

Kantorovich optimal transport problem and Shannon's optimal channel problem

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We show that the optimal transport problem (OTP) in the Kantorovich formulation is equivalent to Shannon's variational problem on optimal channel with one additional constraint, which fixes a specific output measure. Without this constraint, a solution to Shannon's problem generally achieves smaller expected cost than the optimal transport. Therefore, from game theoretic point of view, solutions to the Shannon's problem should be always preferred to the optimal transport maps. This result is a consequence of the geometry of the information divergence. Specifically, we show that strict convexity and differentiability of the divergence implies the fact that optimal joint probability measures are always in the interior of the simplex of all joint measures. We discuss these results in the context of OTP on discrete and continuous domains.