Alfréd Rényi Institute of Mathematics Budapest, Reáltanoda utca 13-15, 1053 diegogs (at) renyi (dot) hu https://dglez91.github.io/

Employment

11/2020 - Present	Research fellow, Alfréd Rényi Institute of Mathematics, Hungary
02/2024 - 05/2024	Professor , Budapest Semesters in Mathematics, Hungary

Education

10/2016 - 10/2020	Ph.D., Autonomous University of Madrid, Spain
	Thesis: Topics in additive combinatorics and higher order Fourier analysis
	Supervisor: Prof. Pablo Candela. Defended on $25/09/2020$.
	Final score: Outstanding (sobresaliente) cum laude.
09/2015 - 07/2016	M.A.St., in Pure Mathematics (Part III), Cambridge University, UK
	Final score: $73/100$, Merit
09/2009 - 06/2015	B.Sc. in Mathematics, Autonomous University of Madrid, Spain.
	Final score: $9.41/10$ outstanding (sobresaliente)
	B.Sc. in Computer Science, Autonomous University of Madrid, Spain.
	Final score: 9.41/10 outstanding (sobresaliente)

Visiting periods (at least one month)

05/2019 – 08/2019 | Visiting researcher, Alfred Renyi Institute of Mathematics, Hungary 09/2013 – 07/2014 | Erasmus student, Technical University of Denmark, Denmark

Papers published or accepted for publication

- [1] On \mathbb{F}_2^{ω} -affine-exchangeable probability measures, (with P. Candela and B. Szegedy). Studia Mathematica, (2024), 79 (1). Open access: arXiv:2203.08915.
- [2] On measure-preserving \mathbb{F}_p^{ω} systems of order k, (with P. Candela and B. Szegedy). Accepted for publication at Journal d'Analyse Mathématique. Open access: arXiv:2311.13899.
- [3] On higher-order Fourier analysis in characteristic p, (with P. Candela and B. Szegedy). Ergodic Theory and Dynamical Systems, 1-70, (2022). Open access: arXiv:2109.15281.
- [4] A refinement of Cauchy-Schwarz complexity, (with P. Candela and B. Szegedy). European Journal of Combinatorics 106, 103592 (2022). Open access: arXiv:2109.05965.
- [5] New estimates for exponential sums over multiplicative subgroups and intervals in prime fields, (with D. Di Benedetto, M. Z. Garaev, V. C. Garcia, I. E. Shparlinski, and C. A. Trujillo). Journal of Number Theory 215, 261-274 (2020). Open access: arXiv:2003.06165.
- [6] On sets with small sumset and m-sum-free sets in Z/pZ, (with P. Candela and D. J. Grynkiewicz. Bulletin de la Société Mathématique de France 149 (1), 155-177 (2020).
 Open access: arXiv:1909.07967.
- [7] A note on the Bilinear Bogolyubov Theorem: Transverse and bilinear sets. With P.-Y.
 Bienvenu and A. D. Martínez. Proceedings of the American Mathematical Society 148 (1), 23-31 (2020). Open access: arXiv:1811.09853.

- [8] On nilspace systems and their morphisms., (with P. Candela and B. Szegedy). Ergodic Theory and Dynamical Systems, Volume 40, Issue 11, (2020), pp. 3015 – 3029. Open access: arXiv:1807.11510.
- [9] A Plünnecke-Ruzsa inequality in compact abelian groups., (with P. Candela and A. de Roton). Revista Matemática Iberoamericana 35 (7), 2169-2186 (2019). Open access: arXiv:1712.07615.

Conference papers

- [10] A short proof of an inverse theorem in bounded torsion groups, (with P. Candela and B. Szegedy). Discrete Mathematics Days, Alcalá de Henares, July 3-5, (2024). Open access: arXiv:2311.13899.
- [11] Optimal transport with f-divergence regularization and generalized Sinkhorn algorithm, (with D. Terjék). International Conference on Artificial Intelligence and Statistics, 5135-5165 (2022). Open access: arXiv:2105.14337.
- [12] A Refinement of Cauchy-Schwarz Complexity, with Applications, (with P. Candela and B. Szegedy). Extended Abstracts EuroComb 2021, 293-298 (2021). Open access: arXiv:2109.05965.
- [13] A step towards the 3k 4 conjecture in Z/pZ and an application to m-sum-free sets, (with P. Candela and D. J. Grynkiewicz). Acta Mathematica Universitatis Comenianae, Volume 88, (2019), Issue 3, pp. 521-525 (2019). Open access: arXiv:1909.07967.

Preprints

- [14] *MLPs at the EOC: Concentration of the NTK*, (with D. Terjék). Open access: arXiv:2501.14724.
- [15] *MLPs at the EOC: Spectrum of the NTK*, (with D. Terjék). Open access: arXiv:2501.13225.
- [16] Spectral algorithms in higher-order Fourier analysis, (with P. Candela and B. Szegedy). Open access: arXiv:2501.12287.
- [17] On the inverse theorem for Gowers norms in abelian groups of bounded torsion, (with P. Candela and B. Szegedy). Open access: arXiv:2311.13899.
- [18] *Free nilspaces, double-coset nilspaces, and Gowers norms*, (with P. Candela and B. Szegedy). Open access: arXiv:2305.11233.
- [19] *A framework for overparameterized learning*, (with D. Terjék). Open access: arXiv:2205.13507.

Contributed talks at conferences and workshops

- 07/2024 | A short proof of an inverse theorem in bounded torsion groups at Discrete Mathematics Days 2024, Alcalá de Henares, Spain.
- $\begin{array}{c|c} 11/2023 & On \ measure-preserving \ \mathbb{F}_p^{\omega} \ systems \ of \ order \ k \ at \ the \ 11th \ workshop \ Operator \ Theoretic \ Aspects \ of \ Ergodic \ Theory, \ Wuppertal, \ Germany. \end{array}$
- 06/2023 Free nilspaces, double-coset nilspaces, and Gowers norms at Nilpotent structures in topological dynamics, ergodic theory and combinatorics, Będlewo Conference Center, Poland.
- 05/2022 On affine-exchangeable measures and nilspaces at the workshop Graphs, Groups, Stochastic Processes, Alfréd Rényi Institute of Mathematics, Budapest, Hungary.

- 09/2021 A Refinement of Cauchy-Schwarz Complexity, with Applications, at EuroComb 2021, online (Barcelona, Spain).
- 12/2017 La desigualdad de Plünnecke-Ruzsa en grupos abelianos compactos at the LXVI Reunión de Comunicaciones Científicas of RSME and UMA, Buenos Aires, Argentina.

Invited talks at seminars

11/2024An algorithm for higher-order Fourier analysis at Séminaire de Théorie des Nombres de Nancy-Metz, Institut Élie Cartan de Lorraine, France. 06/2024On measure-preserving \mathbb{F}_p^{ω} -systems of order k. at DAGGER seminar, University of Warwick, UK. 09/2022The Polyak-Lojasiewicz condition and overparameterized learning (with D. Terjék) at Euler Seminar, Université catholique de Louvain, Louvain, Belgium. 03/2019Conjuntos grandes que se parecen a progresiones en grupos cíclicos de orden primo (Large sets that resemble arithmetic progressions in cyclic groups of prime order), at Junior Seminar, Autonomous University of Madrid, Spain. 06/2018A Plünnecke-Ruzsa inequality in compact abelian groups at UAM-ICMAT number theory seminar, ICMAT, Madrid, Spain. 03/2017El método polinomial en combinatoria aditiva (the polynomial method in additive combinatorics) at the Junior Seminar, Autonomous University of Madrid, Spain.

Other events attended

07/2023	200 Years of Trinity Combinatorics, Cambridge, UK.
06/2022	Graphs, Groups, Stochastic processes summer school, Budapest, Hungary.
08/2019	Number theory in the Americas. Casa Matemática Oaxaca, Oaxaca, Mexico.
09/2018	Arithmetic Ramsey Theory, University of Manchester, Manchester, UK.
09/2017	The music of Numbers. Conference in honor of Javier Cilleruelo. ICMAT, Madrid,
	Spain.
05/2017	Graduate course on Interactions of harmonic analysis, combinatorics and number theory.
	BGSMath, Barcelona, Spain.

Events organized

06/2025 (Expected) New Trends in Arithmetic Combinatorics and related Fields, a BIRS-IMAG workshop. Coorganized with: P. Candela (lead organizer), A. de Roton, H. Helfgott, A. Sedunova, and O. Serra. Check our website: https://birs-imag-ntac.github.io/.

Projects in which I have participated and role

03/2022 - 12/2025 Artificial Intelligence National Laboratory (MILAB, RRF-2.3.1-21-2022-00004), NK-FIH, Hungary. It partially funds the Research Fellow position at Alfréd Rényi institute of Mathematics. I work in the mathematical foundations of AI. Harmonic analysis, combinatorics and arithmetic (PID2020-113350GB-I00) funded by MICINN, Spain. I am part of the working team.

11/2020 - 11/2022	Momentum (Lendület) 30003, NKFIH, Hungary. It partially funds the Research Fellow
	position at Alfréd Rényi institute of Mathematics. I work in HOF and in the mathe-
	matical foundations of AI.
11/2020 - 03/2025	<i>"Élvonal" KKP 133921 grant</i> , NKFIH, Hungary. It partially funds the Research Fellow
	position at Alfréd Rényi institute of Mathematics. I work in HOF and deep learning in
	this project.
01/2018 - 12/2020	Arithmetic and harmonic analysis, (MTM2017-83496-P) MINECO, Spain. I am part
	of the working team.

Research Fellowships/Prizes/Grants

15/07/2021	Extraordinary award to the best theses presented at the Autonomous University of Madrid in the period $01/10/2019$ to $30/09/2020$. Awarded by the Autonomous University of Madrid.
10/02/2017	La Caixa Severo Ochoa scholarship awarded by Fundación la Caixa (private company). Ph.D.'s funding. It included a monthly stipend, an amount for travels and other expenses, and all labour/tax costs.
27/06/2015	X Mutua Madrileña Posgraduate Scholarship awarded by Fundación Mutua Madrileña (private company). M.A.St.'s funding.
18/06/2014	JAE-intro scholarship for introduction to research awarded by CSIC, Ministry of Econ- omy and Competitivity, Spain.
03/12/2012	Madrid Excellence Scholarship awarded by the Autonomous Community of Madrid, Spain.
14/09/2011	Madrid Excellence Scholarship awarded by the Autonomous Community of Madrid, Spain.
26/01/2010	Madrid Excellence Scholarship awarded by the Autonomous Community of Madrid, Spain.

Accreditations

Graduate teaching

08/2021 | Instructor at AGRA IV (Arithmetic, Groups and Analysis), online (Trieste, Italy).

Undergraduate teaching

02/2024 - 05/2024	Professor (jointly with P. Zsámboki) of Introduction to Deep Learning at the Budapest
	Semesters in Mathematics (BSM), Spring Semester 2024 (28 hours taught). Note: This
	was the first time this course was taught at BSM. Thus, Zsámboki and I had to prepare
	it from scratch.
09/2019 - 11/2019	Assistant professor of $Mathematics I$ for the B.Sc. in Chemical engineering at the
	Autonomous University of Madrid (6 hours taught).
09/2018 - 01/2019	Assistant professor of <i>Mathematics</i> for the B.Sc. in Environmental Sciences at the Autonomous University of Madrid (15 hours taught).

09/2017 - 01/2018 Assistant professor of Algebra I for the B.Sc. in Physics at the Autonomous University of Madrid (15 hours taught).

Service

Referee for	TEMat, Analysis and PDE, AISTATS 2022, AISTATS 2024 and The Ramanujan Jour-
	nal.
Reviewer for	Zentralblatt MATH (zbMath).

Other outreach activities

22/04/2024 Recent trends III: Subsets of the integers without three term arithmetic progressions, an outreach article for the Discrete and Algorithmic Mathematics (DAM) network. Available at: https://dam-network.github.io/.

Languages

Human:	Spanish (mother tongue)
	English (fluent, used in professional contexts)
	French (basic).
Programming:	Python (including Pytorch), C, Java, SQL, Matlab, and R.