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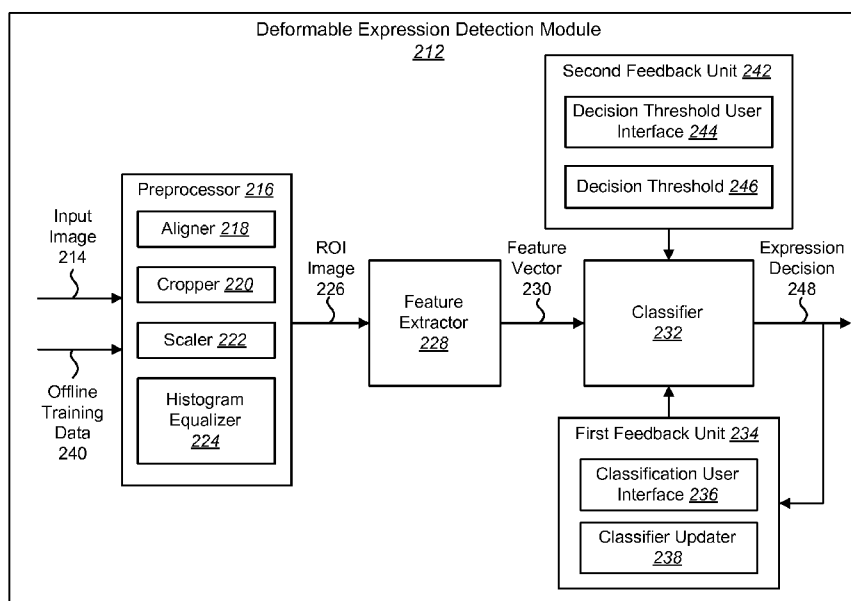
(81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, 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.

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Declarations under Rule 4.17:

— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))

[Continued on next page]

(54) **Title:** DEFORMABLE EXPRESSION DETECTOR**FIG. 2**

(57) **Abstract:** A method for deformable expression detection is disclosed. For each pixel in a preprocessed image, a sign of a first directional gradient component and a sign of a second directional gradient component are combined to produce a combined sign. Each combined sign is coded into a coded value. An expression in an input image is detected based on the coded values.



- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))* — *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))*

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INTERNATIONAL SEARCH REPORT

International application No

PCT/US2014/042162

A. CLASSIFICATION OF SUBJECT MATTER

INV. G06K9/00 G06K9/62
ADD.

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)
G06K

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

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

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GRITTI T ET AL: "Local features based facial expression recognition with face registration errors", 8TH IEEE INTERNATIONAL CONFERENCE ON AUTOMATIC FACE & GESTURE RECOGNITION, FG '08, 17-19 SEPT. 2008, IEEE, PISCATAWAY, NJ, USA, 17 September 2008 (2008-09-17), pages 1-8, XP031448415, ISBN: 978-1-4244-2153-4 abstract section 3.1 and 3.2 ----- -/--	1-8, 20-22, 30-32, 40-42

☒ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

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"P" document published prior to the international filing date but later than the priority date claimed

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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INTERNATIONAL SEARCH REPORT

International application No

PCT/US2014/042162

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	SEONYOUNG LEE ET AL: "HOG feature extractor circuit for real-time human and vehicle detection", TENCON 2012 - 2012 IEEE REGION 10 CONFERENCE, IEEE, 19 November 2012 (2012-11-19), pages 1-5, XP032309614, DOI: 10.1109/TENCON.2012.6412287 ISBN: 978-1-4673-4823-2 figure 4	1-8, 20-22, 30-32, 40-42
A	----- TAM PHUONG CAO ET AL: "Real-Time Vision-Based Stop Sign Detection System on FPGA", COMPUTING: TECHNIQUES AND APPLICATIONS, 2008. DICTA '08.DIGITAL IMAGE, IEEE, PISCATAWAY, NJ, USA, 1 December 2008 (2008-12-01), pages 465-471, XP031371914, ISBN: 978-0-7695-3456-5 Section 3.2.1	1-8, 20-22, 30-32, 40-42
X	----- KAIMIN YU ET AL: "Harvesting Web Images for Realistic Facial Expression Recognition", DIGITAL IMAGE COMPUTING: TECHNIQUES AND APPLICATIONS (DICTA), 2010 INTERNATIONAL CONFERENCE ON, IEEE, PISCATAWAY, NJ, USA, 1 December 2010 (2010-12-01), pages 516-521, XP031853222, ISBN: 978-1-4244-8816-2 abstract; figure 3 Section 4.2.2 & TIMO AHONEN ET AL: "Face Recognition with Local Binary Patterns", 22 April 2004 (2004-04-22), COMPUTER VISION - ECCV 2004; [LECTURE NOTES IN COMPUTER SCIENCE;;LNCS], SPRINGER-VERLAG, BERLIN/HEIDELBERG, PAGE(S) 469 - 481, XP019005797, ISBN: 978-3-540-21984-2 Section 2; figure 2 ----- -/--	1,9-20, 23-30, 33-40, 43-49

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2014/042162

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JIAN-GANG WANG ET AL: "Active Learning for Solving the Incomplete Data Problem in Facial Age Classification by the Furthest Nearest-Neighbor Criterion", IEEE TRANSACTIONS ON IMAGE PROCESSING, IEEE SERVICE CENTER, PISCATAWAY, NJ, US, vol. 20, no. 7, 1 July 2011 (2011-07-01), pages 2049-2062, XP011374277, ISSN: 1057-7149, DOI: 10.1109/TIP.2011.2106794 last 10 lines on the right-hand column on p. 2049 -----	9-19, 23-29, 33-39, 43-49
X	VALERIA TOMASELLI ET AL: "Low complexity smile detection technique for mobile devices", PROCEEDINGS OF SPIE, vol. 8661, 6 March 2013 (2013-03-06), XP055164400, ISSN: 0277-786X, DOI: 10.1117/12.2002449 abstract; figures 1,3,6,7 Eq. (2) -----	1-21, 23-31, 33-41, 43-49

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/042162

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-8, 20-22, 30-32, 40-42

Image normalization for facial expression recognition.

2. claims: 9-19, 23-29, 33-39, 43-49

On-line image classifier training.
