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Aggressive Probabilistic Certification of Complex Control Systems

Abstract. The certification of the performance of a control scheme on an uncertain system is a challenging task. This is especially the case when the system is non-linear, and there is a poor characterization of the disturbances and/or uncertainties in the parameters that describe the dynamics model. We recall the notion of probabilistic maximization and probabilistic scaling, which are randomized methodologies that allow us to obtain probabilistic certificates on complex systems. These approaches do not rely on exact knowledge of the probability distribution of the uncertain vector w, but on the possibility of obtaining i.i.d. samples of the uncertain vector w. We present a novel scheme that allows us to derive probabilistic certifications in a more relaxed setting, where there is limited access to the generation of i.i.d. samples. The approach relies on the notion of aggressive probabilistic certification, which only requires a relaxed probabilistic characterization of the uncertainty. The certification is obtained by randomly generating worst-case scenarios.

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