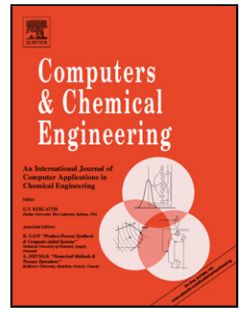
Accepted Manuscript



Title: A new neural network for convex quadratic minimax problems with box and equality constraints

Author: Xingbao Gao Cuiping Li

PII: S0098-1354(17)30150-3
DOI: http://dx.doi.org/doi:10.1016/j.compchemeng.2017.03.022
Reference: CACE 5772

To appear in: *Computers and Chemical Engineering*

Received date: 25-9-2016
Revised date: 22-1-2017
Accepted date: 27-3-2017

Please cite this article as: Xingbao Gao, Cuiping Li, A new neural network for convex quadratic minimax problems with box and equality constraints, *<![CDATA[Computers and Chemical Engineering]]>* (2017), http://dx.doi.org/10.1016/j.compchemeng.2017.03.022

A new neural network for convex quadratic minimax problems with box and equality constraints*

Xingbao Gao and Cuiping Li†

Abstract: This paper presents a new neural network for solving a class of convex quadratic minimax problems with equality and box constraints by means of the sufficient and necessary conditions of the saddle point of the underlying function. By defining a proper energy function, the proposed neural network is proved to be stable in the sense of Lyapunov and converges to an exact solution of the original problem for any starting point under the condition that the objective function is convex-concave on the linear equation sets. Compared with the existing neural networks for the same convex quadratic minimax problem, the proposed neural network has the fewest neurons and lower complexity, and requires weaker stability conditions. The validity and transient behavior of the proposed neural network are demonstrated by some numerical results.

Keywords: Neural network; minimax problem; stability; convergence; saddle point

1. Introduction

Consider a class of minimax problem

$$\min_{x\in\mathcal{U}}\{\max_{y\in\mathcal{V}}\{f(x,y)\}\} \tag{1}$$

where

$$f(x,y)=\frac{1}{2}x^THx+h^Tx+x^TQy-\frac{1}{2}y^TSy-s^Ty$$

symmetric matrices $H\in R^{m\times m}$ and $S\in R^{n\times n}$, $Q\in R^{m\times n}$, $h\in R^m$, $s\in R^n$, $\mathcal{U}=\{x\in R^m|Ax=a,\bar{l}_i\le x_i\le\bar{h}_i$ for $i=1,2,\ldots,m\}$ and $\mathcal{V}=\{y\in R^n|By=b,\tilde{l}_j\le y_j\le\tilde{h}_j$ for $j=1,2,\ldots,n\}$ are given with $A\in R^{q_1\times m}$, $B\in R^{q_2\times n}$, $a\in R^{q_1}$, $b\in R^{q_2}$, $rank(A)=q_1\le m$, $rank(B)=q_2\le n$ and some $-\bar{l}_i$ (or $-\tilde{l}_j$, $\bar{h}_i$, $\tilde{h}_j$) being $+\infty$.

*This work is supported by the National Natural Science Foundation of China No. 61273311 and No. 61603235

†School of Mathematics and Information Science, Shaanxi Normal University, Xi'an, Shaanxi 710062, P. R. China. Email: xinbaog@snnu.edu.cn, cuipli@snnu.edu.cn.