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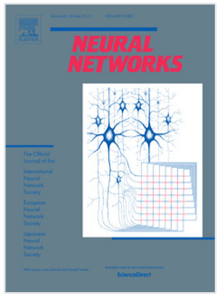

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# A neurodynamic approach to convex optimization problems with general constraint

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**Abstract**

This paper presents a neurodynamic approach with a recurrent neural network for solving convex optimization problems with general constraint. It is proved that for any initial point, the state of the proposed neural network reaches the constraint set in finite time, and converges to an optimal solution of the convex optimization problem finally. In contrast to the existing related neural networks, the convergence rate of the state of the proposed neural network can be calculated quantitatively via the Łojasiewicz exponent under some mild assumptions. As applications, we estimate explicitly some Łojasiewicz exponents to show the convergence rate of the state of the proposed neural network for solving convex quadratic optimization problems. And some numerical examples are given to demonstrate the effectiveness of the proposed neural network.

*Keywords:* Nonsmooth convex optimization, neurodynamic approach, Łojasiewicz inequality, convergence in finite time.

## 1. Introduction

Consider the following nonlinear convex optimization programming

$$\begin{array}{ll} \text{minimize} & f(x) \\ \text{subject to} & x \in \Omega \end{array} \tag{1}$$

where $x = (x_1, x_2, ..., x_n)^T \in \mathbb{R}^n$ is the vector of decision variables, $f : \mathbb{R}^n \to \mathbb{R}$ is a convex function, $\Omega$ is a nonempty close convex bounded subset of $\mathbb{R}^n$. Without loss of generality, in this paper, we assume that nonlinear convex programming (1) has at least an optimal solution.

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