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# Nonstationary Distribution Estimation Via Wasserstein Probability Flows

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We consider a situation in which observations are made from an underlying distribution that changes over time. We use a non-parametric model for the changes in distribution and suppose that the change is most likely to involve a small Wasserstein distance between two successive distributions. This leads naturally to a formulation in which we estimate the underlying set of distributions through maximising the log likelihood of the observations with a penalty applied to the total of the Wasserstein distances between successive probability distributions. We call this the Wasserstein Probability Flow (WPF) problem and we show how it reduces to a simple network flow problem. This can be easily solved, and we derive some properties of optimal solutions. We also show with numerical experiments how the WPF approach can be effective in practice.

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