Borjan Geshkovski

Contact Information

Chair of Computational Mathematics
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Personal Information

Born 9th of August, 1994 (26 years old).
Citizenship: Macedonian.

Expertise

Machine learning and data science (deep neural networks, generative modeling), applied mathematics (control theory, partial differential equations)

Education

PhD, Applied Mathematics
Universidad Autónoma de Madrid — july 2018 - may 2021

Title: *"Control in moving interfaces and deep learning"*

Advisor: Enrique Zuazua.

MSc, Applied Mathematics
Université de Bordeaux — 2018

Summa Cum Laude (Mention "Très Bien"), Ranked 1st.

BSc, Applied Mathematics and Computer Science
Université de Bordeaux — 2016

Cum Laude (Mention "Assez Bien")
Minor in Cognitive Science.

Professional Experience

Early Stage Researcher — july 2018 - july 2021
Universidad Autónoma de Madrid

I am an Early Stage Researcher part of the Marie Sklodowska-Curie H2020 project "Control of flexible structures and fluid-structure interaction – ConFlex". I am also affiliated with the Chair of Computational Mathematics in Fundación Deusto, Bilbao.

Internship — february - april 2018
DeustoTech, Universidad de Deusto, Bilbao (Spain).

Research internship in optimal control and numerics of PDEs, more specifically on parabolic variational inequalities, optimal control of obstacles and finite element discretizations (blog, report).
Supervisor: *Enrique Zuazua.*

Internship — may - august 2017
Institut de Mathématiques de Bordeaux / CNRS (France).

Research internship in analysis and partial differential equations, strongly continuous and analytic operator semigroups, and their application to control theory. I participated in the organization of the international workshop *Control of Distributed Parameter Systems 2017.*
Supervisor: *Marius Tucsnak.*

Internship — may - july 2015
INRIA / Université de Bordeaux (France).

Research internship in signal processing. Working in a team of two, we improved an existing software

and developed a new graphical user interface for the analysis of EEG signals. Programming was done in `Matlab`. (link, report)
Supervisor: *Pierrick Legrand*.

Honors and Awards

- **Best Presentation Prize** `february 2019`
  I was awarded the "Best Presentation Prize" (500€) as the best among 15 presenters during the 2nd. workshop of the ConFlex consortium.
  I finished in second place for the same award during the 3rd. workshop of the ConFlex consortium.
- **Marie Sklodowska-Curie Fellowship** `july 2018 - july 2021`
  My PhD was financed by the Marie Sklodowska-Curie H2020 grant Control of flexible structures and fluid-structure interaction - ConFlex.
- **Bourse du gouvernement français** `september 2016 - may 2017`
  A scholarship awarded on merit by the French government to top foreign MSc students in France.

Publications

† denotes first author, * denotes equal main contributors (authors listed in alphabetical order).

1. Sparse approximation in learning via neural ODEs. Esteve C.*, Geshkovski B.*. *In review in* `SIAM Journal on Mathematics of Data Science` (2021).
   Preprint.
2. Large-time asymptotics in deep learning. Esteve C.*, Geshkovski B.*, Pighin D., Zuazua E. *In review in* `Journal of Machine Learning Research` (2021)
   Preprint.
3. Controllability of one-dimensional viscous free boundary flows. B. Geshkovski†, E. Zuazua. *To appear in* `SIAM Journal on Control and Optimization` (2021).
   Preprint.
4. Turnpike in Lipschitz-nonlinear optimal control Esteve C.*, Geshkovski G.*, Pighin D.*, Zuazua E. *In review in* `Nonlinearity` (2020).
   Preprint.
5. Null-controllability of perturbed porous medium gas flow. B. Geshkovski†, `ESAIM Control, Optimisation and Calculus of Variatons, vol. 26, No. 85` (2020).
   Published, Preprint.

Computer Skills

- Proficient in `Python`: machine learning and neural networks (code in `PyTorch, scikit-learn`), object oriented programming, simulation of PDEs (code in `FEniCS`).
- Proficient in `Matlab`: simulation PDEs, digital image processing (wavelet transformations).
- Proficient in markup languages (`HTML`, LaTeX).
- Operating Systems: Proficient in Mac OS, Linux. Familiar with Windows.

Languages

English (fluent), French (fluent), Spanish (beginner), Slavic languages (basic), Macedonian (native).

Invited Talks at Conferences

- "The interplay of deep learning and control theory", SIAM Conference on Control and its Applications , Spokane WA, USA (virtual, july 19-21, 2021).
- "Turnpike control and deep learning", 2nd. Symposium on Machine Learning and Dynamical Systems at Fields Institute, Toronto, Canada (virtual, 24.08.2020). YouTube video.
- "Control in interfaces and deep learning", 3rd. workshop of the ConFlex consortium, Imperial College London, UK (virtual, 30.06.2020).
- "Control of perturbed porous medium gas flow", 8th Workshop on PDE, Optimal Design and Numerics, Centro de Ciencias "Pedro Pascual" Benasque, Spain (23.08.2019)
- "Control of linearized porous medium gas flow", Workshop on homogenization, spectral theory and other topics in PDEs, ICMAT Madrid, Spain (06.05.2019).

- "Control of free boundary problems", 2nd. workshop of the ConFlex consortium, Bilbao, Spain (20.02.2019).
  I was awarded the Best review and presentation prize.

Invited Talks at Seminars

- "The interplay of deep learning and control theory", Machine Learning in Madrid, CSIC Madrid Spain (virtual, 22.02.2021). Video.
- "The interplay of deep learning and control theory", AG Mathematics of Deep Learning, FAU Erlangen-Nürnberg, Germany (virtual, 09.12.2020). Video.
- "Large-time asymptotics in deep learning", Seminario de Estadísticas, UAM, Spain (virtual 23.10.2020).
- "Mathematical control and deep learning", CAA Seminar, Friedrich Alexander Universität Erlangen-Nürnberg, Germany (21.01.2020).
- "Control and free boundaries", Chair in Applied Mathematics 2 Seminar, Friedrich Alexander Universität Erlangen-Nürnberg, Germany (20.01.2019).

Research Visits

- Chair in Applied Analysis, Friedrich Alexander Universität Erlangen-Nürnberg (Germany), january 2020 – february 2020 (1 month). Invited by M. Gugat.
- Chair in Applied Mathematics 2, Friedrich Alexander Universität Erlangen-Nürnberg (Germany) november 2018 – january 2019 (2 months). Invited by G. Leugering.

Teaching Experience

Peer tutoring `october 2015 - may 2016`
Université de Bordeaux.

I tutored a group of first year undergraduate students in mathematics and computer science.

References

Enrique Zuazua
Alexander von Humboldt
Professor
FAU Erlangen-Nürnberg
enrique.zuazua@fau.de

Marius Tucsnak
Professor of Mathematics
Université de Bordeaux
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Antonio Cuevas
Catedrático de Matemáticas
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