

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau

(43) International Publication Date
16 June 2022 (16.06.2022)



(10) International Publication Number
WO 2022/121644 A1

(51) International Patent Classification:
G06N 3/063 (2006.01) *G06N 20/00* (2019.01)

(21) International Application Number:
PCT/CN2021/131210

(22) International Filing Date:
17 November 2021 (17.11.2021)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
17/115,895 09 December 2020 (09.12.2020) US

(71) Applicant: **INTERNATIONAL BUSINESS MACHINES CORPORATION** [US/US]; New Orchard Road, Armonk, New York 10504 (US).

(71) Applicant (for MG only): **IBM (CHINA) CO., LIMITED** [CN/CN]; 7F, Bldg. 10, ZhangJiang Innovation Park, 399 Keyuan Road, ZhangJiang High-Tech Campus, Pudong New Area, Shanghai 201203 (CN).

(72) Inventors: **ISHII, Masatoshi**; IBM Japan Ltd., 7-7 Shinkawasaki, Saiwai-Ku, Kawasaki 212-0032 (JP). **YASUDA, Takeo**; IBM Japan Ltd., 614 Higashi-Shiokoji-cho, Karasuma-Nishiiru, Kyoto 600-8216 (JP).

(74) Agent: **LIU, SHEN & ASSOCIATES**; 10th Floor, Building 1, 10 Caihefang Road, Haidian District, Beijing 100080 (CN).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN,

(54) Title: BIAS SCHEME FOR SINGLE-DEVICE SYNAPTIC ELEMENT

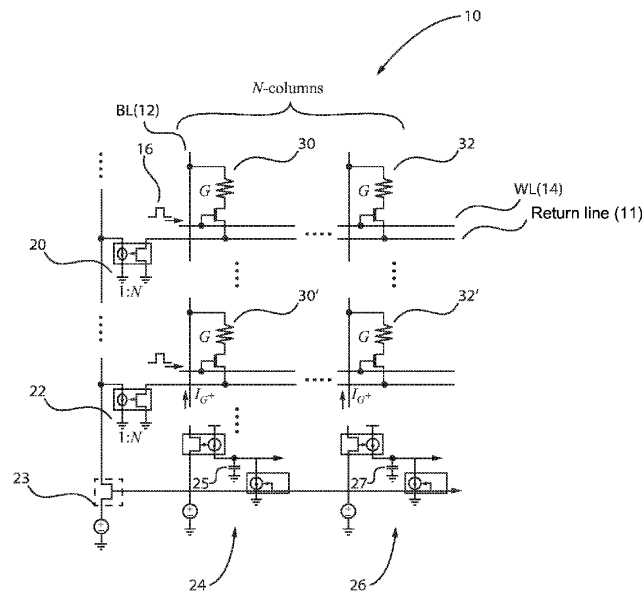


FIG. 2

(57) Abstract: A neuromorphic synapse array includes a plurality of synaptic array cells being connected by circuitry such that the synaptic array cells are assigned to rows and columns of an array, the synaptic array cells respectively having a single polarity synapse weight, the rows respectively connected to respective input ends of the synaptic array cells, the columns respectively connected to respective output ends of the synaptic array cells, the synaptic array cells aligned in a column of the array being defined as operation column arrays and an array of current mirrors, each current mirror exhibiting a mirror ratio of N: 1, wherein N is a number of columns of the synaptic array cells, respectively connected to the respective rows such that weights corresponding to all of the current mirrors are set to average weights of all of the synaptic array cells that are updated during a learning phase.

[Continued on next page]

HR, HU, ID, IL, IN, IR, IS, IT, JO, JP, KE, KG, KH, KN,
KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD,
ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO,
NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW,
SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))