

## INTERNATIONAL RELATIONS



## INTERNSHIP SUBJECT

### 2890 - Geometric regularizations of Wasserstein barycenters

Wasserstein distances provide a way to compare data represented by probability measures while taking into account the geometry of the underlying space. They can be used to compute averages of such data through the notion of Wasserstein barycenter [1]. These barycenters have become popular tools in data science – e.g. to compute averages between images – since they do not require choosing a specific embedding of the data in a Euclidean space and rely on more intrinsic information (an optimal transport cost) to quantify discrepancy.

In general, however, Wasserstein barycenters are not stable with respect to the input data, and in fact they may even fail to be unique. This complicates their use in statistical applications. On the other hand, such uniqueness can be guaranteed upon requiring some geometric conditions, namely that the Wasserstein geodesics connecting the measures to be averaged to their average solving the barycenter problem can be extended. In this internship, we will study a regularization of the Wasserstein barycenter problem that incorporates this requirement via the notion of metric Wasserstein extrapolation, that was recently introduced in [2]. We will aim to provide a more stable notion of barycenter, and study its relation to the original problem theoretically and via numerical simulations.

The internship will be performed at the Université Paris-Saclay.

#### References

- [1] Martial Agueh and Guillaume Carlier. Barycenters in the Wasserstein space. *SIAM Journal on Mathematical Analysis*, 43(2):904–924, 2011.
- [2] Thomas O Gallouët, Andrea Natale, and Gabriele Todeschi. Metric extrapolation in the Wasserstein space. *Calculus of Variations and Partial Differential Equations*, 64(5):147, 2025.

#### Required Skills

The successful candidate will be pursuing a MSc in Applied mathematics. Research experience in calculus of variations, optimal transport and numerical optimization will be appreciated.

#### General Information

- **Research Theme :** Optimization, machine learning and statistical methods
- **Locality :** Orsay
- **Level :** Master
- **Period :** 12th January 2026 -> 12th April 2026 (3 months)



*These are approximative dates. Please contact the training supervisor to know the precise period.*

- **Deadline to apply :** 1st July 2025 (midnight)

#### Contacts

- **Training Supervisor :** Andrea Natale / [andrea.natale@inria.fr](mailto:andrea.natale@inria.fr)
- **Team Manager :** Thomas Gallouët / [thomas.gallouet@inria.fr](mailto:thomas.gallouet@inria.fr)

#### More information

- **Inria Team :** PARMA
- **Inria Center :** Centre Inria de Saclay