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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 November 2014

(54) Title: A METHOD AND APPARATUS FOR MOTION ESTIMATION

Figure 8

(57) Abstract: A method of estimating motion between a pair of image frames of a given scene comprises calculating respective integral images for each of the image frames and selecting at least one corresponding region of interest within each frame. For each region of interest, an integral image profile from each integral image is calculated, each profile comprising an array of elements, each element comprising a sum of pixel intensities from successive swaths of the region of interest for the frame. Integral image profiles are correlated to determine a relative displacement of the region of interest between the pair of frames. Each region of interest is divided into a plurality of further regions of interest before repeating until a required hierarchy of estimated motion for successively divided regions of interest is provided.

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/055125

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06T7/20 H04N19/51
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)
G06T H04N

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)
EPO-Internal , COMPENDEX, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	NGUYEN V A ET AL: "Fast Block-Based Motion Estimation Using Integral Frames", IEEE SIGNAL PROCESSING LETTERS, IEEE SERVICE CENTER, PISCATAWAY, NJ, US, vol. 11, no. 9, 1 September 2004 (2004-09-01), pages **744-747,** XP011117267, ISSN: 1070-9908, DOI: 10.1109/LSP.2004.833500	1-7, 15-17, 22-24
A	abstract sections II, III figures 3(d,f,h)	10, 11

-/- .

[X] Further documents are listed in the continuation of Box C.

[X] 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" documentwhich may throw doubts on priority claim(s) orwhich is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

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

"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

"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

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 June 2014	23/09/2014

Name and mailing address of the ISA/	Authorized officer
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Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/055125

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	KEN SAUER ET AL: "Efficient Block Motion Estimation Using Integral Projections", IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, IEEE SERVICE CENTER, PISCATAWAY, NJ, US, vol. 6, no. 5, 1 October 1996 (1996-10-01), XP011014326, ISSN: 1051-8215	1,2,5, 15-17, 22-24
A	abstract sections 11-A, 11-B	10, 11

Y	US 6 130 912 A (CHANG CHING-FANG [US] ET AL) 10 October 2000 (2000-10-10)	1-7, 15-17, 22-24
A	abstract figures 2,3,5 column 2, lines 50-65 column 3, lines 36-54 column 6, line 23 - column 7, line 4 column 9, lines 1-51 claim 1	10, 11

A	LAI M M L ET AL: "Coding of image sequences using coarse quantization and feature based hierarchical block matching", IMAGE PROCESSING AND ITS APPLICATIONS, 1992., INTERNATIONAL CONFERENCE ON MAASTRICHT, NETHERLANDS, LONDON, UK, IEE, UK, 1 January 1992 (1992-01-01), pages 586-589, XP006500245, ISBN: 978-0-85296-543-6 section "The coding algorithm"	1-7, 10, 11, 15-17, 22-24

A	NAM K M ET AL: "A FAST HIERARCHICAL MOTION VECTOR ESTIMATION ALGORITHM USING MEAN PYRAMID", IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, IEEE SERVICE CENTER, PISCATAWAY, NJ, US, vol. 5, no. 4, 1 August 1995 (1995-08-01), pages 344-351, XP000528335, ISSN: 1051-8215, DOI: 10.1109/76.465087 section II	1-7, 10, 11, 15-17, 22-24

A	JAYANT KUMAR ET AL: "Fast Rule-Line Removal Using Integral Images and Support Vector Machines", 2011 INTERNATIONAL CONFERENCE ON DOCUMENT ANALYSIS AND RECOGNITION, 1 September 2011 (2011-09-01), pages 584-588, XP055126004, DOI: 10.1109/ICDAR.2011.123 ISBN: 978-1-45-771350-7 section 11-A	1-7, 10, 11, 15-17, 22-24

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2014/055125

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.:

1-7, 10, 11, 15-17, 22-24

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: 1-7, 10, 11, 15-17, 22-24

   motion estimation based on integral image profiles

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2. claims: 8, 9, 18-20

   division into sub-regions and estimation of their displacement in the case where more than one displacement within the region of interest is determined

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3. claims: 12, 21

   motion estimation of regions of interest based on the measurements provided by a camera motion sensor

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4. claims: 13, 14

   determination of a geometrical transformation based on an array of motion vectors

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2014/055125

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6130912 A	10-10-2000	AT 537660 T	15-12-2011
		AU 4225199 A	30-12-1999
		EP 1086580 A1	28-03-2001
		JP 4528441 B2	18-08-2010
		JP 2002518897 A	25-06-2002
		US 6130912 A	10-10-2000
		WO 9965232 A1	16-12-1999