Hugo Monzon

Website | 0000-0002-8655-9352 | Google Scholar | hugo91@gmail.com | 070-2626-1265

Summary

I am a former MEXT student (2015-2017), did my PhD and Masters at Shinshu University, Nagano, Japan (2015-2021) under supervision of Prof. D Eng. Hernán Aguirre, while collaborating with researchers at Univ. Lille. Currently I am a postdoc at RIKEN AIP under the supervision of D Eng. Emtiyaz Khan. My interest is to combine multi-objective optimization and probabilistic machine learning to train large models that are accurate, robust, explainable and fair. To this goal, a multi-objective approach will lead to an efficient training method that is able to adjust the importance of data at each iteration, in order to hit desirable trade-offs between conflicting objectives and tasks.

Work Experience

Postdoctoral Researcher at RIKEN AIP, Tokyo Jun 2022 - present

Member of the Adaptive Bayesian Intelligence Team, working on model merging and its interpretation as a multi-objective problem. Learned about Variational Learning methods and optimizers based on the Bayesian objective to obtain distributions over the model's parameters.

System Solution's Engineer at Technopro IT, Yokohama Apr 2021 - Apr 2022

Worked as a software engineer implementing client's needs, writting operation manuals and documentation. All communications, oral and written where done in Japanese.

Education

Oct 2017 - March 2021	**Shinshu University**, Department of Mathematics and System Development
Thesis:	**Dynamic Compartmental and Performance Models for Analysis and Configuration of Multi-Objective Evolutionary Algorithms**
Oct 2015 - Sep 2017	**Shinshu University**, Department of Electric and Electronic Engineering
Thesis:	**Closed State Models for Population Dynamics Analysis of Multi- and Many-Objective Evolutionary Algorithms**
Feb 2009 - Sep 2014	**National University of Asuncion**, Polytechnic Faculty, Computer Engineering
Thesis:	**Dimensionality Reducion in Many-objective problems combining PCA and Spectral Clustering**

Languages

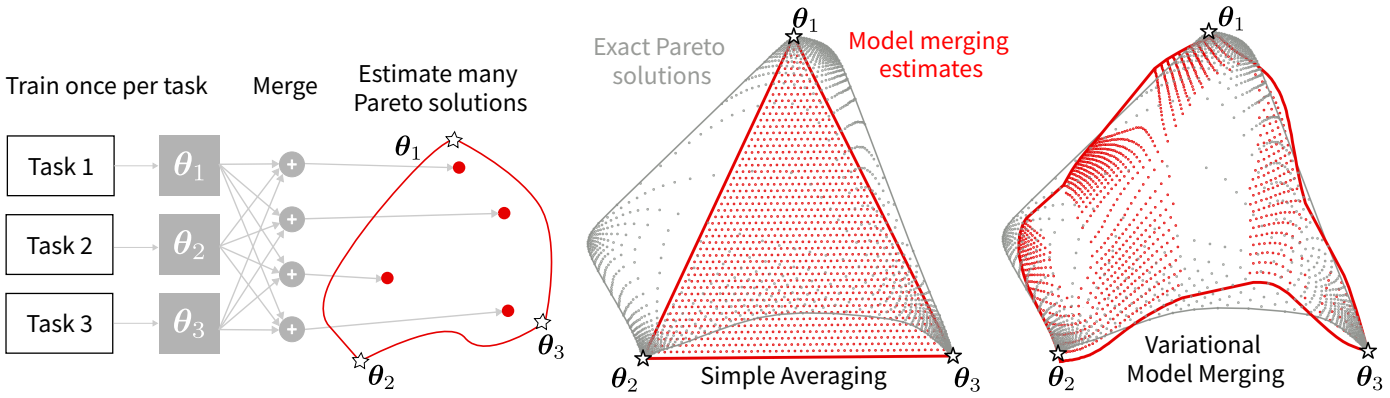
Spanish	Native Speaker
English	Business Level - TOEFL 102/120 pts.
Japanese	Intermediate Level - JPLT N2 passed.

Skills

Linux	High Performance Computing platforms (Sun Grid Engine, qsub), writing scripts to schedule training jobs of ViT, ResNet models, use of multiple GPU nodes, command line tools.
Programming - Python	Trained ViT, ResNet models with pytorch, model merging algorihtms (Task Arithmetic, Gradient Mismatch Hessian-based merging), running classic machine learning models on JAX, scientific plotting with matplotlib
Programming - R	Data frames, statistical data analysis, plotting in ggplot2
Document creation - LaTeX	Manuscript redaction and formatting in LaTeX

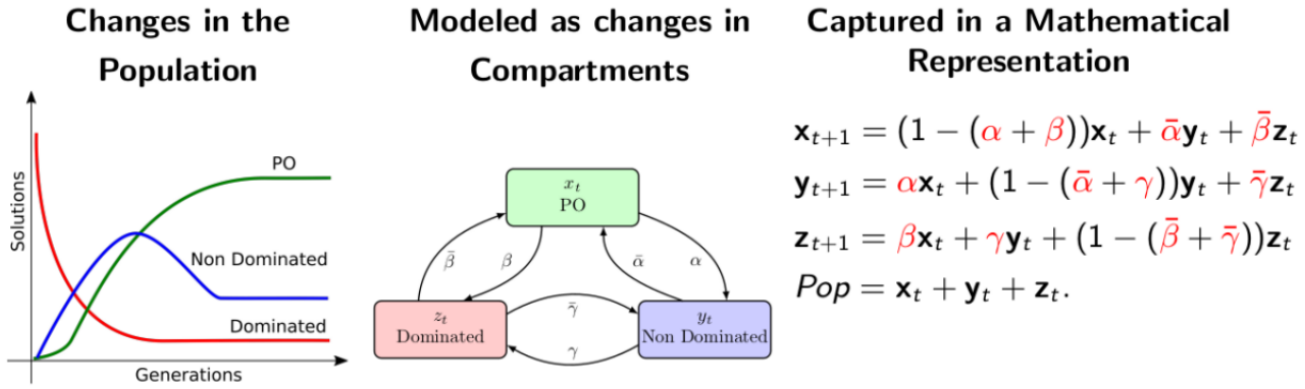
Recent Projects

Variational Model Merging for Pareto Front Estimation in Multitask Finetuning



During my postdoc I worked on variational Bayesian learning, my project connected the trade-offs of merging models on different tasks to Pareto trade-offs between their performance for an equivalent multi-task learning model seen as a multi-objective problem. In this view, each task accuracy is an objective, and the final multi-task learning model can be obtained by weighting them differently. Trying different weights is costly, so model merging acts as a proxy to explore combinations (left), and decide which Pareto solutions and their specific trade-offs are interesting to fully train. It also gives a unified framework that shows Simple Averaging, Task Arithmetic, Gradient Mismatch Hessian weighted merging corresponds to an aggregated weighted posterior, where each model parameters is being represented by an exponential family of some complexity class like: iso-Gaussian, diagonal or Full Gaussian, even a mixture of Gaussians (right) which determines the quality of the final joint model.

Dynamic Compartmental and Performance Models for Analysis and Configuration of Multi-Objective Evolutionary Algorithms



During my doctoral course I studied evolutionary algorithms for multi-objective optimization, a method that simulates natural evolution by a population of solutions, and uses operators such as recombination (takes parameters from two solutions and merges them) and mutation (changes parameters at random) iteratively improving them and reaching the Pareto Set of optimal and non-dominated solutions. I proposed a model that captures changes in the optimality of solutions present in the population and correlates it to performance of the algorithm. Dynamic Compartmental Models (DCM) simulate how individuals in different stages of evolution (optimality) in the population interact and affect each other. Compartments are determined based on Pareto dominance status and presence or not at certain iteration of the solutions. The proportion in each compartment changes as the algorithm progresses in the search of the Pareto Set and this can be used to predict its performance. The main contribution of this work is summarized in the figure.

Publications

Pre-print

- **Hugo Monzon**, Thomas Möllenhoff, Nico Daheim, Iryna Gurevych, Mohammad Emtiyaz Khan, *How to Weight Multitask Finetuning? Fast Previews via Bayesian Model-Merging.* Preprint, December 2024. Pages 21 https://arxiv.org/abs/2412.08147

Journal

- **Hugo Monzon**, Hernan Aguirre, Sebastien Verel, Arnaud Liefooghe, Bilel Derbel, Kiyoshi Tanaka. *Understanding Population Dynamics in Multi- and Many-objective Evolutionary Algorithms for High-Resolution Approximations.* In Advances in Operation Research, Hindawi. December, 2021. Pages 16. https://doi.org/10.1155/2021/6699277.
- **Hugo Monzon**, Hernan Aguirre, Sebastien Verel, Arnaud Liefooghe, Bilel Derbel, Kiyoshi Tanaka. *Estimating Hypervolume using Population Features from Dynamic Compartmental Models.* In Transactions of the Japanese Society for Evolutionary Computation. December, 2020. Pages 14. https://doi.org/10.11394/tjpnsec.12.12

Conferences

- **Hugo Monzon**, Saul Zapotecas-Martinez. *A Dynamic Penalty Function within MOEA/D for Constrained Multi-objective Optimization Problems.* In Proceedings of IEEE Congress on Evolutionary Computation (CEC), Krakow, July, 2021. Pages 8 (1470-1477). https://doi.org/10.1109/CEC45853.2021.9504940
- **Hugo Monzon**, Hernan Aguirre, Sebastien Verel, Arnaud Liefooghe, Bilel Derbel, Kiyoshi Tanaka. *Dynamic Compartmental Models for Large Multi-objective Landscapes and Performance Estimation.* In Proceedings of the European Conference on Evolutionary Computation in Combinatorial Optimization (EvoCOP '20), Seville, April, 2020. Pages 15 (99-113). https://doi.org/10.1007/978-3-030-43680-3_7. **Best Paper Nomination**
- **Hugo Monzon**, Hernan Aguirre, Sebastien Verel, Arnaud Liefooghe, Bilel Derbel, Kiyoshi Tanaka. *Dynamic compartmental models for algorithm analysis and population size estimation.* In Proceedings of the Companion Publication of the Genetic and Evolutionary Computation Conference (GECCO '19), Prague, July, 2019. Pages 4 (2044-2047). https://dl.acm.org/doi/10.1145/3319619.3326912 **Best Student Paper Nomination**
- **Hugo Monzon**, Hernan Aguirre, Sebastien Verel, Arnaud Liefooghe, Bilel Derbel, Kiyoshi Tanaka. *Studying compartmental models interpolation to estimate MOEAs population size.* In Proceedings of the Companion Publication of the Genetic and Evolutionary Computation Conference (GECCO '19), Prague, July, 2019. Pages 2 (227-228). https://dl.acm.org/doi/10.1145/3319619.3321985
- **Hugo Monzon**, Hernan Aguirre, Sebastien Verel, Arnaud Liefooghe, Bilel Derbel, Kiyoshi Tanaka. *Studying MOEAs Dynamics and their Performance using a Three Compartmental Model.* In Companion Publication of the Genetic and Evolutionary Computation Conference (GECCO '18), Kyoto, July, 2018. Pages 2 (191-192). https://dl.acm.org/doi/10.1145/3205651.3205739
- **Hugo Monzon**, Hernan Aguirre, Sebastien Verel, Arnaud Liefooghe, Bilel Derbel, Kiyoshi Tanaka. *Closed State Model for Understanding the Dynamics of MOEAs.* In Proceedings of the Genetic and Evolutionary Computation Conference (GECCO'17), Berlin, July, 2017. Pages 8 (606-616). https://dl.acm.org/doi/10.1145/3071178.3071259
- Christian von Lucken, **Hugo Monzon**, Carlos Brizuela, Benjamin Baran. *Dimensionality Reduction in Many-objective Problems Combining PCA and Spectral Clustering.* In Companion Publication of the Genetic and Evolutionary Computation Conference (GECCO '15), Madrid, July, 2015. Pages 2 (1511-1512). https://dl.acm.org/doi/10.1145/2739482.2764636