Solving indefinite least-squares problem using generalized inverses and Recurrent Neural Network

Predrag S. Stanimirović

University of Niš, Faculty of Science and Mathematics, Niš, SERBIA
[pecko@pmf.ni.ac.rs]

The matrix J in a pseudo-Euclidean space is defined by

$$J = \pm \begin{bmatrix} I_k & 0 \\ 0 & -I_{n-k} \end{bmatrix} = I_{k,n-k} \in \mathbb{C}^{n\times n},\ k \leq n, \tag{1}$$

where I_n denotes the $n \times n$ identity matrix. Then J is the metric tensor satisfying $Ju = \pm(u_1, \ldots, u_k, -u_{k+1}, \ldots, -u_n)$, where $u = (u_1, u_2, \ldots, u_n) \in \mathbb{C}^n$. In the particular case $k = 1$ the metric matrix (1) defines Minkowski inner product. Our goal is to find solutions of the solution of indefinite least-squares problems of the general form

$$\min_x \ (Ax - b)^T J(Ax - b).$$

Firstly, a correlation between the indefinite least-squares problems and particular classes of generalized inverses are investigated. Using various representations of these generalized inverses, two gradient-based recurrent neural networks (RNNs) for their computation are defined.