

Research Agenda

I aim to reformulate basic concepts in machine learning to radically increase its generalizability. To accomplish this, I leverage techniques from meta-learning, learning to search, program synthesis, and insights from mathematics and the physical sciences. I establish collaborations to work across the entire theory-application spectrum.

Education

- 2018-present **MIT - CSAIL**, *PhD candidate on Computer Science*, Cambridge, US.
Advisors: Leslie P. Kaelbling, Tomás Lozano-Pérez and Joshua B. Tenenbaum.
Thesis title: learning to encode and discover structure
MIT Outstanding Direct Mentor Award
- 2016-2018 **MIT - CSAIL**, *MSc on Computer Science*, GPA: 5.0, Cambridge, US.
- 2015-2016 **MIT - MechE**, *Visiting student*, Cambridge, US.
Advisor: Alberto Rodriguez. Planning and Machine Learning for robotic manipulation.
- 2011-2016 **UPC - CFIS**, *2 Degrees: Mathematics & Engineering Physics*, Barcelona, Spain.
Valedictorian of 2-degree program promotion, first of starting promotion in Math degree.

Selected research works

- NeurIPS '21 **Alet** et al., Tailoring: encoding inductive biases by optimizing unsupervised objectives at prediction time.
Also presented as a **Spotlight** at the Physical Inductive Biases workshop.
- ICLR '20 **Alet***, Schneider* et al., Meta-learning curiosity algorithms.
- ICML '19 **Alet** et al., Graph Element Networks: adaptive, structured computation and memory.
Oral (4.5% of all submissions.)
- CoRL '18 **Alet** et al., Modular meta-learning.

Selected CS awards

- 2016,2017 Amazon Robotics Challenge (ARC) 1st ('17) and 3rd ('16) in stowing
Designed and built high level planner of team MIT-Princeton.
- 2011-2015 SWERC-ACM (programming contest) Silver(6th), Gold(2nd), Gold(3rd), Gold(1st), Gold(1st)
Most decorated participant in regional's history(France, Italy, Israel, Portugal, Spain & Switzerland)
- 2011 IOI - International Olympiad in Informatics Bronze Medal

Mentoring and Teaching

- 2021 **Outstanding Direct Mentor Award**.
Given to 2 PhDs across all of MIT

2018-now **Mentor**, 6 grads and 11 undergrads.

I list a student as a mentee if we had one or more weekly 1-on-1 meetings for at least a semester.
3 have applied to grad school so far; attending MIT, Stanford & CMU.

Mentored Masters Thesis:

Shreyas Kapur: Simulator-based modular few-shot inference and action [with Josh Tenenbaum]

Dylan Doblar: Meta-learning and Enforcing Useful Conservation Laws in Sequential Prediction Problems

Martin Schneider: Program synthesis approaches to improving generalization in RL

Erica Weng: Modular graph-structured models for prediction and control

Paolo Gentili: Active learning using meta-learned priors

Other mentoring:

Jan Olivetti: Planning in belief space with meta-learned priors for molecule prediction

Javier Lopez-Contreras: program synthesis & learning theory

Adarsh K. Jeewajee: Graph element networks for neural scene representation

Max Thomsen: GNNs for robotic gripper design [with Maria Bauza]

Catherine Wu: Energy-based models for trajectory prediction [with Yilun Du]

Nurullah Giray Kuru: Tailoring for model-based RL

Margaret Wu: Unsupervised approaches to program synthesis

Edgar Moreno: Library-learning for program synthesis

Shengtong Zhang: Tailoring and adversarial examples

Patrick John Chia: Compositional neural scene representation learning

Scott Perry: Energy-based models

Catherine Zeng: Modular meta-learning for reinforcement learning

2020 **Guest lecture**, *UPC*, Meta-learning class.

2019 **Teacher Assistant**, *Introduction to Machine Learning*.

Primary mentor of non-CS PhDs applying ML to Science. Assisting in lab sessions & OHs.

Most Important Fellowships and Grants

2020 **Grant for Modular Meta-learning**, GoodAI.

I was offered funding from the company to expand my work on modular meta-learning.

2016-2018 **Merit Graduate Scholarship**, 'La Caixa' foundation.

Most prestigious graduate scholarship in Spain, providing full funding for two years.

2011-2016 **Merit Undergrad Program & Scholarship**, CFIS.

Only 40 students around Spain enter this merit program that allows you to complete two degrees.
Within them, I was one of only 4 to have full funding for both degrees.

Work Experience

Summer 2017 **Google Research**, *Internship*, Zurich, Switzerland.

Designed & built 1st Unsupervised Learning prototype to create Youtube ads from raw videos.

Summer 2015 **Google Research**, *Internship*, Zurich, Switzerland.

Machine Learning research to improve Google's handwriting recognizer using LSTMs.

Service

- 2021-now **Spanish Girls Olympiad in Informatics.**
Designing problems for the competition to get high-school girls interested in math CS.
- 2020-now **MIT-GAAP**, Mentoring underrepresented minorities that apply to grad school.
- 2020 **Harvard Science in the News**, Public lecture, introduction to ML and Robotics.
- 2019-now **1st organizer of the MIT Embodied Intelligence Seminar.**
Created the seminar for the group of 18 CV, NLP, and robotics labs at MIT CSAIL.
Responsible for deciding and inviting speakers, logistics, and hosting the talks.
- 2018-2021 **Interviewer of faculty applicants, MIT CSAIL.**
- 2019 **Reviewer of graduate student applications, MIT CSAIL.**
- 2018-now **MIT Embodied Intelligence Graduate Student Committee.**
- 2016-now **Reviewer**, Reviewed for CoRL, CVPR, ICML, ICLR, ICRA, IJCAI and NeurIPS.
- 2011-2016 **Class representative.**

Research

Invited talks

- CMU SciML Learning to encode and discover physics-based inductive biases, January 2022.
- Caltech Learning to encode and discover physics-based inductive biases, January 2022.
- DLBCN w. Learning to encode and discover inductive biases, December 2021.
- UPC Meta-learning: learning to leverage data at different time-scales, November 2020.
- AI@MIT Tailoring: encoding inductive biases by optimizing objectives at prediction time, Nov. 2020.
- MLMA w. Building up knowledge through modularity, June 2020.
- ICML GNN w.** Growing from simple tasks to complex problems with GNNs, June 2020.
- INRIA Meta-learning curiosity algorithms, April 2020.
- MIT ML Tea Meta-learning and combinatorial generalization, November 2019.
- UC Berkeley Meta-learning structure, October 2019.
- KR2ML w. Graph Element Networks, September 2019.

Conference papers

Each paper has a link to the respective PDF. Stars denote equal contribution.

- In prep. '22 **F. Alet** et al. "Functional Risk Minimization: learning in the over-parameterized regime"
- In prep. '22 S. Kapur, **F. Alet**, J. Tenenbaum "Human-level human-efficiency reinforcement learning with modular policies"
- In prep. '22 **F. Alet***, J. Olivetti* et al. "Transposed meta-learning for experiment design in molecular property prediction"
- NeurIPS '21 **F. Alet***, D. Doblal*, A. Zhou, J. Tenenbaum, K. Kawaguchi, C. Finn. "Noether networks: meta-learning useful conserved quantities"

- NeurIPS '21 **F. Alet**, M. Bauza, K. Kawaguchi, N. Kuru, T. Lozano-Perez, L. Kaelbling. "Tailoring: Encoding Inductive Biases by Optimizing Unsupervised Objectives at Prediction Time", Also presented as a **Spotlight** at the NeurIPS '20 Physical Inductive Biases workshop
- ICML '21 **F. Alet***, J. Lopez-Contreras*, J. Koppel, M. Nye, A. Solar-Lezama, T. Lozano-Pérez, L. Kaelbling, J. Tenenbaum. "A large-scale benchmark for few-shot program induction and synthesis", **Spotlight**
- ICLR '20 **F. Alet***, M. Schneider*, T. Lozano-Pérez, L. Kaelbling. "Meta-learning curiosity algorithms"
- NeurIPS '19 **F. Alet**, E. Weng, T. Lozano-Pérez, L. Kaelbling. "Neural Relational Inference with fast Modular Meta-learning"
- ICML '19 **F. Alet**, A. Jeewajee, M. Bauza, A. Rodriguez, T. Lozano-Pérez, L. Kaelbling. "Graph Element Networks: adaptive, structured computation and memory", **Oral**
- IROS '19 M. Bauza, **F. Alet**, Y. Lin, T. Lozano-Pérez, L. Kaelbling, P. Isola, A. Rodriguez. "Omnipush: accurate, diverse, real-world dataset of pushing dynamics with RGB-D video"
- CoRL '18 **F. Alet**, T. Lozano-Pérez, L. Kaelbling. "Modular meta-learning"
- IJCAI '18 **F. Alet**, R. Chitnis, L. Kaelbling, T. Lozano-Pérez. "Finding Frequent Entities in Continuous Data"
- ICRA '18 A. Zeng, S. Song, K. Yu, E. Donlon, F. Hogan, M. Bauza, D. Ma, O. Taylor, M. Liu, E. Romo, N. Fazeli, **F. Alet**, N. Dafle, R. Holladay, I. Morona, P. Nair, D. Green, I. Taylor, W. Liu, T. Funkhouser, A. Rodriguez. "Robotic pick-and-Place of novel objects in clutter with multi-affordance grasping and cross-domain image matching", **Amazon Robotics Best System Paper Award**

Extended list of awards

Context: Catalonia (population of 7.5M) is a State in Spain(47M); similar size as Massachusetts.

Other scholarships

- 2010 **Ross Mathematics Program**, Ohio State University.
Often considered the best math program for precollege students.
As one of its top students, I was awarded a full scholarship for coming back the following year.
- 2009-2011 **Youth and Science Program**, Catalunya Caixa.
3 year scholarship for introducing 50 young scientists to research(< 10% acceptance).

Other CS awards

- 2015,2016 ACM ICPC *26th, 51th out of ~13.000 competing teams*
- 2008-2011 Spanish Olympiad in Informatics *Silver, Silver, Gold (1st place), Gold*
- 2008 Iberoamerican Olympiad in Informatics *Silver (only participation)*

Awards in Math and Physics

- 2011 1st UPF Engineering and Applied Mathematics Prize and
1st UPC Poincaré Prize *research thesis: "Generating Functions and Searching Automata"*

2010,2011	Spanish Math Olympiad	<i>Silver Medal, Silver Medal</i>
2010,2011	Catalan Math Olympiad	<i>Silver Medal, Gold Medal</i>
2009-2011	Kangourou des Mathematiques	<i>Prize A, Mention, Prize B</i>
2011	Spanish Physics Olympiad	<i>Bronze Medal</i>
2011	Catalan Physics Olympiad	<i>Gold Medal (1st place)</i>
<i>General Awards</i>		
2011	Selectivitat Prize	<i>6th out of > 25.000 students in the examination for entering college</i>
2011	EnginyCat Prize	<i>given by the government to promising young scientists</i>
2011	Extraordinary High School Prize	<i>given to less than 1 in every 2.000 students</i>

Languages

English	High Level	<i>TOEFL iBT: 115/120(2015). Living in the US since 2015.</i>
French	High Level	<i>Studied from age 5 to 17; DALF(CEFR Level C1,2011)</i>
Spanish	Mother Tongue	
Catalan	Mother Tongue	

References

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