



US007904398B1

(12) **United States Patent**
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(10) **Patent No.:** **US 7,904,398 B1**
(45) **Date of Patent:** **Mar. 8, 2011**

(54) **ARTIFICIAL SYNAPSE COMPONENT USING MULTIPLE DISTINCT LEARNING MEANS WITH DISTINCT PREDETERMINED LEARNING ACQUISITION TIMES**

6,269,351 B1 7/2001 Black
6,424,961 B1 7/2002 Ayala
7,080,053 B2 7/2006 Adams et al.

OTHER PUBLICATIONS

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Li, A Sigma-Pi-Sigma Neural Network (SPSNN), 2003.*
Beaugé et al., Neuromodulation Mechanisms for the Cooperation of Artificial Neural Networks, NEURAP'95, 1995.*
Journal of Intelligent and Robotic Systems 14: pp. 343-345, 1995, Calendar of Events.*
Sabhnani et al., "Application of Machine Learning Algorithms to KDD Intrusion Detection Dataset within Misuse Detection Context", 2003.*
Riedmiller, "Rprop—Description and Implementation Details", 1994.*
DBLP Maheshkumar Sabhnani.*
Douglas et al., "The role of synapses in cortical computation", Journal of Neurocytology 25, 893-911, 1996.*

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 781 days.

(21) Appl. No.: **11/689,676**

(22) Filed: **Mar. 22, 2007**

Related U.S. Application Data

(63) Continuation-in-part of application No. 11/258,639, filed on Oct. 26, 2005, now abandoned.

(Continued)

(51) **Int. Cl.**
G06F 15/18 (2006.01)
G06N 3/00 (2006.01)
G06N 3/08 (2006.01)

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(52) **U.S. Cl.** **706/15; 706/25; 706/26; 706/27; 706/39**

(57) **ABSTRACT**

(58) **Field of Classification Search** 706/15
See application file for complete search history.

Neuron component and method for use in artificial neural networks (ANNs) with input synapses (204, 204b . . . 204n), each synapse includes multiple weights called synapse weights (206-1, 206-2, 206-3). Each synapse further includes a facility to modulate, or gate, an input signal connected to the synapses, by each of the respective synapse weights within the synapse, supplying the result of each modulating operation. The neuron also sums the results of all modulating operations, and subjects the results to a transfer function. Each of the multiple weights associated with a given synapse, may be specified to have its own weight-adjustment facility (214, 214b, 214c), with its own error-values (216, 216b, 216c), and its own specified learning and aspect (1000) includes a separate sum (1018, 1018b) and transfer function (1020, 1020b) for each synapse weight.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,950,733	A	4/1976	Cooper et al.
4,918,618	A	4/1990	Tomlinson, Jr.
5,050,095	A	9/1991	Samad
5,119,469	A	6/1992	Alkon et al.
5,253,329	A	10/1993	Villarreal et al.
5,467,428	A	11/1995	Ulug
5,479,574	A	12/1995	Glier et al.
5,671,337	A	9/1997	Yoshihara
5,704,016	A	12/1997	Shigematsu et al.
5,822,742	A	10/1998	Alkon et al.
6,219,658	B1	4/2001	Gordon

16 Claims, 14 Drawing Sheets

