



US007814038B1

(12) **United States Patent**
Repici

(10) **Patent No.:** **US 7,814,038 B1**
(45) **Date of Patent:** **Oct. 12, 2010**

(54) **FEEDBACK-TOLERANT METHOD AND DEVICE PRODUCING WEIGHT-ADJUSTMENT FACTORS FOR PRE-SYNAPTIC NEURONS IN ARTIFICIAL NEURAL NETWORKS**

(76) Inventor: **Dominic John Repici**, 120 Jefferson St.,
Riverside, NJ (US) 08075

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 559 days.

- 5,572,628 A 11/1996 Denker et al.
- 5,608,843 A 3/1997 Baird, III
- 5,613,042 A 3/1997 Chung et al.
- 5,630,020 A 5/1997 Makram-Ebeid
- 5,644,681 A 7/1997 Takahashi et al.
- 5,704,016 A 12/1997 Shigematsu et al.
- 5,720,002 A 2/1998 Wang
- 5,748,848 A 5/1998 Tresp
- 5,768,476 A 6/1998 Sugaya et al.
- 5,802,507 A 9/1998 Gentric et al.
- 5,806,053 A 9/1998 Tresp et al.
- 5,822,742 A 10/1998 Alkon et al.

(Continued)

(21) Appl. No.: **11/951,611**

(22) Filed: **Dec. 6, 2007**

(51) **Int. Cl.**
G06F 15/18 (2006.01)
G06N 3/08 (2006.01)

(52) **U.S. Cl.** **706/25**

(58) **Field of Classification Search** **706/25**
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

- 5,050,095 A 9/1991 Samad
- 5,136,687 A * 8/1992 Edelman et al. 706/20
- 5,168,550 A 12/1992 Sakaue et al.
- 5,212,767 A 5/1993 Higashino et al.
- 5,257,342 A 10/1993 Takatori et al.
- 5,293,454 A 3/1994 Kamiya
- 5,355,434 A 10/1994 Yoneda et al.
- 5,430,829 A 7/1995 Takatori et al.
- 5,430,830 A 7/1995 Frank et al.
- 5,448,681 A 9/1995 Khan
- 5,450,528 A 9/1995 Chung et al.
- 5,459,817 A 10/1995 Shima
- 5,473,730 A 12/1995 Simard
- 5,555,345 A 9/1996 Komori et al.
- 5,563,983 A 10/1996 Nozaki et al.

OTHER PUBLICATIONS

Toward Unification of Source Attribution Processes and Techniques, Khosmood, F.; Levinson, R.; Machine Learning and Cybernetics, 2006 International Conference on Digital Object Identifier: 10.1109/ICMLC.2006.258376 Publication Year: 2006, pp. 4551-4556.*

(Continued)

Primary Examiner—Michael Holmes

(57) **ABSTRACT**

In an artificial neural network a method and neuron device that produce weight-adjustment factors, also called error values (116), for pre-synaptic neurons (302a . . . 302c) that are used to adjust the values of connection weights (106 . . . 106n) in neurons (100) used in artificial neural networks (ANNs). The amount of influence a pre-synaptic neuron has had over a post-synaptic neuron is calculated during signal propagation in the post-synaptic neuron (422a . . . 422n) and accumulated for the pre-synaptic neuron (426) for each post-synaptic neuron to which the pre-synaptic neuron's output is connected (428). Influence values calculated for use by pre-synaptic neurons may further be modified by the post-synaptic neuron's output value (102) (option 424), and its error value (116) (option 1110).

18 Claims, 14 Drawing Sheets

