

Isotonic Distributional Regression (IDR): Leveraging Monotonicity, Uniquely So!

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There is an emerging consensus in the transdisciplinary literature that the ultimate goal of regression analysis is to model the conditional distribution of an outcome, given a set of explanatory variables or covariates. This new approach is called “distributional regression”, and marks a clear break from the classical view of regression, which has focused on estimating a conditional mean or quantile only. Isotonic Distributional Regression (IDR) learns conditional distributions that are simultaneously optimal relative to comprehensive classes of relevant loss functions, subject to monotonicity constraints in terms of a partial order on the covariate space. This IDR solution is exactly computable and does not require approximations nor implementation choices, except for the selection of the partial order. Despite being an entirely generic technique, IDR is strongly competitive with state-of-the-art methods in a case study on probabilistic precipitation forecasts from a leading numerical weather prediction model.

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