PIMS- IFDS- NSF Summer School on Optimal Transport -- proposed participant talks

Email *

mjjo@math.ubc.ca

Your name and affiliation:

Min Jun Jo, The University of British Columbia

Your career stage (i.e. graduate student, postdoc, etc.):

Graduate student

The title of your proposed talk:

Asymptotic stability of the 2D MHD equations with a velocity damping term around the constant background magnetic field

The abstract of your proposed talk:

We show the asymptotic stability of the incompressible non-resistive 2D MHD equations with a velocity damping term around the equilibrium $(\bfv,\bfB)=(0,e_1)$. By minimizing the number of the key quantities to estimate, we reduce the minimal Sobolev exponents that were required in the recent result by Jiahong Wu et al. for initial data to ensure both the global well-posedness and the temporal decay of the solutions to the perturbed system around such equilibrium.

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PIMS- IFDS- NSF Summer School on Optimal Transport -- proposed participant talks

Email *

havva.yoldas@univie.ac.at

Your name and affiliation:

Havva Yoldas, University of Vienna

Your career stage (i.e. graduate student, postdoc, etc.):

Postdoc

The title of your proposed talk:

Existence results for some cross-diffusion systems for competing species

The abstract of your proposed talk:

I will start with a cross-diffusion system which consists of two Fokker-Planck equations where the gradient of one species acts as a potential for the other one. The starting point is a discrete, agent based model for interaction of two competing gangs. The gang members perform a biased random walk adding graffiti markings on the walls as they walk and avoid the graffiti markings done by the rival gang members. We will address the existence of solutions for the continuum system via entropy method and gradient flows approach. The talk is based on joint works with A. Barbaro, N. Rodriguez, and N. Zamponi (CMS, '21) and with R. Ducasse and F. Santambrogio (arXiv:2111.13764, '22).

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Your name and affiliation:

Giacomo Enrico Sodini, Faculty of Mathematics of the Technical University of Munich

Your career stage (i.e. graduate student, postdoc, etc.):

PhD student

The title of your proposed talk:

A relaxation approach to optimal transport with applications to the unbalanced case

The abstract of your proposed talk:

We discuss a new interpretation of the optimal transport cost as the largest lower semicontinuous and convex functional extending the cost between pairs of delta measures.
With this in mind, we introduce a notion of optimal transport cost for (nonnegative) measures with possibly different masses, we discuss its metric and topological properties and we present duality formulas.
This is based on a joint work with Giuseppe Savaré (Bocconi University, Milano, Italy).

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PIMS- IFDS- NSF Summer School on Optimal Transport -- proposed participant talks

Email *

bjacelon@gmail.com

Your name and affiliation:

Bhishan Jacelon, Institute of Mathematics of the Czech Academy of Sciences

Your career stage (i.e. graduate student, postdoc, etc.):

Postdoc

The title of your proposed talk:

Optimal transport and unitary orbits in C*-algebras

The abstract of your proposed talk:

A C*-algebra is a norm-closed *-algebra of bounded operators on Hilbert space. These structures act as transport hubs between many diverse areas of mathematics, such as topology, group theory and dynamical systems. The connection with topology is especially well-established, to the extent that C*-algebras are often thought of as noncommutative topological spaces. In practice, this means that many tools from topology, such as K-theory, have meaningful C*-analogues. These days, a wide class of C*-algebras is known to be classified by K-theoretic invariants. In this talk, I will explain how classification machinery can be used to relate the continuous W_∞-Monge problem to a version of the classical Weyl theorem, that is, a spectral computation of the distance between the unitary orbits of certain normal operators.

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PIMS- IFDS- NSF Summer School on Optimal Transport -- proposed participant talks

Email *

yx4247@utexas.edu

Your name and affiliation:

Yangxinyu Xie; University of Texas at Austin

Your career stage (i.e. graduate student, postdoc, etc.):

graduate student

The title of your proposed talk:

Predicting Covid-19 EMS Incidents from Daily Hospitalization Trends

The abstract of your proposed talk:

Introduction: The aim of our retrospective study was to quantify the impact of Covid-19 on the temporal distribution of Emergency Medical Services (EMS) demand in Travis County, Austin, Texas and propose a robust model to forecast Covid-19 EMS incidents.
Methods: We analyzed the temporal distribution of EMS calls in the Austin-Travis County area between January 1st, 2019, and December 31st, 2020. Change point detection was performed to identify critical dates marking changes in EMS call distributions, and time series regression was applied for forecasting Covid-19 EMS incidents.
Results: Two critical dates marked the impact of Covid-19 on the distribution of EMS calls: March 17th, when the daily number of non-pandemic EMS incidents dropped significantly, and May 13th, by which the daily number of EMS calls climbed back to 75% of the number in pre-Covid-19 time. The new daily count of the hospitalization of Covid-19 patients alone proves a powerful predictor of the number of pandemic EMS calls, with an r2 value equal to 0.85. In particular, for every 2.5 cases where EMS takes a Covid-19 patient to a hospital, one person is admitted.
Conclusion: The mean daily number of non-pandemic EMS demand was significantly less than the period before Covid-19 pandemic. The number of EMS calls for Covid-19 symptoms can be predicted from the daily new hospitalization of Covid-19 patients. These findings may be of interest to EMS departments as they plan for future pandemics, including the ability to predict pandemic-related calls in an effort to adjust a targeted response.

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PIMS- IFDS- NSF Summer School on Optimal Transport -- proposed participant talks

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Your name and affiliation:

Manuel Mellado Cuerno - Universidad Autónoma de Madrid

Your career stage (i.e. graduate student, postdoc, etc.):

PHD Student

The title of your proposed talk:

Filling radius and Kuratowski embedding

The abstract of your proposed talk:

We can isometrically embedd a Riemannian manifold M into $L^{\infty}(M)$ with the Kuratowski embedding Φ. In 1983, Gromov defined the Filling radius as the measure of the size of the $(n+1)$-dimensional hole that captures a n-dimensional manifold. In this talk, I will present some of the most important results in the area and some new contributions to the field. This is a joint work with my advisor Luis Guijarro.

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Your name and affiliation:

Daniel Owusu Adu and Queen's University

Your career stage (i.e. graduate student, postdoc, etc.):

Graduate Student

The title of your proposed talk:

Robust Matching for teams

The abstract of your proposed talk:

We investigate a variation of the classical matching problem over a continuum of consumers and producers, where the producer is uncertain about its cost of production. If a consumer selects a good a team of producers is formed to produce the good in spite of such uncertainties and the market designer, knowing how the consumers and producers are going to react, aims to set the price to optimally match consumers to teams of producers so that the market is cleared. Using optimal transportation theory, we provide conditions under which the robust matching equilibrium exists. Our results show that the additive specification of the uncertainty in the cost of production implies that an equilibrium can be achieved by inducing in expectation the matching equilibrium one would obtain under certainty

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PIMS- IFDS- NSF Summer School on Optimal Transport -- proposed participant talks

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business.jshw@gmail.com

Your name and affiliation:

Jeremy, Oxford

Your career stage (i.e. graduate student, postdoc, etc.):

Graduate student

The title of your proposed talk:

Gradient flow structure of the Landau equation

The abstract of your proposed talk:

Using the famous H-theorem property of the Landau equation in kinetic theory, I will discuss how the spatially homogeneous Landau equation can be viewed as a gradient flow of the Boltzmann entropy. More precisely, the metric associated to this gradient flow structure is constructed by generalizing the Benamou-Brenier formulation of classical optimal transportation metrics.

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Your name and affiliation:

Luca Tamanini (Bocconi University)

Your career stage (i.e. graduate student, postdoc, etc.):

Postdoc

The title of your proposed talk:

Convergence rate of general entropic optimal transport costs

The abstract of your proposed talk:

Entropic Optimal Transport consists in the minimization of a transport functional penalized by an entropy term. After the seminal contributions by Carlier, Cuturi, Duval, Peyré, Schmitzer and many others EOT has become a standard (and efficient) way to regularize transport problems more general than the quadratic one, thus approaching also related applications in machine learning

When the penalization/noise parameter vanishes, the original transport problem is recovered and this remark yields several natural questions, as for instance the convergence rate of many quantities: optimal value, optimal solutions and potentials... A Taylor expansion for the optimal value has recently been the subject of a deep investigation, which covers the quadratic case up to the second order [Conforti-T. '21] and suitable smooth perturbations of the quadratic cost up to the first order [Pal '19].

Aim of this talk is to review the existing literature and to present an ongoing work, which extends the previous contributions not from the point of view of the accuracy, but from the point of view of the admissible cost functions. Indeed, we obtain an almost first-order Taylor expansion for EOT problems induced by costs which are only C^2 and infinitesimally twisted. In particular, our result applies to certain costs for which the solutions of the unregularized problem are not induced by a transport map and are not even unique.

(based on a joint work with G. Carlier and P. Pegon)

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PIMS- IFDS- NSF Summer School on Optimal Transport -- proposed participant talks

Email *

as6011@columbia.edu

Your name and affiliation:

Amir Sagiv (Columbia University)

Your career stage (i.e. graduate student, postdoc, etc.):

postdoc

The title of your proposed talk:

Measure Transport and Uncertainty Quantification

The abstract of your proposed talk:

We consider two seemingly unrelated computational tasks: (1) In real-world settings, the parameters of an otherwise deterministic model might be uncertain or noisy. Can one provide a statistical description of the quantity of interest (model output)? (2) How can one learn a computationally inexpensive method to sample from a complicated probability measure?
Perhaps surprisingly, underlying both of these numerical analysis problems is the same fundamental question - if two "similar" functions push-forward the same measure, would the new resulting measures be close, and if so, in what sense?

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PIMS- IFDS- NSF Summer School on Optimal Transport -- proposed participant talks

Email *

liu16@uw.edu

Your name and affiliation:

Lang Liu, University of Washington

Your career stage (i.e. graduate student, postdoc, etc.):

Graduate student

The title of your proposed talk:

Entropy Regularized Optimal Transport Independence Criterion

The abstract of your proposed talk:

We introduce an independence criterion based on entropy regularized optimal transport. Our criterion can be used to test for independence between two samples. We establish non-asymptotic bounds for our test statistic and study its statistical behavior under both the null hypothesis and the alternative hypothesis. The theoretical results involve tools from U-process theory and optimal transport theory. We also offer a random feature type approximation for large-scale problems, as well as a differentiable program implementation for deep learning applications. We present experimental results on existing benchmarks for independence testing, illustrating the interest of the proposed criterion to capture both linear and nonlinear dependencies in synthetic data and real data.

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Email *

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Your name and affiliation:

Sadashige Ishida (IST Austria)

Your career stage (i.e. graduate student, postdoc, etc.):

PhD student

The title of your proposed talk:

Hidden degrees of freedom in implicit curve dynamics

The abstract of your proposed talk:

The deformation of space curves is an interesting topic in many subjects such as differential geometry, low-dimensional topology, fluid dynamics, and optimal transport. In this talk, we present a new representation of curve dynamics. Instead of representing curves with explicit geometry and Lagrangian equations of motion, we represent them implicitly with a new co-dimensional 2 level set description.

Our implicit representation admits several redundant degrees of freedom in both the configuration and the dynamics of the curves. Exploitation of these degrees of freedom has various applications. For example, we demonstrate that they can be tailored to enhance stability in numerical simulation of curve dynamics such as vortex filaments in fluid dynamics or curve shortening flow in differential geometry. Furthermore, we note how these hidden degrees of freedom map to the so-called Clebsch variables in symplectic geometry. Motivated by these observations, we introduced untwisted level set functions and non-swirling dynamics, and show that they successfully regularize sources of instability, particularly in the twisting modes around curves.

As a future work, we expect that our implicit representation via Clebsch variables can be leveraged to describe optimal transport of measures concentrated on codimensional objects such as curves or surfaces in three or higher dimensional spaces.

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Your name and affiliation:

Francesco Mattesini (WWU Münster and MPI MiS Leipzig)

Your career stage (i.e. graduate student, postdoc, etc.):

PhD student

The title of your proposed talk:

There is no invariant cyclically monotone Poisson matching in 2d

The abstract of your proposed talk:

\noindent The optimal matching problem is a classical random variational problem that received interest in the last 30 years. We show that there exists no cyclically monotone invariant matching of two independent Poisson processes in the critical dimension $d=2$. Our argument relies on a recent harmonic approximation theorem together with the two-dimensional local asymptotics for the bipartite matching problem, for which we provide a new self-contained proof based on martingale arguments. \\ \noindent Joint work with \textsc{M. Huesmann} (WWU M\"unster) and \textsc{F. Otto} (MPI Leipzig)

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PIMS- IFDS- NSF Summer School on Optimal Transport -- proposed participant talks

Email *

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Your name and affiliation:

Xin Zhang, University of Vienna

Your career stage (i.e. graduate student, postdoc, etc.):

Postdoc

The title of your proposed talk:

The Wasserstein space of stochastic processes II

The abstract of your proposed talk:

In this talk, we further investigate the properties of the adapted Wasserstein distance for continuous-time processes.
With respect to this metric we show approximation results like Donsker's theorem. Moreover, optimal stopping problems are continuous with respect to the adapted Wasserstein distance. In fact, the topology induced by this metric on the set of continuous processes is the weakest topology that guarantees the continuity of optimal stopping. This talk is based on the joint work with Daniel Bartl, Mathias Beiglböck, Gudmund Pammer and Stefan Schrott.

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Your name and affiliation:

Stefan Schrott, University of Vienna

Your career stage (i.e. graduate student, postdoc, etc.):

PhD student

The title of your proposed talk:

The Wasserstein space of stochastic processes I

The abstract of your proposed talk:

Researchers from different areas have independently defined extensions of the usual weak topology on the space of laws of stochastic processes. This includes Aldous' extended weak convergence, Hellwig's information topology, and convergence in adapted distribution in the sense of Hoover-Keisler.
In finite discrete time Backhoff, Bartl, Beiglböck, Eder and Pammer showed that these topologies coincide on canonical processes and can be metrized by the so-called adapted Wasserstein distance. Moreover, they introduced the space of filtered processes, which is the completion of the canonical processes with respect to the adapted Wasserstein distance.
This talk is about extending these results from discrete to continuous time. In particular, we introduce a Wasserstein-type distance between laws of continuous-time processes, which exhibits several desirable properties, such as continuity of optimal stopping and Donsker-type approximation results.
This talk is based on joint work with Daniel Bartl, Mathias Beiglböck, Gudmund Pammer and Xin Zhang.

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PIMS- IFDS- NSF Summer School on Optimal Transport -- proposed participant talks

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cameron.davies@mail.utoronto.ca

Your name and affiliation:

Cameron Davies, University of Toronto

Your career stage (i.e. graduate student, postdoc, etc.):

PhD Student

The title of your proposed talk:

Recent Results on the Aggregation Equation: an Optimal Transport Perspective

The abstract of your proposed talk:

The aggregation equation describes the motion of particles which interact pairwise through an attractive-repulsive potential, i.e. one which is repulsive at short distances and attractive at longer distances. This equation has often been studied indirectly by examining its interaction energy functional and, in a formal sense, the aggregation equation can be recovered as a d_2-Wasserstein gradient flow of the interaction energy. Depending on the strength of repulsion and attraction, the energy landscape can appear dramatically different and, in a particular region of parameter space known as the mildly repulsive regime, the exact structure of global energy minimizers was not known until my joint work with Tongseok Lim and Robert McCann. My talk will explain some of our key results in a clear and accessible manner, highlighting the prevalence of optimal transport techniques such as Wasserstein distances throughout.

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Bohan.Zhou@dartmouth.edu

Your name and affiliation:

Bohan Zhou, Dartmouth College

Your career stage (i.e. graduate student, postdoc, etc.):

postdoc

The title of your proposed talk:

Efficient and Exact Multimarginal Optimal Transport with Pairwise Costs

The abstract of your proposed talk:

Optimal transport has profound and wide applications since its introduction in 1781 by Monge. Thanks to the Benamou-Brenier formulation, it provides a meaningful functional in the image science like image and shape registrations. However, exact computation through LP or PDE is in general not practical in large scale, while the popular entropy-regularized method introduces additional diffusion noise, deteriorating shapes and boundaries. Until the recent work [Jacobs and Leger, A Fast Approach to Optimal Transport: the back-and-forth method, Numerische Mathematik, 2020], solving OT in a both accurate and fast fashion finally becomes possible. Multiple marginal optimal transport is a natural extension from OT but has its own interest and is in general more computationally expensive. The entropy method suffers from both diffusion noise and high dimensional computational issues. In this work with Matthew Parno, we extend from two marginals to multiple marginals, on a wide class of cost functions when those marginals have a graph structure. This new method is fast and does not introduce diffusion. As a result, the new proposed method can be used in many fields those require sharp boundaries. If time allows, we will illustrate by examples the faithful joint recover via MMOT of images with sharp boundaries, with applications on sea ice prediction.

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Email *

yjl@econ.ku.dk

Your name and affiliation:

Young Jun Lee, University of Copenhagen

Your career stage (i.e. graduate student, postdoc, etc.):

Poctdoc

The title of your proposed talk:

Sieve estimation of optimal transport with general surplus

The abstract of your proposed talk:

This paper considers the nonparametric estimation of the solution to the optimal transport problem. Based on the Monge-Kantorovich duality, we propose a sieve estimator for the dual problem in which the optimization variable is an integrable function. We present consistency and convergence rates for the proposed estimators under regularity conditions on the objective function and two probability distributions to be matched. Our conditions allow the objective function to be more general than the quadratic function.

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Email *

yjl@econ.ku.dk

Your name and affiliation:

Young Jun Lee, University of Copenhagen

Your career stage (i.e. graduate student, postdoc, etc.):

Postdoc

The title of your proposed talk:

Multidimensional matching and labor market complementarity

The abstract of your proposed talk:

We propose an empirical framework for multidimensional matching in a frictionless labor market, where the employment level can be identified, and workers and firms are allowed to negotiate over other contractual terms than wages and who matches with whom. The behavior of workers and firms is described by a class of perturbed utility models in which alternatives may be complements or substitutes. We show that a unique equilibrium exists and how the equilibrium of the model is obtained. As a proof of concept, we estimate the model based on aggregated data for the Danish labor market and find that workers with different educational levels can be complements in production.

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Your name and affiliation:

Rodrigue LELOTTE (Université Paris-Dauphine PSL — CEREMADE)

Your career stage (i.e. graduate student, postdoc, etc.):

PhD student

The title of your proposed talk:

An external dual charge approach to the Optimal Transport with Coulomb cost

The abstract of your proposed talk:

We propose a novel approach to fashion physically relevant algorithms to solve the multimarginal optimal transport problem with Coulomb cost. It relies on the fact that a well-chosen Kantorovich potential can be rewritten as an electrostatic potential stemming from an external charge distribution. In turn, this so-called (external) dual charge is a rather amenable candidate for numerical discretization (over the support of the target density), as comes to light of our numerical investigations.

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Email *

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Your name and affiliation:

Haonan Zhang (IST Austria)

Your career stage (i.e. graduate student, postdoc, etc.):

postdoc

The title of your proposed talk:

Curvature-dimension conditions for symmetric quantum Markov semigroups

The abstract of your proposed talk:

The curvature-dimension condition consists of the lower Ricci curvature bound and upper dimension bound of the Riemannian manifold, which has a number of geometric consequences and is very helpful in proving many functional inequalities. The Bakry--Émery theory and Lott--Sturm--Villani theory allow to extend this notion beyond the Riemannian manifold setting and have seen great progress in the past decades. In this talk, I will first review several notions around lower Ricci curvature bounds in the noncommutative setting and present our work on gradient estimates. Then I will speak about two noncommutative versions of curvature-dimension conditions for symmetric quantum Markov semigroups over matrix algebras. Under suitable such curvature-dimension conditions, we prove a family of dimension-dependent functional inequalities, a version of the Bonnet--Myers theorem, and concavity of entropy power in the noncommutative setting. I will also give some examples satisfying certain curvature-dimension conditions, including Schur multipliers over matrix algebras, Herz-Schur multipliers over group algebras, and depolarizing semigroups. Our work also gives new proofs and new results in the discrete setting. This is based on joint work with Melchior Wirth (IST Austria).

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amiarghyarak@gmail.com

Your name and affiliation:

Arghya Rakshit, Department of Mathematics, UC Irvine

Your career stage (i.e. graduate student, postdoc, etc.):

2nd Year Graduate Student

The title of your proposed talk:

Singular structures in solutions to the Monge-Ampere equation with point masses

The abstract of your proposed talk:

Singular solutions to the Monge-Ampere equation feature prominently in problems arising in optimal transport of rough measures and differential geometry. Motivated by the optimal transport of point masses, we will discuss new examples of solutions to the Monge-Ampere equation that exhibit polyhedral singular structures. We will also explain why the singularities are stable under small perturbations of relevant data, and the connection between these examples and an obstacle problem for the Monge-Ampere equation.

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Email *

hui.huang1@ucalgary.ca

Your name and affiliation:

Hui Huang (University of Calgary)

Your career stage (i.e. graduate student, postdoc, etc.):

postdoc

The title of your proposed talk:

A Mean-Field Optimal Control Approach to the Training of NeurODEs

The abstract of your proposed talk:

In this talk we consider a measure-theoretical formulation of the training of NeurODEs in the form of a mean-field optimal control. We derive first order optimality conditions for the NeurODE training problem in the form of a mean-field maximum principle, and show that it admits a unique control solution. Some instructive numerical experiments will also be provided.

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Your name and affiliation:

Camilla Brizzi Università degli Studi di Firenze - Université Paris Dauphine-PSL

Your career stage (i.e. graduate student, postdoc, etc.):

Graduate student

The title of your proposed talk:

Entropic regularization of the Optimal Transport problem in Linfinity

The abstract of your proposed talk:

In contrast with the classical one, the Optimal Transport problem in Linfinity, i.e. the problem of minimizing the essential supremum of the cost function among all the transport plans, is a nonconvex and presumably much harder problem. Due to the success of entropic approximation of the Monge-Kantorovich problem and of Sinkhorn's algorithm, seeking an analogue for the infinity case seems natural in order to get a better understanding.
In my talk I will show the Gamma convergence of the regularized functionals to the one related to the transport problem in L infinity. An interesting result is that every cluster point of the minimizers is a so-called infinity-cyclically monotone transport plan which is for particular cost functions a solution of the Monge problem.

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Your name and affiliation:

Katharina Eichinger, CEREMADE, Université Paris-Dauphine PSL, Inria MOKAPLAN

Your career stage (i.e. graduate student, postdoc, etc.):

PhD student

The title of your proposed talk:

On Wasserstein barycenters and beyond

The abstract of your proposed talk:

In this talk I would like to present the general idea of interpolating between several measures in Wasserstein spaces with an emphasis on its probabilistic interpretation. The most natural case is to consider the L2 Wasserstein space where the definition of the Wasserstein barycenter coincides with the definition of the Frechet mean. While a law of large numbers in this case is well known, quantifying speeds of convergence of the empirical version towards the mean, in terms of a central limit theorem for example, is a more intricate issue which I would like to discuss. If time permits I will also talk about the impact of changing the cost function, notably the L1 case.

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Email *

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Your name and affiliation:

Daniel Toneian (University of Vienna)

Your career stage (i.e. graduate student, postdoc, etc.):

graduate student

The title of your proposed talk:

Bicausal Optimal Transport and the Knothe-Rosenblatt Coupling

The abstract of your proposed talk:

In this talk, we will discuss how optimal transport can be used to compare stochastic processes in discrete time. While it is possible to use classical optimal transport, it turns out that this approach is ill-suited to accommodate the temporal structure that is crucial for stochastic processes. Hence the appropriate way to adapt optimal transport is to restrict the set of couplings considered to the subset of so-called bicausal couplings, which respect the temporal structure.

For classical optimal transport on the real line, the monotone coupling stands out as particularly important and solves the optimal transport problem in many cases. There exists a natural counterpart to the monotone coupling for the setting of stochastic processes and bicausal couplings, namely the Knothe-Rosenblatt coupling. We will give conditions under which this coupling is optimal. When the necessary conditions are only approximately satisfied, this coupling is likewise approximately optimal, and quantifiably so.

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Email *

ks3zhang@uwaterloo.ca

Your name and affiliation:

Kelvin Shuangjian Zhang, University of Waterloo

Your career stage (i.e. graduate student, postdoc, etc.):

postdoc

The title of your proposed talk:

Strong duality of the principal-agent problem with bilinear preferences and its application to characterize the solutions

The abstract of your proposed talk:

The principal-agent problem is one of the central problems in microeconomics. Rochet and Choné (1998) reduced the multidimensional principal-agent problem with bilinear preferences to a concave maximization over the set of convex functions. We introduce a new duality and use it to characterize solutions to this problem. This is joint work with Robert J. McCann.

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kai-hsiangwang2025@u.northwestern.edu

Your name and affiliation:

Kai-Hsiang Wang, Northwestern University

Your career stage (i.e. graduate student, postdoc, etc.):

Graduate student

The title of your proposed talk:

Sobolev inequality on manifolds with nonnegative Ricci curvature

The abstract of your proposed talk:

Inspired by S.Brendle's work, I will use optimal transport to prove Sobolev inequality on manifolds with nonnegative Ricci curvature.

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PIMS- IFDS- NSF Summer School on Optimal Transport -- proposed participant talks

Email *

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Your name and affiliation:

Stephen Zhang, University of Melbourne

Your career stage (i.e. graduate student, postdoc, etc.):

Graduate Student

The title of your proposed talk:

Inferring cell-specific causal regulatory networks from a drift-diffusion perspective

The abstract of your proposed talk:

The gene expression dynamics of cells are fundamentally governed by networks of interacting genes, and inferring these interactions from data is a central problem in systems biology. Gene expression profiling at single-cell resolution is now routine, allowing for cell state heterogeneity to be studied at scale. In contrast, the vast majority of network inference methods work at the population level to construct a single static network, and thus do not allow for inference of networks that vary across a population of cells. Recent approaches to dynamical inference, including optimal transport, reconstruct a cellular drift-diffusion process in the form of a Markov process. Starting from this framework, we propose a method for inferring cell-specific, causal networks from single-cell data and show some preliminary results.

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Email *

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Your name and affiliation:

Becca Bonham-Carter, UBC

Your career stage (i.e. graduate student, postdoc, etc.):

graduate student

The title of your proposed talk:

Lineage-Informed Optimal Transport Couplings for Developmental Trajectory Inference

The abstract of your proposed talk:

A developmental trajectory is the path of a cell over time through gene expression space. Studying such trajectories sheds light on central questions in biology, such as how cells differentiate from one cell type (e.g. stem cell) to another (e.g. blood cell). Inferring the trajectory of a population of cells from measurements of gene expression at two or more time points may be formulated as an optimal transport problem. However, some trajectories may not be predictable from state information alone. Information about a cell's lineage can be used to improve trajectory estimates. In this talk I will describe my work on extending current methods for integrating lineage information into the OT framework.

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PIMS- IFDS- NSF Summer School on Optimal Transport -- proposed participant talks

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Your name and affiliation:

Dohyun Kwon, University of Wisconsin-Madison

Your career stage (i.e. graduate student, postdoc, etc.):

Postdoc

The title of your proposed talk:

Gradient flows of non-differentiable internal energy functionals

The abstract of your proposed talk:

In this talk, we discuss the gradient flow structure of non-differentiable internal energy functionals in the Wasserstein space. Using the pressure variable, we encode the transition between phases through the critical region where the associated internal energy functional is not differentiable. It allows us to study a class of degenerate parabolic equations and their singular limits. The connection with the congested crowd motion with density constraint will be provided. This is joint work with Alpár Richárd Mészáros (Durham University, UK).

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PIMS- IFDS- NSF Summer School on Optimal Transport -- proposed participant talks

Email *

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Your name and affiliation:

Benjamin Robinson, University of Vienna

Your career stage (i.e. graduate student, postdoc, etc.):

Postdoc

The title of your proposed talk:

Bicausal transport between laws of SDEs

The abstract of your proposed talk:

The problem of bicausal optimal transport between laws of stochastic processes is a variation of the classical optimal transport problem, where the couplings are constrained to respect the flow of information over time. We study bicausal transport between the laws of SDEs with Markovian coefficients in dimension one. Under strong regularity conditions, Bion-Nadal and Talay showed that an optimal coupling is induced by choosing a common driving Brownian motion for each SDE. We call this the synchronous coupling.

We present an extension of this result to a larger class of SDEs. In contrast to Bion-Nadal and Talay's PDE-based proof, our proof rests on known results for bicausal transport in discrete time. We discretise the SDEs in such a way that the kernels of the resulting discrete-time Markov processes are monotone. In this case, it is know that the Knothe-Rosenblatt coupling is the optimal bicausal coupling between the discrete-time processes. Passing to a limit, we find that the synchronous coupling is optimal between the laws of the continuous-time processes. In this way, one can view the synchronous coupling as a continuous-time limit of the Knothe-Rosenblatt coupling. This is joint work with Julio Backhoff Veraguas and Sigrid Källblad.

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PIMS- IFDS- NSF Summer School on Optimal Transport -- proposed participant talks

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Your name and affiliation:

Lorenz Riess, University of Vienna

Your career stage (i.e. graduate student, postdoc, etc.):

graduate student

The title of your proposed talk:

Clustering financial institutions based on Wasserstein distance

The abstract of your proposed talk:

Financial institutions submit data on their credit portfolios to regulators. An individual institution can be identified with a distribution that is representative of its respective credit portfolio. We are interested in finding representative clusters of financial institutions based on the notion of Wasserstein barycenter. A particular challenge arises from missing data since financial institutions are subject to different regulatory requirements. This leads us to establish a form of the k-means clustering algorithm in Wasserstein space which can deal with missing coordinates.

This is based on joint work with Julio Backhoff and Mathias Beiglböck.

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Your name and affiliation:

Sebastian Munoz, University of Chicago.

Your career stage (i.e. graduate student, postdoc, etc.):

Graduate student

The title of your proposed talk:

Classical solutions to first-order mean field games

The abstract of your proposed talk:

We present recent results on the existence of classical solutions to first-order mean field games systems with a local coupling. We mention some of the main methods, which include the reformulation of the problem as a single quasilinear elliptic equation.

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Your name and affiliation:

Juan Pablo Vigneaux, Caltech

Your career stage (i.e. graduate student, postdoc, etc.):

Postdoc

The title of your proposed talk:

Entropy and optimal transport on Lie groups

The abstract of your proposed talk:

Let us consider a locally compact topological group G, a closed subgroup H, and its coset space G/H.

In some situations, one can find Haar measures on these three spaces such that the Haar measure on the group disintegrates in terms of the Haar measures on the other two (Cf. Weil's formula). I have shown that in this case a probability measure p on G absolutely continuous with respect to its Haar measure also disintegrates, and one gets a chain rule relating the entropy of p, its marginal on G/H, and the measures on the fibers of the projection. This chain rule is new because the reference Haar measure is not a product measure (cf. https://arxiv.org/abs/2102.09584).

In the case of a semi-simple Lie group G, one can introduce a Riemannian structure on it using the Killing form on its Lie algebra (which by a theorem of Cartan is nondegenerate). The volume form associated with this metric defines a Haar measure. Moreover, the Killing form also determines a Casimir element in the universal enveloping algebra, which corresponds to the Laplace-Beltrami operator on G. Hence, we have a nice interplay between algebra, measure-theory, and Riemannian geometry, as well as the necessary ingredients to talk about optimal transport.

I'm currently studying the relationships between optimal transport on G, H, and G/H, expecting some counterparts to the entropic chain rule for groups. (Remark that the tensorization argument for product reference measures, together with the usual chain rule for entropy, is used to extend some transport-entropy inequalities e.g. from R to R^2, this is, from H and G/H to G in the notation used above.)

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Your name and affiliation:

University of Washington

Your career stage (i.e. graduate student, postdoc, etc.):

postdoc

The title of your proposed talk:

Flat minima generalize for low-rank matrix recovery

The abstract of your proposed talk:

Empirical evidence suggests that for a variety of overparameterized nonlinear models, most notably in neural network training, the growth of the loss around a minimizer strongly impacts its performance. Flat minima—those around which the loss grows slowly—appear to generalize well. This work takes a step towards understanding this phenomenon by focusing on the simplest class of overparameterized nonlinear models: those arising in low-rank matrix recovery. We analyze overparameterized matrix and bilinear sensing, robust PCA, covariance matrix estimation, and single hidden layer neural networks with quadratic activation functions. In all cases, we show that flat minima, measured by the trace of the Hessian, exactly recover the ground truth under standard statistical assumptions. For matrix completion, we establish weak recovery, although empirical evidence suggests exact recovery holds here as well. We complete the paper with synthetic experiments that illustrate our findings.

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Your name and affiliation:

Henri Schmidt, Institute for Applied Mathematics, University of Heidelberg, Germany

Your career stage (i.e. graduate student, postdoc, etc.):

undergraduate

The title of your proposed talk:

Using Lipschitz-constrained neural networks to estimate the Wasserstein distance of single cell transcriptomes

The abstract of your proposed talk:

TBA

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PIMS- IFDS- NSF Summer School on Optimal Transport -- proposed participant talks

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Matthew.Werenski@tufts.edu

Your name and affiliation:

Matthew Werenski, Tufts University

Your career stage (i.e. graduate student, postdoc, etc.):

PhD Candidate

The title of your proposed talk:

Estimation in the Barycentric Coding Model

The abstract of your proposed talk:

Suppose you have a distribution that is known to be a Wasserstein barycenter, but do not know its coordinate and can only access it through i.i.d. sampling. Is it possible to recover the coordinate in a statistically efficient way? We consider this regression problem and propose a method which utilizes the Riemannian geometry of Wasserstein-2 space and recent advances in the estimation of optimal transport maps to reduce the problem to a tractable optimization problem. Our algorithm relies only on solving standard quadratic programs and computing entropically regularized transport maps which makes it highly efficient. Furthermore, we prove a non-asymptotic convergence rate for the estimated coordinate to the true coordinate. We demonstrate our approach on several interesting datasets.

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Your name and affiliation:

Jorge A. Rivero, Economics at the UW

Your career stage (i.e. graduate student, postdoc, etc.):

4th year PhD

The title of your proposed talk:

Lorenz Curves for Multidimensional Inequality

The abstract of your proposed talk:

We propose a multivariate extension of the Lorenz curve based on multivariate rearrangements of optimal transport theory. We define a vector Lorenz map as the integral of the vector quantile map associated to a multivariate resource allocation. Each component of the Lorenz map is the cumulative share of each resource, as in the traditional univariate case. The pointwise ordering of such Lorenz maps defines a new multivariate majorization order. We define a multi-attribute Gini index and complete ordering based on the Lorenz map. We propose the level sets of an Inverse Lorenz Function as a practical tool to visualize and compare inequality in two dimensions, and apply it to income-wealth inequality in the United States between 1989 and 2019.

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Your name and affiliation:

Hanye Zhu, Brown University

Your career stage (i.e. graduate student, postdoc, etc.):

Graduate Student

The title of your proposed talk:

Potential estimates for elliptic/parabolic p-Laplace type equations with measure data

The abstract of your proposed talk:

We will discuss recent results on gradient estimates for solutions to singular quasilinear elliptic (or parabolic) equations with measure data, whose prototype is given by the elliptic (or parabolic) p-Laplace equation $-\Delta_p u=\mu$ (or $u_t-\Delta_p u=\mu$) with $p\in(1,2)$. For these singular nonlinear equations, we obtain pointwise gradient estimates via linear elliptic (or parabolic) Riesz potential and gradient continuity results via certain assumptions on the linear Riesz potential. This is based on joint works with Hongjie Dong.

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