KKT-INFORMED NEURAL NETWORK

A PARALLEL SOLVER FOT PARAMETRIC CONVEX OPTIMIZATION PROBLEM

A PREPRINT

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ABSTRACT

This is the abstract

1 Introduction

2 Background

Consider a parametric convex optimization problem in the standard form:

$$\begin{aligned} \min_{x \in \mathcal{D} \subseteq \mathbb{R}^n} \quad & f(x, \theta) \\ \text{s.t.} \quad & g_i(x, \theta) \leq 0 \quad i = 1, \dots, m \\ & A(\theta)x - b(\theta) = 0 \end{aligned}$$

where $x \in \mathcal{D} \subseteq \mathbb{R}^n$ is the optimization variable; $\theta \in \mathcal{D}_\theta \subseteq \mathbb{R}^k$ are the parameters defining the problem; $f : \mathcal{D}_f \subseteq \mathbb{R}^n \times \mathbb{R}^k \to \mathbb{R}$ is the convex cost function; $g_i : \mathcal{D}_{g_i} \subseteq \mathbb{R}^n \times \mathbb{R}^k \to \mathbb{R}$ are the convex inequality constraints, $A : \mathcal{D}_\theta \to \mathbb{R}^{p \times n}$ and $b : \mathcal{D}_\theta \to \mathbb{R}^p$ defines the affine equality constraints and $\mathcal{D} = \bigcap_{i=1}^m \mathcal{D}_{g_i} \cap \mathcal{D}_f$ is the domain of the optimization problem.

Assume differentiable cost and constraints functions and that g_i satisfies Slater's condition. Given a set of parameters θ, $x^* \in \mathcal{D}$ is optimal if and only if there are λ^* and ν^* that, with x^*, satisy the Karush-Kuhn-Tucker conditions (KKT):

$$A(\theta)x^* - b(\theta) = 0 \tag{1}$$

$$g_i(x^*, \theta) \leq 0 \quad i = 1, \dots, m \tag{2}$$

$$\lambda_i^* \geq 0 \quad i = 1, \dots, m \tag{3}$$

$$\lambda_i^* g_i(x^*, \theta) = 0 \quad i = 1, \dots, mCompl \tag{4}$$

$$\nabla_{x^*} f(x^*, \theta) + \sum_{i=1}^m \lambda_i^* \nabla_{x^*} g_i(x^*, \theta) + A^T \nu^* = 0Stationairty \tag{5}$$

3 Proposed method

4 Case study

4.1 Problem description

4.2 Experimental results

5 Conclusions