is applied in the image restoration process by formulating it as a split feasibility problem. The integration of fixed point methods with modern image restoration highlights the novelty of our approach and underscores its potential as a powerful tool for advancing variational and projection-based techniques in imaging sciences.

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Golden ratio splitting algorithm for equilibrium problems

K. Mittal[1], **H. u. Rehman**[2], **E. Köbis**[3], **J.-C. Yao**[4], **and X. Zhao**[5]

Abstract: The notion of sharp minima, given by Polyak, is an important tool in studying the convergence analysis of algorithms designed to solve optimization problems. It has been studied extensively for variational inequality problems and equilibrium problems. In this talk, convergence analysis of the sequence generated by proximal point method for the quasiequilibrium problem (QEP) is discussed under sharp minima conditions. Also, an inexact proximal point method is introduced and the convergence of the sequence for solving the QEP is deduced. Lastly, some applications are discussed.

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Approximately scalable sets in normed spaces

P. D. Khanh[1], **P. H. Du**[1], **and H. L. B. Ty**[1]

Abstract: This talk presents the theory of approximately scalable sets in normed spaces. We introduce the notions of approximate scalability and uniform approximate scalability, investigate their fundamental properties, and present representative examples and counterexamples. We prove that these notions coincide for convex sets but are genuinely distinct for nonconvex sets, thereby revealing a fundamental difference between the convex and nonconvex settings. We further study the stability of approximate scalability under various set operations and obtain geometric characterizations in terms of asymptotic cones, recession cones, excess distances, and complementary decompositions. In particular, we establish one-sided geometric characterizations for nonconvex sets and necessary and sufficient geometric characterizations for convex sets. As one of the main applications, we obtain a new characterization of finite-dimensional normed spaces. Finally, we establish a close connection between approximate scalability and the rough continuity of linear operators between normed spaces. This connection yields new characterizations of rough continuity and provides a unified geometric framework for the calculus of rough continuity, including the sum, chain, and Cartesian product rules.

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Inexact proximal point and Tseng algorithms with nonsummable errors to solve monotone inclusions

L. B. Khiet[1], **B. S. Mordukhovich**[2], **and M. Théra**[3]

Abstract: In this talk, we establish the convergence of the practical versions of the Inexact Proximal Point Algorithm (IPPA) and the Inexact Tseng Algorithm (ITA) for computing approximate solutions to monotone inclusions in Hilbert spaces under the the presence of nonsummable errors. Our approach relies on Tikhonov regularization, the contraction property of the associated monotone operators, and the recently developed R-continuity theory. The proposed techniques and results can be extended to analyze various important inexact algorithms in optimization-related problems with nonsummable errors.

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Properties of cones and sets via positive functionals and applications

M. Durea[1]

Abstract: In this presentation, we pursue two main, closely related directions. First, we explore several dual topological properties of cones in normed vector spaces, motivated by the study of stability issues arising in some classes of optimization problems. This part includes an analysis of the relationships among several widely used properties such as sequential normal compactness, dual compactness, and w^*-local compactness, among others. Second, we formulate and investigate several dual conic topological properties of sets in normed vector spaces, tailored to naturally address issues arising in set optimization. In particular, we examine how the classical Uniform Boundedness Principle operates in this conic setting and provide a complete classification of several types of boundedness of a set with respect to a cone. This also provides an opportunity to revisit some concepts frequently used in the literature, such as hyperbolic and pseudo-hyperbolic sets. A central focus is on the concepts of conic compactness and sequential conic compactness, which provide a natural framework for extending classical compactness ideas to the conic setting and for capturing boundedness and compactness phenomena that are particularly relevant in set optimization. As applications, we analyze several conic cancellation rules and Rådström-type embedding results, illustrating their role in addressing problems arising in set optimization.

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Methods for solving equilibrium problems involving convex and quasiconvex bifunctions

L. D. Muu[1]

Abstract: The problem under consideration in this talk is given as follows

$$\text{Find } x^* \in C \text{ such that } f(x^*, y) \geq 0 \text{ for all } y \in C, \qquad (EP(C, f))$$

where C is a closed convex subset in a real Hilbert space, and f is a bifunction defined in $C \times C \subset \text{dom} f$ satisfying $f(x, x) \geq 0$ for every $x \in C$. The talk consists of two parts: the first part briefly reviews the problem and main solution approaches for solving Problem $EP(C, f)$ in the case $f(x, \cdot)$ is convex for every $x \in C$. In the second part, we present some algorithms for solving the problem when $f(x, \cdot)$ is quasiconvex for any $x \in C$. Unlike in the convex case, where the auxiliary problem principle can be successfully applied, this principle is no longer applicable in the quasiconvex case.

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On long orbit empty value principle

M. Ivanov[1], **D. Kamburova**[2], **and N. Zlateva**[2]

Abstract: We study the Long Orbit Empty Value (LOEV) principle, a useful tool in Variational Analysis, in progressively more concrete settings.

We prove, using the LOEV principle, a number of basic results in Variational Analysis. We characterize Σ_g-semicompleteness for a generalized metric function g which need not be symmetric or satisfy the triangle inequality, in terms of the validity of the Ekeland Theorem for this g.

We present an application to perturbability to a minimum on a G_δ subset of a perfectly normal Σ_g-semicomplete space.

The results are published in a paper dedicated to Prof. Michel Théra: M. Ivanov, D. Kamburova, and N. Zlateva (2026). On long orbit empty value (LOEV) principle. Optimization, 1–24, https://doi.org/10.1080/02331934.2026.2661838

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Scalarization in vector optimization with two-variable domination structures

D. T. Ngoan[1]

Abstract: This talk focuses on studying domination structures in real topological linear spaces that take into account the two involved points in each comparison. These binary relations are applied, in the usual way, to define notions of set minimizers and optimality concepts for vector optimization problems, and their basic properties are established. After that, results on nonlinear scalarization that characterize these notions are presented. These results can be applied to vector optimization problems with variable ordering structures, for which the existing scalarization methods do not work.

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On the boundedness of inverses of regularized Jacobian matrices in nonlinear optimization and applications

P. Armand[1] **and T. N. Nguyen**[2]

Abstract: In nonlinear optimization, when certain regularity conditions fail to hold, the coefficient matrices of the linear systems arising from Newton-type methods may become singular. This leads to a loss of the fast convergence rate of these methods. To overcome this difficulty, regularization terms are introduced into these matrices to resolve the singularity issue. In this talk, we will present several boundedness properties of the inverses of these regularized matrices and discuss their applications to the convergence analysis of algorithms for solving nonlinear optimization problems.

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Second-order necessary optimality conditions for an elliptic optimal control problem with exponential nonlinearity and discrete measures

V. H. Nhu[1]

Abstract: We study a box-constrained optimal control problem governed by a semilinear elliptic equation with exponential nonlinearity and discrete measure sources, where the control variable belongs to the space of absolutely summable sequences. The combination of exponential growth and measure-valued data leads to significant analytical challenges, most notably the possible failure of directional differentiability of the control-to-state mapping. To overcome this difficulty, we first establish directional differentiability along finite-dimensional subspaces of the control space. Motivated by this property, we introduce a generalized derivative obtained as the limit of these finite-dimensional directional derivatives. Using this framework together with first- and second-order Taylor-type estimates for the associated exponential Nemytskii operator, we prove first- and second-order generalized differentiability of the reduced objective functional. These results enable us to derive first- and second-order necessary optimality conditions for the control problem.

This talk is based on joint work with Nguyen Hai Son, Phan Quang Sang, and Tran Duy.

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Stochastic modelling and performance analysis of a circular supply chain

K. S. Sangwan[1], R. Kulshrestha[2], Paras[2], and V. Poonia[1]

Abstract: The circular economy aims to increase the useful life of products through repair, reuse, refurbishment, and recycling. However, most of the existing studies on circular supply chains are based on deterministic models. In practice, customer arrivals, product returns, and recovery activities are uncertain and may change over time. To consider these aspects, this paper develops a continuous-time Markov chain-based queueing-inventory model for a circular supply chain. The retailer maintains three types of products: fresh, repaired, and refurbished. These products are supplied by the manufacturer, inspection and collection centre, and refurbishing and recycling centre, respectively. The model considers the movement of products through different stages of the supply chain, as well as customer arrivals, inventory changes, product returns, inspection, repair, and refurbishment. The steady-state probabilities are used to obtain different performance measures of the system. The model also considers economic, environmental, and social objectives to study the overall performance of the supply chain and identify suitable inventory decisions. Numerical results show that repair, reuse, refurbishment, and recycling can improve the system's economic performance and reduce its environmental impact. The proposed model can help decision-makers in managing inventory and recovery activities in a circular supply chain.

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A coupled nonsmooth dynamical system: Global well-posedness, stability and sensitivity analysis

J. Chen[1], V. T. Phat[2], and S. Zeng[1]

Abstract: This talk presents a coupled nonsmooth dynamical system in which a semilinear evolution equation is coupled with an implicit algebraic law governed by the normal cone to a time-dependent convex set. The main difficulty is that the algebraic variable is not given by an explicit feedback, but must be recovered from a state-dependent normal cone relation. Using a transformed variable, we recast each frozen algebraic law as a variational inequality over a convex set. Under a strongly pseudomonotone, Lipschitz continuous hypothesis, this frozen problem has a unique algebraic response and admits a sensitivity estimate for the state-to-control map without a projection-contraction argument. We also give verifiable sufficient conditions for this hypothesis, including a weighted strongly monotone construction and a standard Lipschitz-smallness condition, and point out that the framework allows strongly pseudomonotone nonmonotone frozen operators. The coupled system is then reduced to a semilinear evolution equation with a single state variable. By combining C_0-semigroup estimates with a Bielecki fixed-point argument, we prove global existence and uniqueness of mild solution pairs on finite time intervals and establish Hadamard well-posedness through explicit continuous-dependence estimates. We further derive an incremental exponential stability criterion in the dissipative semigroup regime and prove continuity of the parameter-to-solution map with respect to the initial datum and an external parameter. A reduced contact-mechanics example illustrates the variational inequality formulation and an explicit projection residual that can be used as a starting point for projection- and Newton-type inner solvers after discretization.

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Variational stability and sufficient conditions for local optimality

R. T. Rockafellar[1]

Abstract: When should a problem requiring computations be considered "well posed"? The long history of this issue in the numerical analysis of solving equations ties it to properties of inverse mappings, such as condition numbers, but in optimization the challenge is bigger and more ideas need to be brought in. The study broadens to include solution stability with respect to variations of the natural parameters in a problem and how that relates to different levels of conditions tied to local optimality. Current developments in understanding this will be explained.

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Support profiles and exact capacities of Pareto spectra in orders three and four

S. Adly[1]

Abstract: The Pareto eigenvalue problem is an eigenvalue complementarity problem associated with the nonnegative orthant $\mathbb{R}^n_+$.Unlike the ordinary spectrum, the Pareto spectrum of a real matrix may contain more distinct eigenvalues than its order n. This first part of the talk investigates how the supports of the eigenvectors constrain this multiplicity and determine sharp spectral bounds.

We present a complete classification of the support profiles of real matrices of order $n = 3$ that attain the maximum of nine distinct Pareto eigenvalues. By assigning each distinct eigenvalue to one of its producing supports, we show that the only possible aggregate profiles are (1,5,3), (2,4,3), and (2,5,2), where the entries count values assigned to supports of sizes one, two, and three.

We then explain how these structural restrictions allow us to establish that the maximum number of distinct Pareto eigenvalues of a real matrix of order four is exactly 23. A fixed-point formulation on the standard simplex leads to an odd cardinality theorem under assumptions of regularity and uniqueness. Combined with restrictions on the support and determinant identities, this result excludes the remaining possible cardinality of 25. This talk highlights the interaction between spectral theory, support combinatorics, and topological methods.

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Control of the Maxwell equations in the framework of J. C. Willems' theory of behaviours

S. Shankar[1]

Abstract: Kalman's fundamental notion of a controllable state space system has been spectacularly generalised to higher order lumped systems by J. C. Willems in his theory of behaviours, and further extended to distributed systems defined by partial differential operators by H. Pillai and S. Shankar. This talk will explain this development, and illustrate it by discussing the Maxwell equations in this framework.

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Solution mappings and directional derivatives of convex infimal convolutions

T. T. Nam[1] **and** **T. Q. Son**[1]

Abstract: In this talk, we present some new results on the directional derivatives of the infimal convolution of two given convex functions on $\mathbb{R}^n$, defined by

$$(f\square g)(x) := \inf_{y\in\mathbb{R}^n} \big[f(y) + g(x-y)\big].$$

The results are established under the assumption that the infimal convolution is exact at x, that is, there exists

$$y_x \in \operatorname{argmin}_{y\in\mathbb{R}^n} \big[f(y) + g(x-y)\big]$$

such that

$$(f\square g)(x) = f(y_x) + g(x-y_x).$$

We first investigate the properties of the solution mapping associated with the infimal convolution:

$$S : \mathbb{R}^n \rightrightarrows \mathbb{R}^n,\ S(x) = \operatorname{argmin}_{y\in\mathbb{R}^n} \big[f(y) + g(x-y)\big].$$

We then establish directional derivative formulas for the infimal convolution associated with each exact decomposition of x. More precisely, the directional derivative of $f\square g$ can be expressed in terms of the directional derivative of either f or g. As applications, we derive several optimality conditions for unconstrained convex optimization problems whose objective functions are given by the infimal convolution of two convex functions. Some illustrative examples are also provided.

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A variable step size inertial forward-backward algorithm for monotone variational inclusions

S. Rath[1] **and S. K. Mishra**

Abstract: We propose a modified inertial forward-backward algorithm for solving a variational inclusion problem involving the sum of two operators, where one operator is maximally monotone and the other is monotone and Lipschitz continuous. The proposed algorithm employs variable step sizes that are updated at each iteration via computationally inexpensive procedures. Notably, these step sizes are determined without requiring prior knowledge of the Lipschitz constant of the operator and without the use of a line search technique, making the algorithm efficient and easy to implement.

Under standard assumptions, we establish the weak convergence of the proposed method and analyze its convergence rate. Furthermore, preliminary numerical experiments are presented to validate the theoretical findings and to demonstrate the effectiveness of the proposed algorithm in comparison with existing methods.

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New fixed point results on interpolative metric spaces

S. Verma[1]

Abstract: This study aims to generalize and extend recent fixed point theorems within the framework of interpolative metric spaces. In particular, we investigate the relationship between strong b–metric spaces and b–metric spaces and establish new fixed point results under suitable interpolative contractive conditions. The proposed approach incorporates the interpolation of distances between points and their corresponding images, thereby providing a broader framework for several existing contraction principles. Under appropriate completeness and continuity assumptions, we establish the existence and uniqueness of fixed points and derive several related consequences. The obtained results provide unified extensions of well-known contraction principles, including Kannan and Chatterjea contractions. Furthermore, suitable examples are constructed to illustrate the applicability of the proposed results and to demonstrate that the established conditions are genuinely distinct from the corresponding classical assumptions. These results contribute to the development of interpolative fixed point theory and provide a basis for further investigations in generalized metric structures.

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Stability radius and dichotomy radius of infinite-dimensional linear systems under unbounded perturbations via Yosida distance

D. D. Thuan[1]

Abstract: In this talk, by using the concept of Yosida distance between two closed linear operators, we present the stability radius $r(A)$ of linear systems $u'(t) = Au(t)$, where A is the generator of an analytic semigroup, under unbounded perturbations in this class of generators. We extend a classic result by Henrichsen and Pritchard to the infinite-dimensional case. A formula of the dichotomy radius is also established. Finally we give an estimate of the stabilty radius of general C_0-semigroups. Two examples from a parabolic equation are given.

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Optimization challenges in intelligent autonomous sensing systems: From energy autonomy to adaptive sensing and communication

L. M. Thuy[1]

Abstract: Intelligent sensing systems are increasingly expected to operate continuously and reliably with minimal human intervention, despite stringent constraints on energy, computation, communication, and sensing quality. Achieving such autonomy requires sensing, computation, communication, and energy management to be jointly considered and dynamically adapted to changing operating conditions. This talk discusses a class of optimization and control problems arising from our recent research on intelligent and energy-autonomous sensing systems. We begin at the device level, where energy harvesting and wireless power transfer require balancing harvested energy, conversion efficiency, energy storage, and load demand under uncertain operating conditions. We then extend this perspective to autonomous sensing systems, where sensing rate, local computation, wireless transmission, and energy management need to be dynamically coordinated to balance sensing quality, latency, communication reliability, and energy consumption. This common framework is illustrated through two application scenarios at different scales: wearable health monitoring, where system operation is adapted to physiological states and user activities; and large-scale environmental monitoring, where distributed sensing nodes need to cope with uncertain energy availability, time-varying wireless connectivity, sensor drift, and heterogeneous environmental conditions. These examples lead to multi-objective optimization problems with coupled constraints on sensing performance, computational resources, communication reliability, and energy availability. Rather than focusing on a particular optimization algorithm, the talk presents representative engineering problems from our recent work and discusses opportunities for applying optimization, adaptive control, and machine learning to improve the reliability, energy efficiency, and long-term autonomous operation of intelligent sensing systems.

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Some vector transports for nonlinear conjugate gradient optimization schemes on the indefinite Stiefel manifold

D. V. Tiep[1] **and N. T. Son**[2]

Abstract: Optimization on the indefinite Stiefel manifold, which provides a solution to some constrained optimization problems, has been recently addressed in terms of a Riemannian gradient descent method. In this talk, we proceed to construct several vector transports and propose some Riemannian conjugate gradient schemes. Our preliminary numerical tests show that the new conjugate gradient schemes deliver competitive results.

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Derivative-free trust-region methods for noisy functions

P. D. Khanh[1], B. H. Tram[1], and T. B. Dat[2]

Abstract: We study unconstrained smooth optimization problems where the objective function is continuously differentiable with Lipschitz continuous gradient, but exact function evaluations are unavailable and only noisy observations can be accessed. We propose a derivative-free trust-region method that approximates gradients using forward finite differences without requiring prior knowledge of the noise level or the Lipschitz constant of the gradient. We establish the complexity analysis of the proposed algorithm and show that it reaches a near-stationary point in a finite number of iterations, while providing estimates on the required numbers of iterations and function evaluations.

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Nonlinear and orbital directional regularities for set-valued mappings and applications to fixed points

M. Durea[1,2], N. H. Tron[3], and M. Théra[4]

Abstract: Motivated by developments in metric regularity theory for set-valued mappings, this paper introduces several directional regularity notions that are weaker than the corresponding classical regularity properties. We investigate the relationships among these concepts and establish a classification framework based on directional minimal time functions. Particular attention is devoted to directional orbital regularity and directional orbital Aubin continuity, which are shown to provide a natural setting for the analysis of fixed point phenomena.

Using these notions, we derive approximate and exact fixed point theorems for set-valued mappings under directional assumptions. The obtained results are expressed in terms of minimal time functions and orbital approximation procedures, allowing for anisotropic and asymmetric behaviors that are not captured by the classical nondirectional framework. We further apply the developed theory to directional coincidence point results, coupled fixed point theorems, and Milyutin-type perturbation stability properties. The proposed approach provides a unified directional perspective on fixed point theory and variational analysis. In particular, it recovers several known results from the literature as special cases and yields new extensions under substantially weaker assumptions than classical contraction or global regularity conditions.

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Second-order sufficient optimality conditions for multiobjective time-optimal control problems with endpoint and mixed constraints

S. Adly[1], N. T. Doan[2], B. T. Kien[3], and N. Q. Tuan[4]

Abstract: In this talk, we study multiobjective time-optimal control problems with end-point and mixed constraints. Our main contribution is the derivation of second-order sufficient optimality conditions for locally Pareto optimal solutions. Under a Robinson-type constraint qualification and a strengthened Legendre-Clebsch condition, we obtain a unified second-order framework that generalizes several classical results from scalar optimal control theory.

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Second-order optimality conditions for $C^{1,1}$ sparsity constrained optimization problems via disjunctive programming

L. Jiao[1], L. T. T. Huyen[2], and N. V. Tuyen[3]

Abstract: In this talk, we investigate second-order necessary and sufficient optimality conditions for a class of $C^{1,1}$ sparsity constrained optimization problems via a disjunctive programming approach. More precisely, by employing the limiting (Mordukhovich) second-order subdifferential of the associated Lagrangian function, we derive new second-order necessary and sufficient conditions for local optimal solutions of the considered problem. Furthermore, we apply the developed results to sparse multiobjective optimization problems and derive second-order optimality conditions for efficient solutions. Several illustrative examples are provided to demonstrate the applicability and effectiveness of the obtained results.

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Multiobjective bilevel optimization problem with switching constraints

U. Bajpei[1], **S. K. Mishra**[1], **D. Singh**[1]

Abstract: In this talk, a new class of multiobjective bilevel optimization problems with switching constraints is discussed. We explain an optimality and duality framework based on tangential subdifferentials by reformulating the bilevel problem as an equivalent single-level optimization problem. We derive necessary optimality conditions under the Abadie constraint qualification and then prove sufficient optimality conditions under generalized convexity (quasiconvexity and pseudoconvexity) assumptions. In addition, we develop Wolfe-type and Mond-Weir-type dual models and establish the corresponding weak, strong, and strict converse duality theorems. We illustrate the proposed theoretical results by several examples, showing the effectiveness and applicability of the developed framework.

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Subtransversality and strong CHIP for finitely many closed subsets

Z. Wei[1], M. Théra[2], and J.-C. Yao[3]

Abstract: In this talk, we study *subtransversality*, strong conical hull intersection property(*strong CHIP*) and Jameson's property (*property (G)*) for finitely many closed subsets. We first recall the well-established equivalence theorem among these important concepts for closed convex subsets. In terms of Fréchet/Mordukhovich normal cones, we study strong Fréchet and limiting CHIPs, and prove seveal equivalence results among subtransversality, strong CHIP and property (G) for some speical closed subsets in the Asplund space. Further, we consider the strong proximal CHIP via proximal normal cones and introduce a concept of "*bounded subtransversality*" for finitely many closed subsets. This concept is proved to be equivalent to subtransversality for the convex case. For finitely many prox-regular closed subsets in the Hilbert space, we establish dual characterizations of bounded subtransversality via strong proximal CHIP and property (G). Our work is an extension of the equivalence result on subtransversality, strong CHIP and property (G) from the convex setting to the possibly non-convex situation.

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Optimization aspect of machine learning: Neurodynamical neural network approach for solving support vector machines with generalized pinball loss function via hyperbolic tangent smoothing function

R. Wangkeeree[1], R. Wangkeeree[1], Y. A. Belay[2], and K. Ungchittrakool[1]

Abstract: In this talk, we propose a neurodynamical neural network approach for solving machine learning problems, specifically, support vector machines with hyperbolic tangent smoothed general pinball loss function. First, we use the hyperbolic tangent smoothing technique to find a smooth approximation of the non-smooth loss function. Then we propose a continuous-time neurodynamical neural network model which enables us to find continuous real time solutions of the given support vector machine problem. We rigorously prove the equivalence between the set of optimal solutions of the hyperbolic tangent smoothed problem and the set of equilibrium points of the proposed dynamical system. Then we analyze the existence and uniqueness of solutions, global asymptotic stability, global convergence and exponential stability of the proposed method. Next we conduct experiments on both synthetic and benchmark real-world datasets to show the effectiveness of the proposed method.

We evaluate the performance of the model using the accuracy (ACC), Matthews Correlation Coefficient (MCC), and F1-score performance metrics. Then we compare our model against the state of the art methods of solving support vector machine problems. Finally, we perform Friedman test followed by Nemenyi post-hoc statistical analysis to examine the significance of the performance difference among the methods.

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