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Alireza Nazemi, Atiye Sabeghi

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A novel gradient-based neural network for solving convex second-order cone constrained variational inequality problems

Alireza Nazemi [1,*], **Atiye Sabeghi** [1,†]

[1]Faculty of Mathematical Sciences, Shahrood University of Technology, P.O. Box 3619995161-316, Tel-Fax No:+98 23 32300235, Shahrood, Iran.

ABSTRACT In this paper, we apply a gradient neural network model to efficiently solve the convex second-order cone constrained variational inequality problem. According to a smoothing method, the variational inequality problem is first reduced to a convex second order cone programming (CSOCP). Using a capable neural network, the obtained convex programming problem is solved. The stability in the sense of Lyapunov and globally convergence of the proposed neural network model are also provided. The effectiveness of the scheme is established by several numerical examples.

Keywords: Neural network, variational inequalities, second order cone programming, gradient based, stability, convergent.

1. Introduction

Consider the second order cone constrained variational inequality problem (SOCCVI) problem which is to find $x \in C$ satisfying

$$\langle F(x), y - x\rangle \geq 0, \qquad \forall\ y \in C, \tag{1}$$

where the set C is finitely representable as

$$C = \{x \in \mathbb{R}^n : Ax - b = 0, \quad -G(x) \in \mathcal{K}\}. \tag{2}$$

Here $\langle ., .\rangle$ denotes the Euclidean inner product, $F : \mathbb{R}^n \to \mathbb{R}^n, h : \mathbb{R}^n \to \mathbb{R}^l$, $G : \mathbb{R}^n \to \mathbb{R}^m$ are continuously differentiable functions, $A \in \mathbb{R}^{l\times n}$ has full row rank, $b \in \mathbb{R}^l$, and $\mathcal{K}$ is a

*(Corresponding Author): nazemi20042003@gmail.com
†sabeghi77@yahoo.com