Neural Computing and Applications (2023) 35:18087–18088
https://doi.org/10.1007/s00521-023-08690-y

CORRECTION

Correction to: Multi-valued neural networks I: a multi-valued associative memory

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Received: 17 May 2023 / Accepted: 17 May 2023 / Published online: 27 May 2023

Correction to: Neural Computing and Applications https://doi.org/10.1007/s00521-021-05781-6

1 Introduction

Following the publication of our article [1], we have found out that expression (7) for $TS^G_{ij}((\mathbf{W}^0, \mathbf{d}); Y)$ and the proof of Theorem 2 should be as follows:

$$TS^G_{ij}((\mathbf{W}^0, \mathbf{d}); Y) = \{k \in P : | \ x^k_i \wedge y^k_j \leqslant w^0_{ij}\}, \tag{7}$$

Theorem 2 *The set* $M^{wcd} \neq \emptyset$ *and* $(\mathbf{W}^0, \mathbf{c}, \mathbf{d}) \in M^{wcd}$, *if* $\forall j \in M,\ i \in N,\ c_j \leqslant d^0_j = \bigwedge_{k \in P} y^k_j,\ \bigcup_{i \in N} TS^G_{ij}((\mathbf{W}^0, \mathbf{d}); Y) = P$ *and* $\forall k \in P\ \bigvee_{i:\, k \in TS^G_{ij}} x^k_i \geqslant y^k_j$.

Proof Let us $\forall j \in M,\ k \in P,\ \exists n \in N:\ k \in TS^G_{nj}((\mathbf{W}^0, \mathbf{d}); Y)$. Then,

$$w^0_{nj} \geqslant x^k_n \wedge y^k_j, \tag{9}$$

and

$$\bigvee_{n:\, k \in TS^G_{nj}} x^k_n \wedge y^k_j = y^k_j. \tag{10}$$

Let us consider:

$$\bigvee_{i \in N} ((x^k_i \vee c_j \vee d_j) \wedge (w^0_{ij} \vee d_j)) \geqslant$$
$$\geqslant \bigvee_{i \in N} (x^k_i \wedge w^0_{ij}) \wedge y^k_j \geqslant$$
$$\geqslant \bigvee_{n:\, k \in TS^G_{nj}} (x^k_n \wedge w^0_{nj} \wedge y^k_j) = y^k_j,$$

since 9 and 10.

Hence,

$$\bigvee_{i \in N} \{(x^k_i \vee c_j \vee d_j) \wedge (w^0_{ij} \vee d_j)\} \in \{x^l_i \in L \ | \ l \in GE_{ij}(X, Y)\}. \tag{11}$$

On the other hand, we get by the definitions of implication, $\mathbf{d}^0$, and $\mathbf{W}^0$ and Theorem 1 that $\forall i \in N,\ j \in M,\ k \in P,\ (x^k_i \vee c_j \vee d_j) \wedge (w^0_{ij} \vee d_j) \in \{x^l_i \ \in L \ | \ l \in LE_{ij}(X, Y)\}$, since $w^0_{ij} \geqslant d^0_j \geqslant d_j,\ x^k_i \wedge w^0_{ij} \leqslant y^k_j$ (since $x^k_i \wedge \bigwedge_l [x^l_i \Rightarrow y^l_j] \leqslant x^k_i \wedge [x^k_i \Rightarrow y^k_j] \leqslant y^k_j$), and $(c_j \vee d_j) \leqslant y^k_j$. Hence,

$$\bigvee_{i \in N} \{(x^k_i \vee c_j \vee d_j) \wedge (w^0_{ij} \vee d_j)\} \in \{x^l_i \in L \ | \ l \in LE_{ij}(X, Y)\}. \tag{12}$$

Combining (11) and (12), we get $(\mathbf{W}^0, \mathbf{c}, \mathbf{d}) \in M^{wcd}$, i.e., $M^{wcd} \neq \emptyset$. However, if there is a set of lattice elements that satisfy the condition of the theorem: $\{(y')^k_j \mid y^k_j < (y')^k_j \leqslant w^0_{i_0 j}\}$ with the same matrix w^0_{ij}, the matrix is the solution only for

The original article can be found online at https://doi.org/10.1007/s00521-021-05781-6.

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y, since $(x_i^k \vee c_j \vee d_j) \wedge (w_{ij}^0 \vee d_j) \leqslant y_j^k$ and this expression does not change for such y'[1]. Hence, the proof is valid only for y_j^k. $\square$

Declarations

Conflict of interest The author declare that he has no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Reference

1. Maximov D, Goncharenko VI, Legovich YS (2021) Multi-valued neural networks i: a multi-valued associative memory. Neur. Comp. and App. 33(16):10189–10198. https://doi.org/10.1007/s00521-021-05781-6

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[1] $x_i^k \wedge \bigwedge_l [x_i^l \Rightarrow y_j^l] \leqslant x_i^k \wedge [x_i^k \Rightarrow y_j^k] = x_i^k \wedge y_j^k$.