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A novel neural network model for solving a class of nonlinear semidefinite programming problems

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ABSTRACT In this paper, we describe a dynamic optimization technique for solving a class of nonlinear semidefinite programming based on Karush- Kuhn-Tucker optimality conditions. By employing Lyapunov function approach, it is investigated that the suggested neural network is stable in the sense of Lyapunov and globally convergent to an exact optimal solution of the original problem. The effectiveness of the proposed method is demonstrated by two numerical simulations.

AMS Mathematics Subject Classification: 90C25, 93D20, 90C30, 90C46.
Keywords: Neural network, Nonlinear semidefinite programming, Convex optimization, Stability, Convergence.

1. Introduction

Consider the nonlinear semidefinite programming problem (NSDP):

$$\text{minimize} \quad f(x) \tag{1}$$

$$\text{subject to} \quad A(x) = A_0 + \sum_{i=1}^{n} x_i A_i \preceq 0, \tag{2}$$

$$g(x) \leq 0, \tag{3}$$

where $x \in \mathbb{R}^n$, $A_i \in \mathbb{R}^{m \times m}, i = 1, ..., n$ and $f : \mathbb{R}^n \to \mathbb{R}$ and $g : \mathbb{R}^n \to \mathbb{R}^q$ are convex and continuously differentiable. The notation $A \preceq 0$ means that the matrix A is negative semidefinite. The constraint $A(x) \preceq 0$ is called linear matrix inequality (LMI).

The NSDP problem (1)-(3) is a convex optimization problem since its objective and

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