

Solution of the Linear Programming Problems based on Neural Network Approach

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ABSTRACT

In this paper we discuss solution of Linear Programming problems through neural network. Without having location restriction this network uses only simple hardware. Here we proved to be completely stable to exact solution without any multipliers. Moreover using this network we can solve linear programming problems and its dual simultaneously. These linear programming problems use circuit implementation.

Keywords

Neural network; Globally exponentially stable; Linear programming.

1. INTRODUCTION

Hopfield and Tank proposed a recurrent neural network for solving linear programming problems [1]. Sadhuranan and Sundareshan [2] introduced a method to programming a single layered recurrent neural network to execute optimization via quadratic minimization. The optimization method employed by generalized network is shown to descend in to the usual class of Gradient method for restrained nonlinear optimization. In contrast with penalty function method [3]. The optimization variables problem which can get up in such various topics as rigid body Mechanics, Fluid dynamics and elastic-plastic torsion [4]. The global exponential stability of different neural networks have been deliberate [5] in which weight matrices need to be accepted some sufficient conditions. The optimization of the new Back-Propagation algorithm by using imitative information [9].

Our work inspired Youchen Xia[6] and Youchen Xia, Jun Wang [7] Here we use neural network method for solving different type of linear programming problems. We use basic problem for mathematical formulation to extend a new network. Here we describe circuit implementation of proposed network for proportional analysis.

2. LINEAR PROGRAMMING PROBLEMS OF THE GENERAL FORM

The general form of the linear programming problems, that is considered for the solution purpose is as mentioned below;

$$\begin{aligned} & \text{Minimize, } c^T x + d^T y \\ & \text{Subject to: } A_{01} x_1 + A_{02} x_2 + A_{03} x_3 + A_{04} x_4 \geq b_1 \\ & A_{01} x_1 + A_{02} x_2 + A_{03} x_3 + A_{04} x_4 \geq b_2 \end{aligned}$$

$$A_{01} x_1 + A_{02} x_2 + A_{03} x_3 + A_{04} x_4 \geq b_3 \quad (1)$$

$$A_{01} x_1 + A_{02} x_2 + A_{03} x_3 + A_{04} x_4 = b_4$$

$$x \geq 0$$

Where,

$$\begin{aligned} x &= \begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{pmatrix} \in K^n, \quad c = \begin{pmatrix} c_1 \\ c_2 \\ c_3 \\ c_4 \end{pmatrix} \in K^n, \quad d = \begin{pmatrix} d_1 \\ d_2 \end{pmatrix} \in K^2, \\ a &= \begin{pmatrix} a_1 \\ a_2 \end{pmatrix} \in K^2, \quad b = \begin{pmatrix} b_1 \\ b_2 \end{pmatrix} \in K^2 \end{aligned}$$

By the duality theory [7] the dual problem of the primal problem (1) is of the following form;

$$\text{Maximize, } b^T x + a^T y$$

$$\begin{aligned} \text{Subject to: } & A^T_{11} y_1 + A^T_{12} y_2 + A^T_{13} y_3 + A^T_{14} y_4 \leq c_1 \\ & A^T_{21} y_1 + A^T_{22} y_2 + A^T_{23} y_3 + A^T_{24} y_4 \leq c_2 \\ & A^T_{31} y_1 + A^T_{32} y_2 + A^T_{33} y_3 + A^T_{34} y_4 \leq d_1 \\ & A^T_{41} y_1 + A^T_{42} y_2 + A^T_{43} y_3 + A^T_{44} y_4 = d_2 \end{aligned} \quad (2)$$

$$y \geq 0$$

$$\text{Where, } y = \begin{pmatrix} y_1 \\ y_2 \\ y_3 \\ y_4 \end{pmatrix} \in K^4$$

Both the special type cases (1) and (2) are of the following linear programming problem in its standard form;

$$\begin{aligned} & \text{Minimize, } c^T x + d^T y \\ & \text{Subject to: } Ax \geq a \\ & Ax \geq b \\ & x \geq 0 \end{aligned} \quad (3)$$

Where, $A \in \mathbb{R}^{m \times n}$, $c, d \in K^n$ and $a, b \in K^m$ and its dual

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