



- (51) International Patent Classification:
G01S 15/88 (2006.01) G01S 15/89 (2006.01)
- (21) International Application Number:
PCT/US2019/055435
- (22) International Filing Date:
09 October 2019 (09.10.2019)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
62/743,768 10 October 2018 (10.10.2018) US
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(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, HR, HU, ID, IL, IN, IR, IS, 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, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, 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,

(54) Title: THREE-DIMENSIONAL FORWARD-LOOKING SONAR TARGET RECOGNITION WITH MACHINE LEARNING

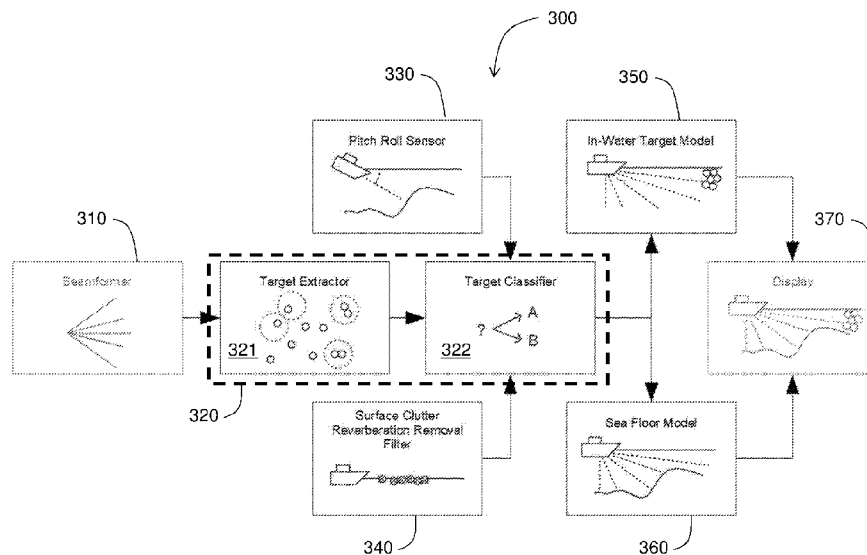


FIG. 3

(57) Abstract: Machine learning algorithms can interpret three-dimensional sonar data to provide more precise and accurate determination of seafloor depths and in-water target detection and classification. The models apply architectures for interpreting volumetric data to three-dimensional forward-looking sonar data. A baseline set of training data is generated using traditional image and signal processing techniques, and used to train and evaluate a machine learning model, which is further improved by additional inputs to improve both seafloor and in-water target detection.



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))*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

(88) Date of publication of the international search report:

13 August 2020 (13.08.2020)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 19/55435

A. CLASSIFICATION OF SUBJECT MATTER

IPC - G01S 15/88; G01S 15/89 (2020.01)

CPC - G01S 15/88; G01S 15/89; G01S15/66; G01S 15/87; G01S15/96

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)
See Search History document

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2017/0371039 A1 (NAVICO HOLDING AS) 28 December 2017 (28.12.2017) entire document, especially: para [0005], [0043], [0046]-[0048], [0054], [0071], [0078], [0090]-[0102], [0116]	1-5, 7-17, 19-23, 25-27 ----- 6, 18, 24
Y	"Convolutional neural network-based real-time ROV detection using forward-looking sonar image" (Kim et al.) 2016 IEEE/OES Autonomous Underwater Vehicles (AUV) published on 09 November 2016 (09.11.2016) retrieved from the internet at: [http://srv.uib.es/public/AUV2016/pdf/10.3.pdf] entire document, especially: p 396, left col, para 4; p 398, left col, para 4; p 398, right col, para 3	6, 18, 24
A	US 7,355,924 B2 (Zimmerman et al.) 08 April 2008 (08.04.2008) entire document	1-27
A	US 6,449,215 B1 (Shell) 10 September 2002 (10.09.2002) entire document	1-27

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

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
27 May 2020

Date of mailing of the international search report
25 JUN 2020

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