(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
22 January 2015 (22.01.2015)

WIPO | PCT

(10) International Publication Number
WO 2015/006922 Al

(51) International Patent Classification:
H04N 19/00 (2014.01)

(21) International Application Number:
PCT/CN20 13/079468

(22) International Filing Date:
16 July 2013 (16.07.2013)

(25) Filing Language: English

(26) Publication Language: English

(71) Applicant *(for all designated States except US)*: **MEDIATEK SINGAPORE PTE. LTD.** [SG/SG]; No.l Fusionopolis Walk, #03-01 Solaris, Singapore 138628 (SG).

(72) Inventors; and
(71) Applicants *(for US only)*: **AN, Jicheng** [CN/CN]; No. 44 Zhanlanguan Road, Xicheng District, Beijing 100037 (CN). **ZHANG, Kai** [CN/CN]; A l 101, Dongfang Yujinxiang Building, No. 216 Tangli Road, Chaoyang District, Beijing 100013 (CN). **LIN, Jian-Liang** [CN/CN]; No. 133, Neipi Rd., Nanjian Vil. Su'ao Township, Yilan County, Taiwan 270 (CN).

(74) Agent: **BEIJING SANYOU INTELLECTUAL PROPERTY AGENCY LTD.;** 16th FL, Block A, Corporate Square, No. 35 Jinrong Street, Beijing 100033 (CN).

(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, 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, 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, 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, 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))*

(54) **Title:** METHODS FOR RESIDUAL PREDICTION

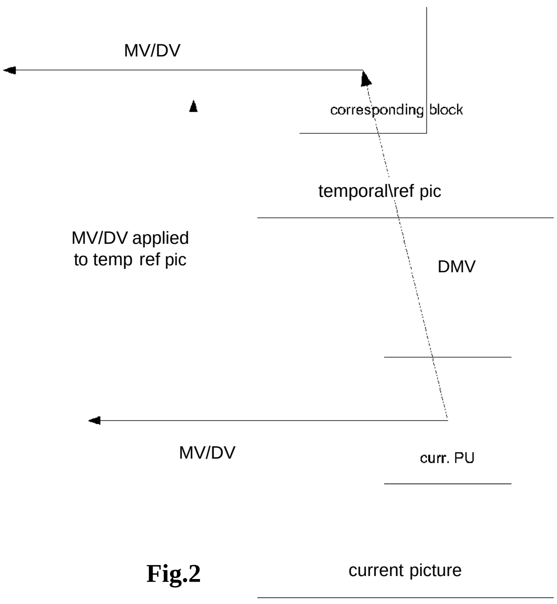

Fig.2

(57) Abstract: Methods of residual prediction for multi-view video coding and 3D video coding are disclosed. The motion (disparity) parameter of the current PU is applied to the corresponding block in a temporal reference picture in the same view to generate the reference residual.

WO 2015/006922 A1

METHODS FOR RESIDUAL PREDICTION

TECHNICAL FIELD

The invention relates generally to Three-Dimensional (3D) video processing. In particular, the present invention relates to methods for residual prediction in 3D video coding.

BACKGROUND

3D video coding is developed for encoding or decoding video data of multiple views simultaneously captured by several cameras. Since all cameras capture the same scene from different viewpoints, multi-view video data contains a large amount of inter-view redundancy. To exploit the inter-view redundancy, additional tools such as advanced residual prediction (ARP) have been integrated to conventional 3D-HEVC (High Efficiency Video Coding) or 3D-AVC (Advanced Video Coding) codec.

The basic concept of the ARP in current 3DV-HTM is illustrated in Fig. 1. In ARP, to ensure high correlation between residues of two views, motion parameter of the current prediction unit (PU) of picture in current view is applied to the corresponding block in a reference view picture to generate residual in the base view to be used for inter-view residual prediction. The corresponding block in a reference view picture is located by a derived disparity vector (DDV).

However, the current ARP is not a complete solution. Because the ARP scheme in current HTM7.0 is only applied to the motion compensated prediction but not applied to the disparity compensated prediction. Since current scheme is only applied on inter-view residual prediction, current ARP can also be called as advanced inter-view residual prediction (AIVRP).

SUMMARY

In light of the previous described problem, an advanced temporal residual prediction (ATRP) method is proposed to be applied for the disparity compensated prediction.

Other aspects and features of the invention will become apparent to those with ordinary skill in the art upon review of the following descriptions of specific embodiments.

BRIEF DESCRIPTION OF DRAWINGS

The invention can be more fully understood by reading the subsequent detailed description and examples with references made to the accompanying drawings, wherein:

Fig. 1 is a diagram illustrating the concept of current ARP;

Fig. 2 is a diagram illustrating the concept of proposed ATRP;

Fig. 3 is a diagram illustrating the derivation of the derived motion vector.

DETAILED DESCRIPTION

The following description is of the best-contemplated mode of carrying out the invention. This description is made for the purpose of illustrating the general principles of the invention and should not be taken in a limiting sense. The scope of the invention is best determined by reference to the appended claims.

When current prediction in reference list X (with X equal to 0 or 1) is the disparity compensated prediction, i.e., the MV is pointing to an inter-view reference picture, also called as a disparity vector, the proposed ATRP can be applied.

In the proposed ATRP, the motion parameter (disparity vectors) of the current PU is applied to a corresponding block in a temporal reference picture in the same view to generate the reference residual in temporal direction. The corresponding block in a temporal reference picture can be located by a derived motion vector (DMV), the DMV is the MV of one reference block in the reference view, and the reference block is located by current MV, also called as a disparity vector, or current DDV The concept of proposed ATRP is illustrated in Fig. 2, and the derivation of DMV is illustrated in Fig. 3.

Specifically, the DMV is derived as follows:

– Add the current MV/DV in list X or DDV to the middle (or other) position of current PU to obtain a sample position, and find the reference block which covers that sample location in the reference view.

- If the reference picture in list X of the reference block has the same POC as one reference picture in current reference list X,
  - o The DMV is set equal to the MV in list X of the reference block
- Else if the reference picture in list 1-X of the reference block has the same POC as one reference picture in current reference list X
  - o The DMV is set equal to the MV in list 1-X of the reference block
- Else, the DMV is set equal to a default value such as (0, 0) pointing to the temporal reference picture in list X with the smallest reference index.

Alternatively, the DMV can also be derived as follows:

- Add the current MV/DV in list X or DDV to the middle position of current PU to obtain a sample position, and find the reference block which covers that sample location in the reference view.
- If the reference picture in list X of the reference block has the same POC as one reference picture in current reference list X,
  - o The DMV is set equal to the MV in list X of the reference block
- Else, the DMV is set equal to a default value such as (0, 0) pointing to the temporal reference picture in list X with the smallest reference index.

In the above two DMV derivation methods, the DMV can be scaled to the first temporal reference picture (in term of reference index) in the reference list X.

The proposed ATRP method described above can be used in a video encoder as well as in a video decoder. Embodiments of ATRP method according to the present invention as described above may be implemented in various hardware, software codes, or a combination of both. For example, an embodiment of the present invention can be a circuit integrated into a video compression chip or program codes integrated into video compression software to perform the processing described herein. An embodiment of the present invention may also be program codes to be executed on a Digital Signal Processor (DSP) to perform the processing described herein. The invention may also involve a number of functions to be performed by a computer processor, a digital signal processor, a microprocessor, or field programmable gate array (FPGA). These processors can be configured to perform particular tasks according to the invention, by executing machine-readable software code or firmware code that defines the particular methods embodied by the invention. The software code or firmware codes may be developed in different programming languages and different format or style. The software code may also be compiled for different target platform. However, different code formats, styles and languages of software codes and other means of configuring code to perform the tasks in accordance with the invention will not depart from the spirit and scope of the invention.

The invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described examples are to be considered in all respects only as illustrative and not restrictive. To the contrary, it is intended to cover various modifications and similar arrangements (as would be apparent to those skilled in the art). Therefore, the scope of the appended claims should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangements.

CLAIMS

1. A method of residual prediction for multi-view video coding or 3D video coding.

2. The method as claimed in claim 1, a motion or disparity parameter of a current Prediction Unit PU is applied to a corresponding block in a temporal reference picture in the same view to generate a reference residual.

3. The method as claimed in claim 2, the corresponding block in the temporal reference picture is located by a derived motion vector (DMV).

4. The method as claimed in claim 3, wherein the DMV is a motion vector (MV) of one reference block in a reference view.

5. The method as claimed in claim 4, wherein the reference block is located by the MV or disparity vector of the current PU.

6. The method as claimed in claim 4, wherein the reference block is located by a derived DV (DDV) of the current PU.

7. The method as claimed in claim 3, wherein the DMV is derived according to a specific method.

8. The method as claimed in claim 3, the DMV is always scaled to a first temporal reference picture.

9. The method as claimed in claim 3, the DMV is scaled to one temporal reference picture.

10. The method as claimed in claim 4, when the DMV, the MV of a reference block in the reference view, is unavailable, a default MV is used, and the default MV is a zero MV with reference picture index=0.

11. The method as claimed in claim 3, wherein the DMV is set equal to the MV of a spatial/temporal neighboring block of the current PU.

12. The method as claimed in claim 3, wherein the DMV is signaled explicitly to a decoder.

13. The method as claimed in claim 2, wherein the corresponding block in a temporal reference picture is a co-located bock with a derived motion vector equals to zero.

14. The method as claimed in claim 1 is applied when current prediction is disparity compensated prediction.

15. The method as claimed in claim 1 cannot be applied when current

prediction is motion compensated prediction.

16. The method as claimed in claim 2, the reference residual is used to predict a residual of disparity compensated prediction.

17. The method as claimed in claim 1, a flag is signaled in each Coding Unit (CU) or PU to control the on/off/weighting of Advanced Residual Prediction (ARP), when the flag is enabled and motion compensated prediction is performed, advanced inter-view residual prediction (AIVRP) is applied, when the flag is enabled and the disparity compensated prediction is performed, advanced temporal residual prediction (ATRP) is applied.

18. The method as claimed in claim 1, wherein a flag is signaled in a bitstream to control On/Off/weighting.

19. The method as claimed in claim 17, wherein the flag is explicitly signaled in a sequence, view, picture or slice level, and slice header, or the flag is signaled in sequence parameter set (SPS), video parameter set (VPS), or adaptive parameter set (APS).

20. The method as claimed in claim 17, the flag is implicitly derived.

21. The method as claimed in claim 17, a weighting parameter is used to control the weighting of the reference residual.

22. The method as claimed in claim 21, the weighting is ½ and the reference residual is divided by 2.

23. The method as claimed in claim 1, the on/off/weighting flag is inherited in merge mode.

24. The method as claimed in claim 23, when a merge candidate is chosen, in addition to the motion parameters, the on/off control/weighting flag is also inherited from a selected candidate.

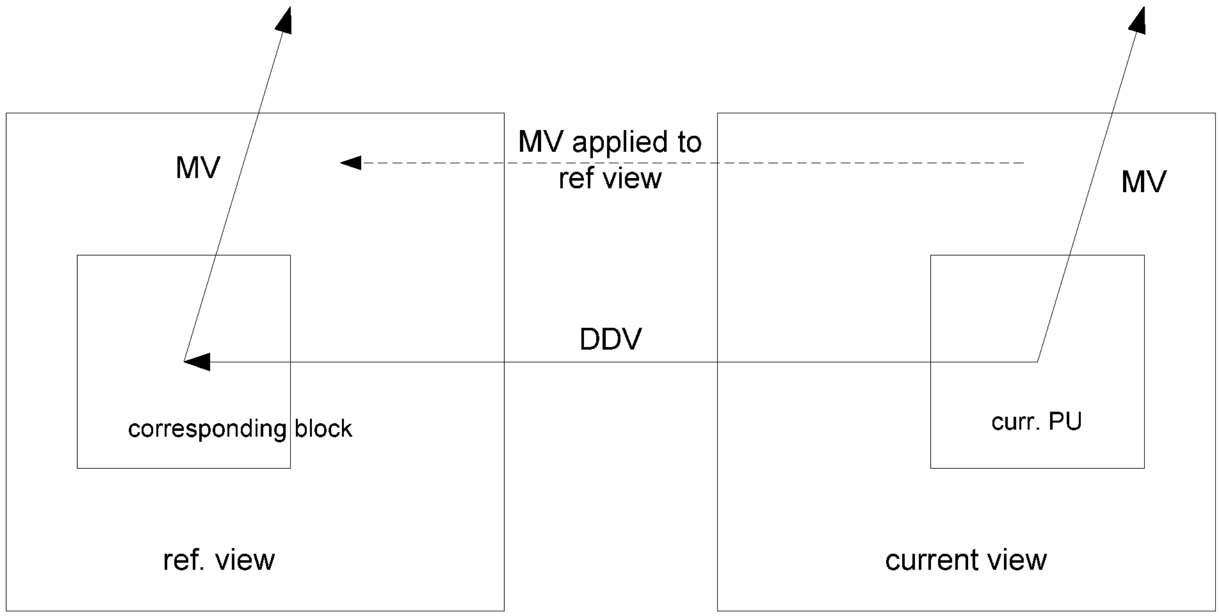
MV
MV applied to
ref view
MV
DDV
corresponding block
curr. PU
ref. view
current view

Fig.1

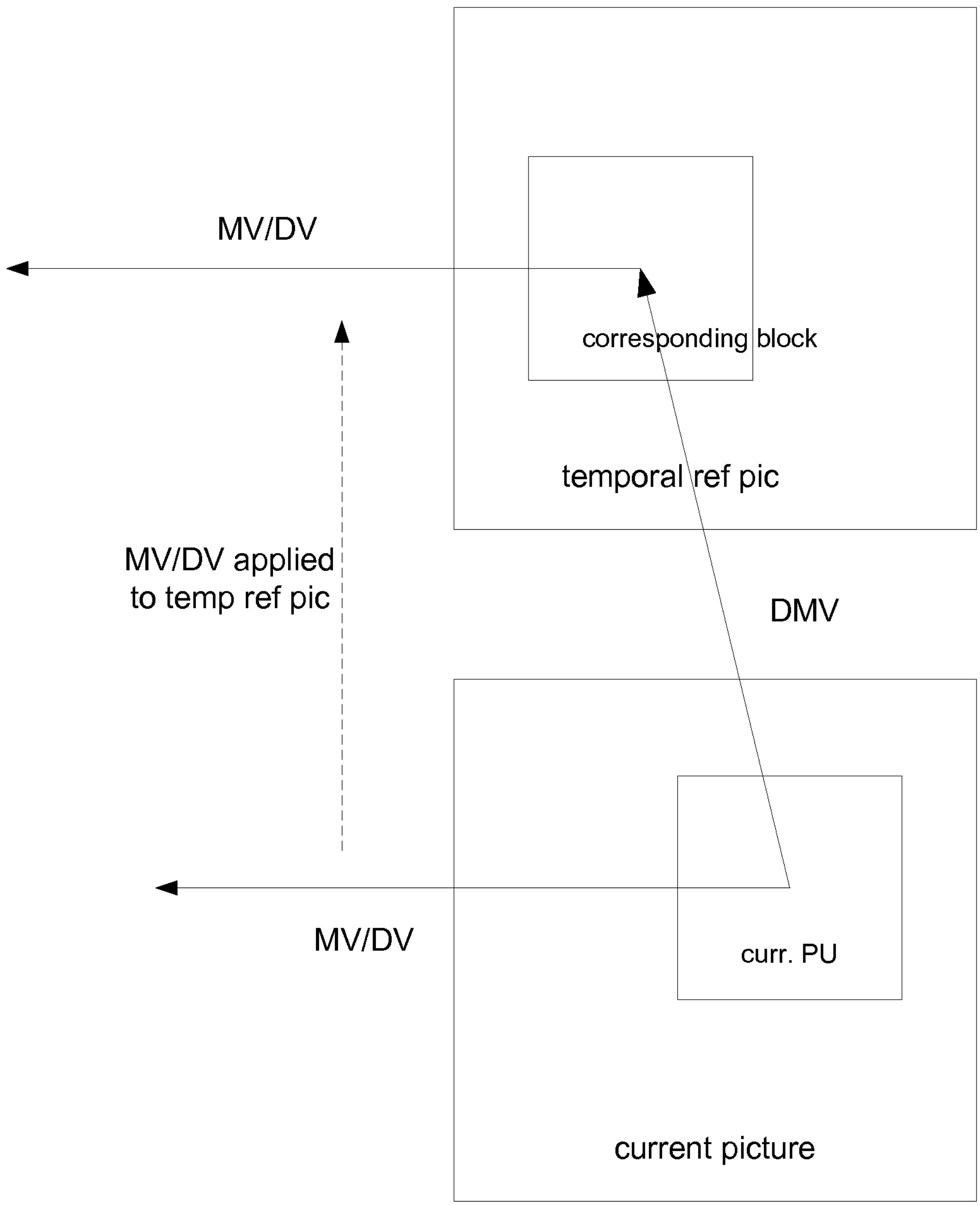
MV/DV
corresponding block
temporal ref pic
MV/DV applied
to temp ref pic
DMV
MV/DV
curr. PU
current picture

Fig.2

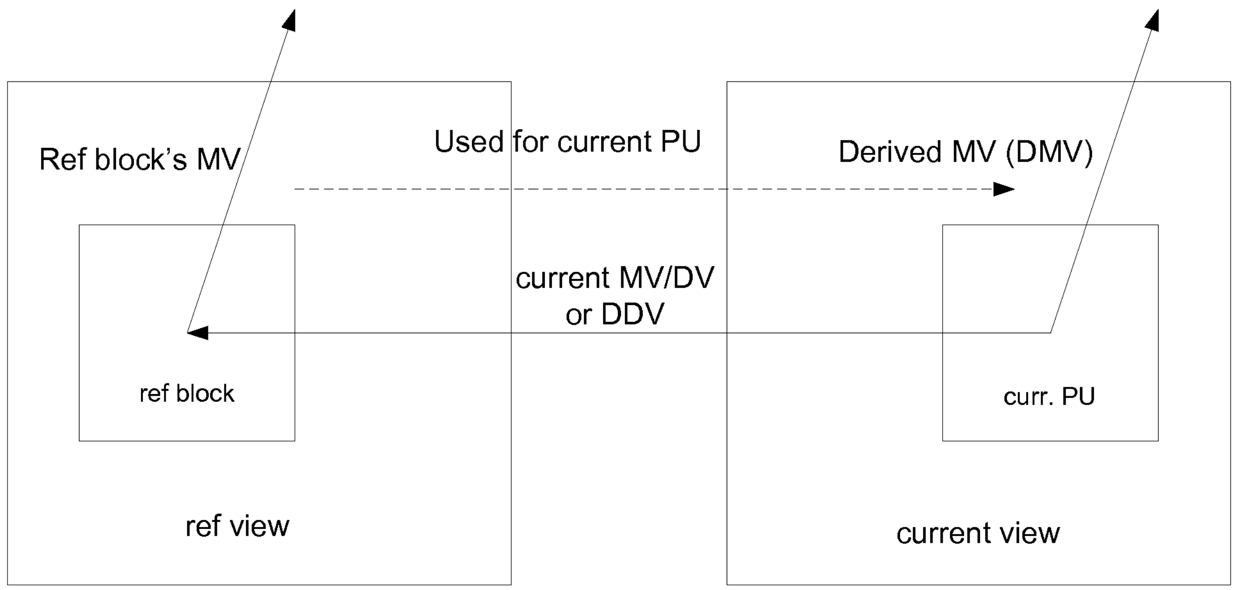
Ref block's MV
Used for current PU
Derived MV (DMV)
current MV/DV
or DDV
ref block
curr. PU
ref view
current view

Fig.3

INTERNATIONAL SEARCH REPORT	International application No. **PCT/CN2013/079468**

A. CLASSIFICATION OF SUBJECT MATTER

H04N 19/00(2014.01)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)

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)

WPI,EPODOC,CNKI,IEEE,CNPAT:residual,predict+,three dimension,3D

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 101690231A (THOMSON LICENSING) 31 March 2010 (2010-03-31) description, page 1 lines 13-18, page 7 line 4 to page 8 line 12, and claims 7, 9, 13, 15	1, 14, 15, 18, 23, 24
Y	CN 101690231A (THOMSON LICENSING) 31 March 2010 (2010-03-31) description, page 1 lines 13-18, page 7 line 4 to page 8 line 12, and claims 7, 9, 13, 15	2-9, 11, 12, 16
Y	ANTHONY Vetro et al. "Overview of the Stereo and Multiview Video Coding Extensions of the H.264/MPEG-4 AVC Standard" *PROCEEDINGS OF THE IEEE (2011)*, 31 December 2011 (2011-12-31), page 8 left column lines 18-20, lines 33-37	2-9, 11, 12, 16
Y	US 2006133485A1 (PARK, SEUNG WOOK ET AL.) 22 June 2006 (2006-06-22) the whole document	1-24
Y	CN 102598667A (THOMSON LICENSING) 18 July 2012 (2012-07-18) the whole document	1-24

☐ 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)
- "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
28 March 2013	**23 April 2014**
Name and mailing address of the ISA/ **STATE INTELLECTUAL PROPERTY OFFICE OF THE P.R.CHINA(ISA/CN)** **6,Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China** **100088 China**	Authorized officer **CHEN,Ronghua**
Facsimile No. **(86-10)62019451**	Telephone No. **(86-10)61648252**

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2013/079468

Patent document cited in search report	Publication date (day/monfh/year)	Patent family member(s)	Publication date (day/month/year)
CN 101690231A	31 March 2010	EP 2168380A2	31 March 2010
		US 2010135388A1	03 June 2010
		JP 2010531622A	24 September 2010
		CN 101690230A	31 March 2010
		WO 2009005658A2	08 January 2009
		KR 20100030625A	18 March 2010
		WO 2009005626A2	08 January 2009
		wo 2009005658A3	14 May 2009
		KR 20100032390A	25 March 2010
		US 20101 18942A1	13 May 2010
		wo 2009005626A3	22 May 2009
		EP 2168383A2	31 March 2010
		JP 2010531623A	24 September 2010
US 2006133485A1	22 June 2006	US 7733963B2	08 June 2010
		us 8054890B2	08 November 2011
		us 2009190669A1	30 July 2009
		KR 101003430B1	23 December 2010
		KR 100893868B1	20 April 2009
		US 2009060050A1	05 March 2009
		us 7835452B2	16 November 2010
		KR 2009003 1537A	26 March 2009
		KR 20080079633A	01 September 2008
		KR 100888962B1	17 March 2009
		US 2O09190658A1	30 July 2009
		KR 2O060063612A	12 June 2006
CN 102598667A	18 July 2012	JP 2013504972A	07 February 2013
		US 2012170652A1	05 July 2012
		EP 2478702A1	25 July 2012
		KR 20120060886A	12 June 2012
		WO 2011031332A1	17 March 201 1