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(54) Title: ANOMALY DETECTION USING DEEP LEARNING ON TIME SERIES DATA

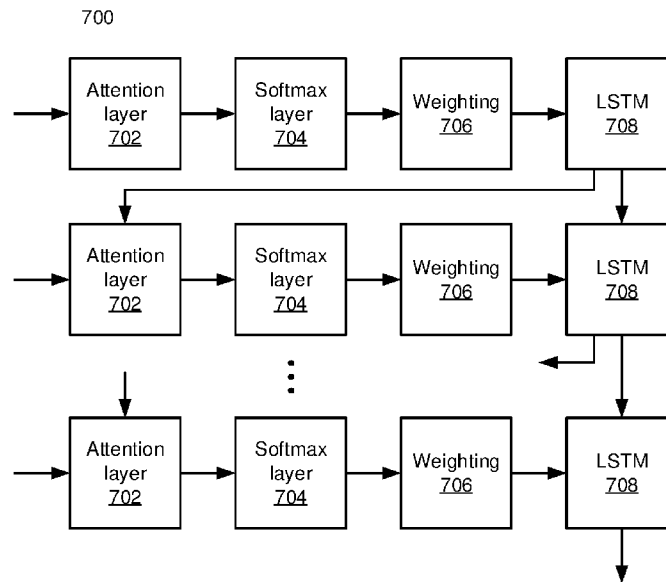


FIG. 7

(57) Abstract: Methods and systems for detecting and correcting anomalies include comparing (204) a new time series segment, generated by a sensor in a cyber-physical system, to previous time series segments of the sensor to generate a similarity measure for each previous time series segment. It is determined (206) that the new time series represents anomalous behavior based on the similarity measures. A corrective action is performed (208) on the cyber-physical system to correct the anomalous behavior.



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).

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A. CLASSIFICATION OF SUBJECT MATTER**G06F 16/245(2019.01)i, G06F 16/22(2019.01)i, G05B 23/02(2006.01)i, G06N 3/08(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G06F 16/245; G05B 9/02; G06F 15/18; G06K 9/62; G06N 3/12; G06N 5/04; G06N 7/00; G06F 16/22; G05B 23/02; G06N 3/08

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: time series, segment, similarity, anomalies, hash code, distance

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2012-0041575 A1 (SHUNJI MAEDA et al.) 16 February 2012 paragraphs [0002]-[0015], [0065]-[0074], [0086]-[0088], [0063]-[0069], [0118]-[0154] and figure 1	1-6, 8-16, 18-20
A		7, 17
Y	US 2016-0210556 A1 (ANODOT LTD.) 21 July 2016 paragraphs [0014]-[0018], [0090], [0109] and figure 1	1-6, 8-16, 18-20
Y	US 2014-0201126 A1 (LOTFI A. ZADEH et al.) 17 July 2014 paragraphs [1815], [1822], [2486] and figure 208	8-9, 18-19
A	KR 10-2017-0078252 A (SAMSUNG SDS CO., LTD.) 07 July 2017 paragraphs [0005]-[0007], [0027]-[0045] and figure 1	1-20
A	LUIS MARTI et al., `YASA: Yet Another Time Series Segmentation Algorithm for Anomaly Detection in Big Data Problems`, Conference Paper, 11 November 2014, DOI: 10.1007/978-3-319-07617-1_61, pp. pp. 697-708 [Retrieved on: 2020.03.11]. Retrieved from the Internet: <URL: https://www.researchgate.net/publication/262486029> pages 697-708	1-20

 Further documents are listed in the continuation of Box C. See patent family annex.

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"&" document member of the same patent family

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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