BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. DO NOT EXCEED FIVE PAGES.

NAME: Peter, Ioan Radu

eRA COMMONS USER NAME (credential, e.g., agency login): RADUPETER

POSITION TITLE: Professor

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE (if applicable)	END DATE MM/YYYY	FIELD OF STUDY
Babes Bolyai University, Cluj-Napoca, Romania	BS	06/1993	Mathematics
University of Debrecen, Debrecen, Hungary	PhD	10/2003	Mathematics

A. Personal Statement

I am Professor of Mathematics at the Technical University of Cluj-Napoca, Romania, where I coordinate Data Science courses at the Faculty of Automation and Computer Science. My background in global differential geometry and geometric analysis provides a rigorous foundation for understanding data structures and algorithms at a conceptual level. This mathematical perspective supports a deep comprehension of algorithmic behavior, allowing me to design and fine-tune data-analysis pipelines that maximize the extraction of information hidden within complex datasets.

Since 2014, I have maintained a long-term collaboration with the Chiosis Lab at Memorial Sloan Kettering Cancer Center (MSKCC). Within this collaboration, I have designed and implemented proteomics data-analysis pipelines, starting from raw mass spectrometry data and extending through missing-value imputation, normalization, differential expression modeling, protein–protein interaction (PPI) integration, and pathway analysis. My role focused on the mathematical and statistical design of these pipelines, ensuring that each computational step aligns with the intrinsic structure of the data and preserves biological interpretability.

Beyond the analytical work, this collaboration has also involved extensive interdisciplinary dialogue. I have taken part in multiple discussions with MSKCC bioinformaticians, highlighting the mathematical motivations and conceptual consistency underlying our analytical approaches. These exchanges have strengthened my commitment to bridging mathematics and life sciences through both research and education.

Overall, my research combines mathematical depth, computational rigor, and biological insight, with the goal of developing robust, interpretable analytical frameworks for biomedical data. I believe that the integration of geometric reasoning with modern data science provides a sustainable foundation for advancing multi-omics research and translational bioinformatics.

1. Joshi S, Gomes E, Wang T, Corben A, Taldone T, Gandu S, Xu C, Sharma S, Buddaseth S, Yan P, Chan L, Gokce A, Rajasekhar V, Shrestha L, Panchal P, Almodovar J, Digwal C, Rodina A, Merugu S, Pillarsetty N, Miclea V, **Peter R**, Wang W, Ginsberg S, Tang L, Mattar M, de Stanchina E, Yu K, Lowery M, Grbovic-Huezo O, O'Reilly E, Janjigian Y, Healey J, Jarnagin W, Allen P, Sander C, Erdjument-Bromage H, Neubert T, Leach S, Chiosis G. Pharmacologically controlling protein-protein interactions through epichaperomes for therapeutic vulnerability in cancer. Communications Biology. Commun Biol. 2021 Nov 25;4(1):1333. doi: 10.1038/s42003-021-02842-3. PMID: 34824367; PMCID: PMC8617294.
2. Yan P, Wang T, Guzman ML, **Peter RI**, Chiosis G. Chaperome Networks - Redundancy and Implications for Cancer Treatment. Adv Exp Med Biol. 2020;1243:87-99. PubMed Central PMCID: PMC7279512.
3. Rodina A, Wang T, Yan P, Gomes E, Dunphy M, Pillarsetty N, Koren J, Gerecitano J, Taldone T, Zong H, Caldas-Lopes E, Alpaugh M, Corben A, Riolo M, Beattie B, Pressl C, **Peter R**, Xu C, Trondl R, Patel H, Shimizu F, Bolaender A, Yang C, Panchal P, Farooq M, Kishinevsky S, Modi S, Lin O, Chu F, Patil S, Erdjument-Bromage H, Zanzonico P, Hudis C, Studer L, Roboz G, Cesarman E, Cerchietti L, Levine

R, Melnick A, Larson S, Lewis J, Guzman M, Chiosis G. The epichaperome is an integrated chaperome network that facilitates tumour survival. Nature. 2016 Oct 20;538(7625):397-401. doi: 10.1038/nature19807. Epub 2016 Oct 5. PMID: 27706135; PMCID: PMC5283383.

4. Jhaveri K, Ochiana SO, Dunphy MP, Gerecitano JF, Corben AD, **Peter RI**, Janjigian YY, Gomes-DaGama EM, Koren J 3rd, Modi S, Chiosis G. Heat shock protein 90 inhibitors in the treatment of cancer: current status and future directions. Expert Opin Investig Drugs. 2014 May;23(5):611-28. PubMed Central PMCID: PMC4161020.

B. Positions, Scientific Appointments and Honors

Positions and Scientific Appointments

2018 - present	Professor, Technical University of Cluj Napoca, Department of Mathematics, Cluj-Napoca, Romania
2006 - 2018	Associate Professor, Technical University of Cluj Napoca, Department of Mathematics, Cluj-Napoca, Romania
2000 - 2006	Lecturer, Technical University of Cluj Napoca, Department of Mathematics, Cluj-Napoca, Romania
1996 - 2000	Assistant Professor, Technical University of Cluj Napoca, Department of Mathematics, Cluj-Napoca, Romania

Honors

2013 - 2014	Bilateral Romania Hungary Grant RO-HU 2013-2014 (local PI), Ministry of Education and Research, Romania
2013	DynAPSNeur, “Dynamics Analysis of Parallel Simulations of Biological Neural Microcircuits”, FP7 "Research Infrastructures" action , European Comission
2005	Matsumae International Foundation postdoctoral fellowship, Matsumae Intenational Foundation
2004	NATO postdoctoral fellowship, NATO
2003	Grant 100-565/2003, Romanian Ministry of Education and Research
2002	Grant 24-565/2002 , Romanian Ministry of Education and Research
1998	Fellowship of Romanian Ministry of Education and Research (fellowship at the University of Debrecen, Hungary), Romanian Ministry of Education and Research

C. Contribution to Science

1. Exploring Functional Inequalities in Geometric Structures. My work has made significant contributions to the field of mathematics, particularly in the realm of functional inequalities on Riemannian manifolds and Morse Theory for Finsler manifolds. In the context of functional inequalities, I have proven a generic functional inequality on Riemannian manifolds, both in additive and multiplicative forms, leading to the discovery of both well-known and genuinely new Hardy-type inequalities. By introducing Riccati pairs, I have provided concise proofs of various functional inequalities, including Caccioppoli inequalities, Hardy-type inequalities, spectral gap estimates, and others, on Riemannian manifolds with bounded sectional curvature. Additionally, I have established sharp uncertainty principles on Cartan-Hadamard manifolds and Hardy inequalities involving weight functions on complete Finsler manifolds. Furthermore, my research extends to Morse Theory for Finsler manifolds, where I have proven two cases of the Morse Index Theorem. In the first case, one of the endpoints of the geodesic is fixed, while the other is variable in a submanifold. The second theorem deals with the case of two variable endpoints in submanifolds of a Finsler manifold. Additionally, I have explored connectedness problems under various curvature hypotheses, including Ricci and flag curvature. This work contributes to a deeper understanding of geometric structures and inequalities across different manifold settings, emphasizing the complexities and differences between Finsler and Riemann settings.

a. Kajántó S, Kristály A, **Peter I**, Zhao W. A generic functional inequality and Riccati pairs: an alternative approach to Hardy-type inequalities. Mathematische Annalen. Math. Ann. (2024). https://doi.org/10.1007/s00208-024-02827-7

b. Mester Á, **Peter I**, Varga C. Sufficient Criteria for Obtaining Hardy Inequalities on Finsler Manifolds. Mediterr. J. Math. 18, 76 (2021). https://doi.org/10.1007/s00009-021-01725-5

c. **Peter I**. Some connectedness problems in positively curved Finsler manifolds. Journal of Geometry and Physics. 2009 January; 59(1):54-62. DOI: 10.1016/j.geomphys.2008.09.004

d. **Peter I.R**.. On the Morse Index Theorem where the ends are submanifolds in Finsler geometry. Houston Journal of Mathematics. 2006; 32(4):995-1009. eid: 2-s2.0-33846654734

2. **Optical Flow Computation and Image Enhancement**. I have contributed my knowledge in mathematics to research that led to significant advancements in the field of optical flow computation and image enhancement, particularly in challenging conditions such as foggy environments. One key aspect of precise optical flow computation is the use of the L1 norm for mathematical modeling, which has been proven to yield better results than the L2 norm for discrete signals. Additionally, combining local and global approaches can leverage the advantages of both methods. I have developed a combined local-global approach that utilizes the L1 norm for both data fidelity and regularization terms, resulting in robustness to noise and occlusions while preserving motion boundaries. Furthermore, I have investigated versions of the approach using only L1 or L2 norms for the regularization term, each offering distinct benefits in real-world scenarios. Importantly, all numerical schemes developed are highly parallelizable, optimized for execution on graphic processing units. In the realm of image enhancement, this work addresses the challenges posed by degraded contrast in foggy conditions. I have proposed an efficient single-image enhancement algorithm tailored for daytime fog conditions, utilizing an original mathematical model to compute the atmospheric veil. Inspired by functions found in partition of unity in differential geometry, this model accounts for variations in fog density with distance, capturing the nonlinear increase in density and its impact on visibility. Through the application of this mathematical model, my algorithm achieved superior reconstructions of fog-free images compared to traditional methods, with the added advantage of adaptability to varying fog densities. Comprehensive evaluations on synthetic and real camera images demonstrated the effectiveness of the model in restoring contrast in both homogeneous and heterogeneous fog conditions. Moreover, the algorithm achieved real-time contrast restoration for both color and grayscale images, enhancing its practical utility in various imaging applications.

a. Negru M, Nedevschi S, **Peter R**. Exponential Contrast Restoration in Fog Conditions for Driving Assistance. IEEE Transactions on Intelligent Transportation Systems. 2015; 16(4):2257-2268. DOI: 10.1109/TITS.2015.2405013

b. Negru M, Nedevschi S, **Peter R**. Exponential image enhancement in daytime fog conditions. 17th International IEEE Conference on Intelligent Transportation Systems (ITSC). 2014 IEEE 17th International Conference on Intelligent Transportation Systems (ITSC); ; Qingdao, China. IEEE; c2014. DOI: 10.1109/ITSC.2014.6957934

c. Drulea M, **Peter I**, Nedevschi S. Optical flow A combined local-global approach using L1 norm. Proceedings of the 2010 IEEE 6th International Conference on Intelligent Computer Communication and Processing. 2010 IEEE International Conference on Intelligent Computer Communication and Processing (ICCP); Cluj-Napoca, Romania. IEEE; c2010. DOI: 10.1109/ICCP.2010.5606437

3. Biomedical Metadata Analysis. My collaboration with the Chiosis lab and other collaborators has been instrumental in advancing cutting-edge biomedical research. Leveraging my background in mathematics, I have made significant contributions in optimizing algorithms for missing data imputation, conducting statistical analyses of metadata, and exploring topics within network biology. Recently, I had the opportunity to collaborate with the lab on developing an integrated bioinformatics pipeline tailored for in-depth analyses of epichaperomics datasets. Our primary goal is to bridge the gap between raw metadata generated by epichaperomics and accessible information for the broader biomedical community. This innovative approach streamlines data processing and visualization, empowering researchers within the scientific community to analyze complex datasets and formulate meaningful hypotheses. By simplifying the data interpretation process, this integrated pipeline aims to facilitate greater engagement and collaboration among researchers, ultimately driving advancements in understanding epichaperomics and its implications for biomedical research.

a. Yan P, Wang T, Guzman ML, **Peter RI**, Chiosis G. Chaperome Networks - Redundancy and Implications for Cancer Treatment. Adv Exp Med Biol. 2020;1243:87-99. PubMed Central PMCID: PMC7279512.
b. Rodina A, Wang T, Yan P, Gomes E, Dunphy M, Pillarsetty N, Koren J, Gerecitano J, Taldone T, Zong H, Caldas-Lopes E, Alpaugh M, Corben A, Riolo M, Beattie B, Pressl C, **Peter R**, Xu C, Trondl R, Patel H, Shimizu F, Bolaender A, Yang C, Panchal P, Farooq M, Kishinevsky S, Modi S, Lin O, Chu F, Patil S, Erdjument-Bromage H, Zanzonico P, Hudis C, Studer L, Roboz G, Cesarman E, Cerchietti L, Levine R, Melnick A, Larson S, Lewis J, Guzman M, Chiosis G. The epichaperome is an integrated chaperome network that facilitates tumour survival. Nature. 2016 Oct 20;538(7625):397-401. doi: 10.1038/nature19807. Epub 2016 Oct 5. PMID: 27706135; PMCID: PMC5283383.
c. Jhaveri K, Ochiana SO, Dunphy MP, Gerecitano JF, Corben AD, **Peter RI**, Janjigian YY, Gomes-DaGama EM, Koren J 3rd, Modi S, Chiosis G. Heat shock protein 90 inhibitors in the treatment of cancer: current status and future directions. Expert Opin Investig Drugs. 2014 May;23(5):611-28. PubMed Central PMCID: PMC4161020.
d. Joshi S, Gomes E, Wang T, Corben A, Taldone T, Gandu S, Xu C, Sharma S, Buddaseth S, Yan P, Chan L, Gokce A, Rajasekhar V, Shrestha L, Panchal P, Almodovar J, Digwal C, Rodina A, Merugu S, Pillarsetty N, Miclea V, **Peter R**, Wang W, Ginsberg S, Tang L, Mattar M, de Stanchina E, Yu K, Lowery M, Grbovic-Huezo O, O'Reilly E, Janjigian Y, Healey J, Jarnagin W, Allen P, Sander C, Erdjument-Bromage H, Neubert T, Leach S, Chiosis G. Pharmacologically controlling protein-protein interactions through epichaperomes for therapeutic vulnerability in cancer. Communications Biology. Commun Biol. 2021 Nov 25;4(1):1333. doi: 10.1038/s42003-021-02842-3. PMID: 34824367; PMCID: PMC8617294.

4. Warped and Twisted Product of Finsler Manifolds: My research contributed to the construction and investigation of geometric properties related to Cartan connection, geodesics, completeness, and curvatures in the warped and twisted product of Finsler manifolds. This work aimed to provide deeper insights into the structural properties of Finsler spaces and their applications in differential geometry. Specifically, we explored the mathematical structures arising from the warped and twisted product constructions, extending previous results and introducing novel techniques to analyze these spaces. Our research shed light on the geometric intricacies of Finsler manifolds and their implications for various geometric phenomena. This work was published in:

a. **Peter R**.. Coincidence of correspondences in Kähler-Finsler manifolds. Publicationes Mathematicae. 2002; 61(3-4):419-427. eid: 2-s2.0-0036455723
b. Kozma L, **Peter I**, Shimada H. On the twisted product of Finsler manifolds. Reports on Mathematical Physics. 2006; 57(3):375-383. DOI: 10.1016/S0034-4877(06)80028-5
c. WARPED PRODUCT OF FINSLER MANIFOLDS. Annales Universitatis Scientiarium Budapestinensis de Rolando Eötvös Nominatae Sectio Mathematica. 2001.
d. Marian, D., **Peter, I.R**., Pintea, C. Operations with monotone operators and the monotonicity of the resulting operators. Monatsh Math 181, 143–168 (2016). https://doi.org/10.1007/s00605-015-0820-x

5. Topology and Curvature in Finsler Geometry: Investigating the interplay between curvature and topology in both Riemannian and Finslerian geometry, I explored conditions on the Ricci scalar and the Ricci tensor that impact the topology of the base manifold, including limitations on injectivity radius and configurations of cut points. This research led to insights into the relationship between curvature and topology. In the Riemannian as well as in the Finslerian geometry, certain conditions on the Ricci scalar or the Ricci tensor provide obstructions on the topology of the base manifold and so on the configuration of cut points by limitations of the injectivity radius, see the Bonnet–Myers theorem and its variants and generalizations. In this paper, we show that conversely, prescribing the injectivity radius of a Finsler manifold, some limitations of the Ricci scalar are obtained. Some consequences of the condition that the Ricci tensor is h-parallel with respect to the Chern–Rund connection are found. In addition, some classes of examples are provided. My contributions were published in:

a. **Peter I**. A Bound of the Finslerian Ricci Scalar. Mediterranean Journal of Mathematics. 2018; 15(3): DOI: 10.1007/s00009-018-1180-2

b. Anastasiei M, **Peter I**. A compactness theorem in Finsler geometry. Publicationes Mathematicae Debrecen. 2014 January 01; 84(1-2):75-88. DOI: 10.5486/PMD.2014.5834

c. Kozma L., **Peter I.R**.. Weinstein's theorem for Finsler manifolds. Journal of Mathematics of Kyoto University. 2006; 46(2):377-382. issn: 0023608X

d. **Peter R**.. Coincidence of correspondences in Kähler-Finsler manifolds. Publicationes Mathematicae. 2002; 61(3-4):419-427. eid: 2-s2.0-0036455723