BUDAPESTI CORVINUS EGYETEM
CORVINUS INSTITUTE FOR ADVANCED STUDIES

Activity summary of CIAS research fellow in Budapest

Grant category: ☐ junior ☒ senior

Name: Alexandru Kristály (non-resident senior research fellow)

Home institute (name, position, country): Babes-Bolyai University, Cluj-Napoca, Romania, Full Professor & Óbuda University, Budapest, Hungary, Full Professor.

Academic Year / Semester: 2022-2023 / First Semester

Duration: 5 months (1 September 2022- 31 January 2023)

Project title: Sharp geometric inequalities: an optimal transport approach

Project description*: The primordial purpose of the present project is to establish sharp geometric and functional inequalities by using the theory of optimal mass transportation on geometric objects modelled by spaces which are curved in the sense of Lott-Sturm-Villani (including Finsler/Riemannian manifolds with non-negative Ricci curvature). In such inequalities the presence of the so-called *asymptotic volume ratio* is expected, which provides a subtle geometric feature of the curvature at "infinity".

Achieved result(s)*:
During the last few months, a deep study has been elaborated, with the title "Sharp log-Sobolev inequalities in CD(0,N) spaces with applications", a joint work with Z. Balogh (Bern, Switzerland) and F. Tripaldi (Bern, Switzerland). More precisely, for given p,N>1, we prove the sharp L^p-log-Sobolev inequality on metric measure spaces satisfying the CD(0,N) condition in the sense of Lott-Sturm-Villani, where the optimal constant involves the asymptotic volume ratio of the space. Combining the sharp L^p-log-Sobolev inequality with the Hamilton-Jacobi inequality, we established a sharp hypercontractivity estimate for the Hopf-Lax semigroup in CD(0,N) spaces. Moreover, a Gaussian-type L^2-log-Sobolev inequality is also obtained in RCD(0,N) spaces. Our results are new, even in the smooth setting of Riemannian/Finsler manifolds.

Connected publications*
1.
Title: Sharp log-Sobolev inequalities in CD(0,N) spaces with applications
Date of submission/acceptance/publication: 3 November 2022

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Journal: Archive for Rational Mechanics and Analysis
Accessible at: https://arxiv.org/abs/2210.15774
Journal category (if applicable): ☒ Q1 ☐ Q2 ☐ Q3
Status: ☐ accepted/published ☒ in progress ☐planned

Professional collaborations, partnerships*
1.
Name: Zoltán M. Balogh
Institution: Mathematische Institute, Bern, Switzerland
Field of research: Mathematics (Geometric Measure Theory)
Future plans for joined research: collaboration, joint papers
2.
Name: Francesca Tripaldi
Institution: Mathematische Institute, Bern, Switzerland
Field of research: Mathematics (Measure Theory)
Future plans for joined research: collaboration
3.
Name: Tibor Illés
Institution: Corvinus Centre for Operations Research, Corvinus University of Budapest
Field of research: Optimization
Future plans for joined research: collaboration on optimization problems, proximal point algorithms
4.
Name: Miklós Pintér
Institution: Corvinus Centre for Operations Research, Corvinus University of Budapest
Field of research: Game Theory, Optimization
Future plans for joined research: collaboration on game theoretical aspects on curved spaces
5.
Name: Marianna Eisenberg-Nagy
Institution: Corvinus Centre for Operations Research, Corvinus University of Budapest
Field of research: Optimization
Future plans for joined research: collaboration on optimization problems
6.
Name: Petra Rigó
Institution: Corvinus Centre for Operations Research, Corvinus University of Budapest
Field of research: Optimization on manifolds
Future plans for joined research: collaboration on optimization
7.
Name: Miklós Pálfia
Institution: Corvinus University of Budapest
Field of research: Optimization on manifolds, optimal mass transport theory
Future plans for joined research: collaboration on optimal mass transport theory

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Additional activities* (public lectures, presentations, professional meetings, media connections etc.):

1. Public lecture (3 x 2 hours), Corvinus Institute for Advanced Studies, Corvinus University of Budapest, Budapest, Hungary, 7-8 September 2022. Title of the lecture: *Optimization phenomena on curved spaces.*
2. Workshop "Optimization on curved spaces", Corvinus University of Budapest, Corvinus Institute for Advanced Studies, 8 September 2022. Title of the talk: *Sharp geometric inequalities on non-euclidean settings: an optimal mass transport approach.*
3. Attending the workshop “Optimal Transport on Quantum Structures”, Rényi Institute, (Erdős Center), Budapest, 19-23 September 2022.
4. 6th CIAS International Workshop, Corvinus Institute for Advanced Studies, Corvinus University of Budapest, Budapest, Hungary, 25 October 2022. Title of the talk**:** *Sharp geometric and functional inequalities on curved structures.*

Future plans, planned return (if any):
☒ I plan to return to Hungary later
☒ I plan to maintain my professional contacts via e-mail
☐ Any other comment:

*Please give us a properly detailed summary.

Date: 29 November 2022

Signature: