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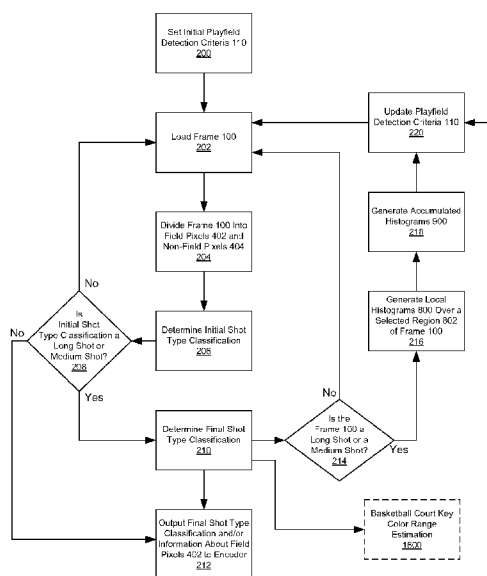
(54) Title: PLAYFIELD DETECTION AND SHOT CLASSIFICATION IN SPORTS VIDEO

FIG. 2

(57) Abstract: A method of classifying the shot type of a video frame, comprising loading a frame, dividing the frame into field pixels and non-field pixels based on a first playfield detection criteria, determining an initial shot type classification using the number of the field pixels and the number of the non-field pixels, partitioning the frame into one or more regions based on the initial classification, determining the status of each of the one or more regions based upon the number of the field pixels and the non-field pixels located within each the region, and determining a shot type classification for the frame based upon the status of each the region.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/022152

A. CLASSIFICATION OF SUBJECT MATTER INV. G06T7/40 G06K9/00 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 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) EPO-Internal		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EKIN A ET AL: "Shot type classification by dominant color for sports video segmentati on and summarizati on", PROCEEDINGS OF INTERNATIONAL CONFERENCE ON ACOUSTICS, SPEECH AND SIGNAL PROCESSING (ICASSP'03) 6-10 APRIL 2003 HONG KONG, CHINA; [IEEE INTERNATIONAL CONFERENCE ON ACOUSTICS, SPEECH, AND SIGNAL PROCESSING (ICASSP)], IEEE, 2003 IEEE INTERNATIONAL CONFE, vol . 3, 6 April 2003 (2003-04-06) , pages III_173-III_176, XP010639037, DOI: 10.1109/ICASSP.2003.1199135 ISBN: 978-0-7803-7663-2	1-4,6-8, 12-14
A	abstract secti ons 2 and 3 figure 3 ----- -/- .	11
☒ 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) on which 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 2 July 2014		Date of mailing of the international search report 22/09/2014
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Angel opoul ou, Mari a

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2014/022152

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PENG XU ET AL: "Algori thms and system for segmentati on and structure analysi s in soccer video" , MULTIMEDIA AND EXPO, 2001 . ICME 2001 . IEEE INTERNATIONAL CONFERENCE ON, ADVANCED DISTRIBUTED LEARNING, 22 August 2001 (2001-08-22) , pages 721-724, XP032177085 , DOI : 10.1109/ICME. 2001 .1237823 ISBN : 978-0-7695-1198-6 secti on 3 -----	1-4, 12-14
X	US 2003/063798 A1 (LI BAOXIN [US] ET AL) 3 April 2003 (2003-04-03)	1, 5, 9, 10
A	paragraphs [0049] , [0050] , [0061] , [0069] , [0072] figure 7 -----	11, 14
A	ZHOU W ET AL: "RULE-BASED VIDEO CLASSIFICATION SYSTEM FOR BASKETBALL VIDEO INDEXING" , PROCEEDINGS ACM MULTIMEDIA 2000 WORKSHOPS. MARINA DEL REY, CA, NOV. 4, 2000; [ACM INTERNATIONAL MULTIMEDIA CONFERENCE] , NEW YORK, NY : ACM, US, vol . CONF. 8, 4 November 2000 (2000-11-04) , pages 213-216, XP001003729 , DOI : 10.1145/357744.357941 ISBN : 978-1-58113-311-0 the whol e document -----	1-14
A	Soo-Chang Pei ET AL: "Semanti c Scenes Detecti on and Classi ficati on in Sports Videos" , 16th I PPR Conference on Computer Vi sion, Graphi cs and Image Processi ng (CVGIP 2003) , 17 August 2003 (2003-08-17) , pages 210-217 , XP055124895 , Retri eved from the Internet: URL: http://roboti cs.csi e.ncku.edu. tw [retri eved on 2014-06-24] the whol e document -----	1-14
A	Anonymous : "Otsu 's method - wi ki pedi a , the free encycl opedi a" , , 28 February 2013 (2013-02-28) , XP055125194, Retri eved from the Internet: URL: http://en .wi ki pedi a.org/w/i ndex.php?ti tle=Otsu%27s _method&ol di d=541198190 [retri eved on 2014-06-25] the whol e document -----	13
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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/022152

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Anonymous: "Point Operations - Logical OR/NOR", , 19 December 2012 (2012-12-19) , XP055125185 , Retrieved from the Internet: URL: https://web.archive.org/web/20121219105946/http://homepages.inf.ed.ac.uk/rbf/HIPR2/or.htm [retrieved on 2014-06-25] the whole document -----	10
A	Anonymous: "How to find RGB/HSV color parameters for color tracking? - Stack Overflow", , 16 April 2010 (2010-04-16) , XP055125819 , Retrieved from the Internet: URL: https://web.archive.org/web/20100416173748/http://stackoverflow.com/questions/1518761/how-to-find-rgb-hsv-color-parameters-for-color-tracking [retrieved on 2014-06-30] section starting "As far as I understand. . ." -----	14

INTERNATIONAL SEARCH REPORT

International application No.
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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. :

1-14

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: 1-14

Generating accumulated histograms and updating the detection criteria by narrowing the current detection criteria to fit the accumulated histogram peaks; applying second playfield detection criteria with a color range that is different from that of the first detection criteria, and merging the field pixels obtained from the first and second detection criteria; generating a binary mask based on the division of the frame into field and non-field pixels; generating a binary mask based on a logical combination of multiple masks, each generated by dividing the frame in field/non-field pixels using different color ranges; calculating the standard deviation values of the hue of field and non-field pixels, comparing the standard deviation of field and non-field pixels by computing the ratio of standard deviation values and comparing that ratio to a threshold value; obtaining a value component threshold by applying Otsu's method; finding a first and a second threshold, $S1$ and $S2$, such that the sum of values of the accumulated histogram that are between 0 and $S1/S2$ is not less than $T1$ and $T2$, respectively, and returning the histogram index corresponding to the minimum point between $S1$ and $S2$ as the "value component threshold".

2. claims: 15-19

Determining the camera view angle, generating a seed mask, generating a local histogram of the mask pixels of the seed mask, accumulating the local histograms for each camera view and determining, based on the accumulated histogram, one or more color ranges for the key area of a basketball court.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2014/022152

Patent document cited in search report	Publication date	Patent family member(s)	Publication date	
US 2003063798	A1	03-04-2003	US 2003063798 A1	03-04--2003
			US 2005114908 A1	26-05--2005
			US 2005117020 A1	02-06--2005
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