

# Challenges and opportunities in scalable Alpha-divergence Variational Inference: application to Importance Weighted Auto-Encoders

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## **Abstract**

Several algorithms involving the Variational Rényi (VR) bound have been proposed to minimize an alpha-divergence between a target posterior distribution and a variational distribution. Despite having led to promising empirical results, those algorithms resort to biased stochastic gradient descent procedures and thus lack theoretical guarantees. In this talk, we formalize and study the VR-IWAE bound, a generalization of the Importance Weighted Auto-Encoder (IWAE) bound. We show that the VR-IWAE bound enjoys several desirable properties and notably leads to the same stochastic gradient descent procedure as the VR bound in the reparameterized case, but this time using unbiased estimators. We then provide two complementary theoretical analyses of the VR-IWAE bound. Those analyses, which encompass the case of the IWAE bound, shed light on the conditions behind the success or failure of the VR-IWAE bound methodology. Lastly, we illustrate our theoretical claims over toy and real-data examples.

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