

ATENEO



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Robustness of Optimal Transport maps

Abstract: Optimal transport (OT) was originally formulated as a resource allocation problem. More recently, it has found many applications in statistics and data science, including statistical testing, multivariate distribution functions, and variational inference. A central object in OT is the transport map T , which sends a reference measure μ to a target measure P , typically representing the data distribution. In this talk, we discuss recent advances on the robustness of the transport map T evaluated at a point u . First, we study its robustness in terms of the breakdown point, namely, the smallest level of contamination of the target measure P that can force $T(u)$ to take arbitrarily extreme values. This result holds for transport maps induced by strictly convex costs. In particular, it implies that the transport-based median introduced by Hallin et al. (2021) has breakdown point $1/2$. More generally, points on the transport-based depth contour of order $\tau \in [0, 1/2]$ have breakdown point τ , showing that multivariate transport depth has the same robustness as its univariate counterpart. The argument relies on a connection between the breakdown point of transport maps and the Tukey depth of points in the reference measure. In the second part of the talk, we study the influence function of the transport map. We show that the influence function of $T(u)$ is unbounded and has a pole-type singularity when the perturbation is located near $T(u)$. This suggests that the most harmful perturbations of the target measure P are those concentrated near $T(u)$. We will briefly outline the proof, which uses PDE methods, and conclude with a list of open problems.

Alberto González Sanz ha recibido recientemente el Premio de Investigación Matemática José Luis Rubio de Francia RSME – Fundación BBVA 2025 y obtuvo uno de los premios Vicent Caselles RSME – Fundación BBVA 2024

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