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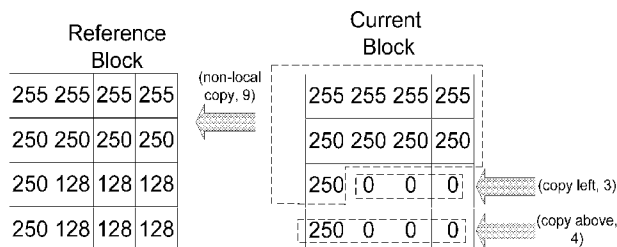


FIG.4

(57) Abstract: Several improvements for non-local index prediction methods are proposed. By utilizing these improvements, the performance of non-local index prediction method is improved.

IMPROVEMENTS FOR NON-LOCAL INDEX PREDICTION

TECHNICAL FIELD

The invention relates generally to video/image processing. In particular, the presented invention relates to palette coding.

5

BACKGROUND

In the current HEVC screen content coding extensions draft specification [1], palette mode was adopted to efficiently compress the texts and graphics in screen contents. The basic idea behind a palette mode is that the samples in the CU are represented by a small set of representative color values. This set is referred to as the palette. It is also possible to indicate a sample that is outside the palette by signaling an escape symbol followed by (possibly quantized) component values. This is illustrated in Fig.1.

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Each sample in the block is assigned the index of the nearest (in SAD) palette entry. The palette indices are coded using two main modes: 'INDEX' and 'COPY_ABOVE'. The escape symbol is also signaled as an 'INDEX' mode. It is assigned an index equal to the maximum palette size. The mode is signaled using a flag except for the top row or when the previous mode was 'COPY_ABOVE'. In the 'COPY_ABOVE' mode, the palette index of the sample in the row above is copied. In the 'INDEX' mode, the palette index is explicitly signaled. For both 'INDEX' and 'COPY_ABOVE' modes, a run value is signaled which specifies the number of subsequent samples that are also coded using the same mode. When escape symbol is part of the run in 'INDEX' or 'COPY_ABOVE' mode, the escape component values are signaled for each escape symbol. The coding of palette indices is illustrated in Fig.

2.

The 'COPY_ABOVE' mode in PLT mode only takes the palette index of the sample in the row above into account. There are a large number of non-local duplicated contents in screen pictures as depicted in Fig.3. Thus a lot of non-local repeated indices can be observed in the whole picture.

The 'COPY_ABOVE' mode cannot deal with non-local duplicated indexes efficiently.

SUMMARY

5 In light of the previously described problems, non-local index prediction methods are proposed.

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.

10 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 an example of a block coded in palette mode;
- 15 Fig.2 is a diagram illustrating the coding manner of palette indices;
- Fig.3 is a diagram illustrating the non-local repeated patterns in screen contents;
- Fig.4 is a diagram illustrating non-local index prediction method.

DETAILED DESCRIPTION

20 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.

Several improved non-local index prediction (NIP) methods are proposed. In the
25 original NIP methods, non-local index map can be used to predict the index map of the current block, as shown in Fig 4.

In one embodiment, the reconstructed indices with the coded run length can be obtained by copying from the indices in the reference block.

In another embodiment, the reconstructed samples with the coded run length can be obtained by copying from the samples in the reference block.

In still another embodiment, each pixel can choose copy-left method, copy-above method, and non-local index prediction method. Several flags can be coded to represent the chosen result. A decoder can infer the chosen result for the current pixel implicitly.

In still another embodiment, the flags used to represent the chosen results can be CABAC coded or context coded. The flags of neighboring pixels also can be used as contexts for the current flag.

In still another embodiment, the current pixel cannot choose the non-local index prediction method if the previous one pixel selects the non-local index prediction method.

In still another embodiment, the current pixel cannot choose the non-local index prediction method if the previous one pixel selects the non-local index prediction method.

One or more bits are coded for each run to indicate whether the coded run is the last run of the current block.

Since some samples are unavailable in the parsing process, index redundancy removal cannot be performed for those samples. To solve this problem, coding one or more additional refinement bits is performed and index redundancy removal can be always performed for all samples.

In one embodiment, if the parsed out index is equal to MAX_INDEX-1, one additional refinement bit should be parsed. If the refinement bit is equal to 1, the reconstructed index is MAX_INDEX-1. Otherwise, the reconstructed index is MAX_INDEX-2.

Since some samples are unavailable in the parsing process, index redundancy removal cannot be performed for those samples. To solve this problem, coding all run type flags before coding all indices is proposed. And index redundancy removal is not performed for NIP samples.

An exemplary syntax structure is described as below.

7.3.8.8 Palette syntax

palette_coding(x0, y0, nCbS) {	Descriptor
----------------------------------	-------------------

palettePredictionFinished = 0	
NumPredictedPaletteEntries = 0	
for(i = 0; i < PredictorPaletteSize && !palettePredictionFinished && NumPredictedPaletteEntries < palette_max_size; i++) {	
palette_predictor_run	ue(v)
if(palette_predictor_run != 1) {	
if(palette_predictor_run > 1)	
i += palette_predictor_run - 1	
PalettePredictorEntryReuseFlag[i] = 1	
NumPredictedPaletteEntries++	
} else	
palettePredictionFinished = 1	
}	
if(NumPredictedPaletteEntries < palette_max_size)	
num_signalled_palette_entries	ue(v)
numComps = (ChromaArrayType == 0) ? 1 : 3	
for(cIdx = 0; cIdx < numComps; cIdx++)	
for(i = 0; i < num_signalled_palette_entries; i++)	
palette_entry	ae(v)
if(CurrentPaletteSize != 0)	
palette_escape_val_present_flag	ae(v)
if(palette_escape_val_present_flag) {	
if(cu_qp_delta_enabled_flag && !IsCuQpDeltaCoded) {	
cu_qp_delta_palette_abs	ae(v)
if(cu_qp_delta_palette_abs)	
cu_qp_delta_palette_sign_flag	ae(v)
}	
if(cu_chroma_qp_offset_enabled_flag && !IsCuChromaQpOffsetCoded)	
{	
cu_chroma_qp_palette_offset_flag	ae(v)
if(cu_chroma_qp_offset_flag && chroma_qp_offset_list_len_minus1 > 0)	
cu_chroma_qp_palette_offset_idx	ae(v)
}	
}	
if(MaxPaletteIndex > 0) {	
palette_transpose_flag	ae(v)
copy_inter_flag	ae(v)
if(MaxPaletteIndex > 0){	
num_palette_indices_idc	ae(v)

for(i=0; i < NumPaletteIndices; i++) {	
palette_index_idc	ae(v)
PaletteIndexIdc[i] = palette_index_idc	
}	
if(copy_inter_flag)	
last_copy_inter_run_type_flag	ae(v)
if(!last_copy_inter_run_type_flag)	
last_palette_run_type_flag	ae(v)
}	
CurrNumIndices = 0	
PaletteScanPos = 0	
SignalRun = copy_inter_flag	
while(PaletteScanPos < nCbS * nCbS) {	
xC = x0 + travScan[PaletteScanPos][0]	
yC = y0 + travScan[PaletteScanPos][1]	
if(PaletteScanPos > 0) {	
xcPrev = x0 + travScan[PaletteScanPos - 1][0]	
ycPrev = y0 + travScan[PaletteScanPos - 1][1]	
}	
PaletteRun = nCbS * nCbS - PaletteScanPos - 1	
if(copy_inter_flag)	
copy_inter_run_type_flag[xC][yC]	ae(v)
if(MaxPaletteIndex > 0 && CurrNumIndices < NumPaletteIndices) {	
if(PaletteScanPos >= nCbS && palette_run_type_flag[xcPrev][ycPrev] != COPY_ABOVE_MODE && PaletteScanPos < nCbS * nCbS - 1 && !copy_inter_flag) {	
palette_run_type_flag[xC][yC]	ae(v)
}	
readIndex = 0	
if(palette_run_type_flag [xC][yC] == COPY_INDEX_MODE && AdjustedMaxPaletteIndex > 0)	
readIndex = 1	
if(readIndex == 1 && (((palette_run_type_flag[xcPrev][ycPrev] == COPY_ABOVE_MODE && PaletteIndexMap[xC][yC-1] == COPY_INTER_INDEX) palette_run_type_flag[xcPrev][ycPrev] == COPY_INTER_MODE) && CurrPaletteIndex == CurrentPaletteSize - 2)	
palette_index_refinement_bits	
if(palette_index_refinement_bits == 1)	
CurrPaletteIndex = CurrentPaletteSize - 1	

maxPaletteRun = nCbS * nCbS - PaletteScanPos - 1	
if(copy_inter_flag && (CurrNumIndices + readIndex >= NumPaletteIndices && RunType[xC][yC] == LastRunType){	
last_run_flag	ae(v)
SignalRun = !last_run_flag	
}	
if(SignalRun (AdjustedMaxPaletteIndex > 0 && ((CurrNumIndices + readIndex) < NumPaletteIndices palette_run_type_flag[xC][yC] != last_palette_run_type_flag))	
if(maxPaletteRun > 0) {	
palette_run_msb_id_plus1	ae(v)
if(palette_run_msb_id_plus1 > 1)	
palette_run_refinement_bits	ae(v)
}	
CurrNumIndices += readIndex	
}	
runPos = 0	
while (runPos <= paletteRun) {	
xR = x0 + travScan[PaletteScanPos][0]	
yR = y0 + travScan[PaletteScanPos][1]	
if(palette_run_type_flag[xC][yC] == COPY_INDEX_MODE) {	
PaletteSampleMode[xR][yR] = COPY_INDEX_MODE	
PaletteIndexMap[xR][yR] = CurrPaletteIndex	
} else if(palette_run_type_flag[xC][yC] == COPY_ABOVE_MODE) {	
PaletteSampleMode[xR][yR] = COPY_ABOVE_MODE	
PaletteIndexMap[xR][yR] = PaletteIndexMap[xR][yR - 1]	
}else {	
PaletteSampleMode[xR][yR] = COPY_INTER_MODE	
PaletteIndexMap[xR][yR] = COPY_INTER_INDEX	
}	
}	
if(palette_escape_val_present_flag) {	
sPos = 0	
while(sPos < nCbS * nCbS) {	
xC = x0 + travScan[sPos][0]	
yC = y0 + travScan[sPos][1]	
if(PaletteIndexMap[xC][yC] == MaxPaletteIndex) {	
for(cIdx = 0; cIdx < numComps; cIdx++)	

<pre> if(cIdx == 0 (xR % 2 == 0 && yR % 2 == 0 && ChromaArrayType == 1) (xR % 2 == 0 && ChromaArrayType == 2) ChromaArrayType == 3) { </pre>	
palette_escape_val	ae(v)
PaletteEscapeVal[cIdx][xC][yC] = palette_escape_val	
}	
}	
sPos++	
}	
}	
if(copy_inter_flag)	
prediction_unit(x0, y0, nCbS, nCbS)	
}	

7.4.9.6 Palette mode semantics

copy_inter_flag equal to 1 specifies that the current coding unit is coded by inter palette mode. **palette_mode_flag** equal to 0 specifies that the current coding unit is not coded by inter palette mode.

When **copy_inter_flag** is not present, it is inferred to be equal to 0.

last_copy_inter_run_type_flag equal to 1 specifies that the last one run type is COPY_INTER mode.

A variable **LastRunType** is set equal to **last_copy_inter_run_type_flag**?

10 COPY_INTER_MODE : (last_palette_run_type_flag ? COPY_ABOVE_MODE : COPY_INDEX_MODE)

inter_run_type_flag equal to 1 specifies that the current palette index is equal to the palette index at the same location inside the index map of the block indicated by the decoded block vector.

15 A variable **RunType[xC][yC]** is set equal to **inter_run_type_flag[xC][yC]** ?
COPY_INTER_MODE : (last_palette_run_type_flag[xC][yC] ?
COPY_ABOVE_MODE : COPY_INDEX_MODE)

palette_index_refinement_bits equal to 1 specifies that the current palette index is equal to **CurrentPaletteSize** minus 1

20 **last_run_flag** equal to 1 specifies that the current run is the last run in the current block.

The variable InterIndexMap[xC][yC] specifies a palette index in the reference index map, which is an index to the array represented by CurrentPaletteEntries. The reference index map refers to the index map of the block indicated by the decoded block vector. The array indices xC, yC specify the location (xC , yC) of the sample relative to the top-left luma sample of the picture. The value of InterIndexMap[xC][yC] shall be in the range of 0 to MaxPaletteIndex, inclusive.

In another embodiment, the run type for the current pixel should not be COPY_INTER if the run type for the previous pixel is COPY_INTER.

In one embodiment, part of the syntax structure should be

if(copy_inter_flag&& palette_run_type_flag[xcPrev][ycPrev] != COPY_INTER)	
copy_inter_run_type_flag[xC][yC]	ae(v)

The methods described above can be used in a video encoder as well as in a video decoder. Embodiments of disparity vector derivation methods 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 methods described above can be used in a video encoder as well as in a video decoder. Embodiments of disparity vector derivation methods 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

5 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

10 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

15 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

20 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 non-local index prediction, wherein a non-local index map is used to predict the index map of the current block.

2. The method as claimed in claim 1, wherein the reconstructed indices with the coded run length are copied from the indices in the reference block.

3. The method as claimed in claim 1, wherein the reconstructed samples with the coded run length are copied from the samples in the reference block.

4. The method as claimed in claim 1, wherein each pixel can choose copy-left method, copy-above method, and non-local index prediction method; Several flags can be coded to represent the chosen result; A decoder can infer the chosen result for the current pixel implicitly.

5. The method as claimed in claim 1, wherein the flags used to represent the chosen results can be CABAC coded or context coded; The flags of neighboring pixels also can be used as contexts for the current flag.

6. The method as claimed in claim 1, wherein the current pixel cannot choose the non-local index prediction method if the previous one pixel selects the non-local index prediction method.

7. The method as claimed in claim 1, wherein the current pixel cannot choose the non-local index prediction method if the previous one pixel selects the non-local index prediction method.

8. The method as claimed in claim 1, wherein one or more bits are coded for each run to indicate whether the coded run is the last run of the current block.

9. The method as claimed in claim 1, wherein the indices in the current index map are coded a different way to the case where non-local index prediction is not used when non-local index prediction is used for the current block.

10. The method as claimed in claim 1, wherein if the parsed out index is equal to MAX_INDEX-1, one additional refinement bit should be parsed; If the refinement bit is equal to 1, the reconstructed index is MAX_INDEX-1; Otherwise, the reconstructed index is MAX_INDEX-2.

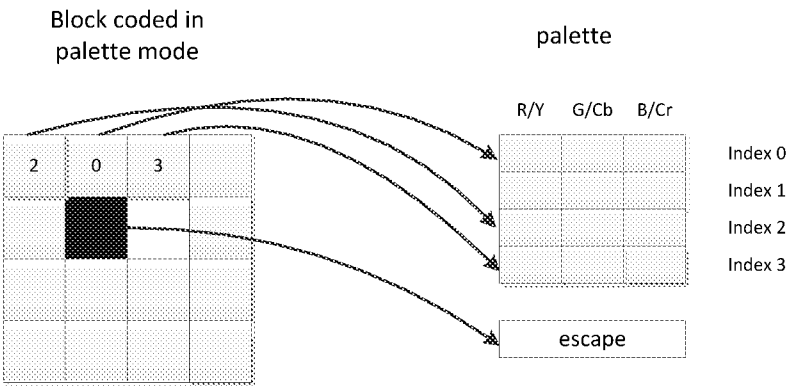


FIG.1

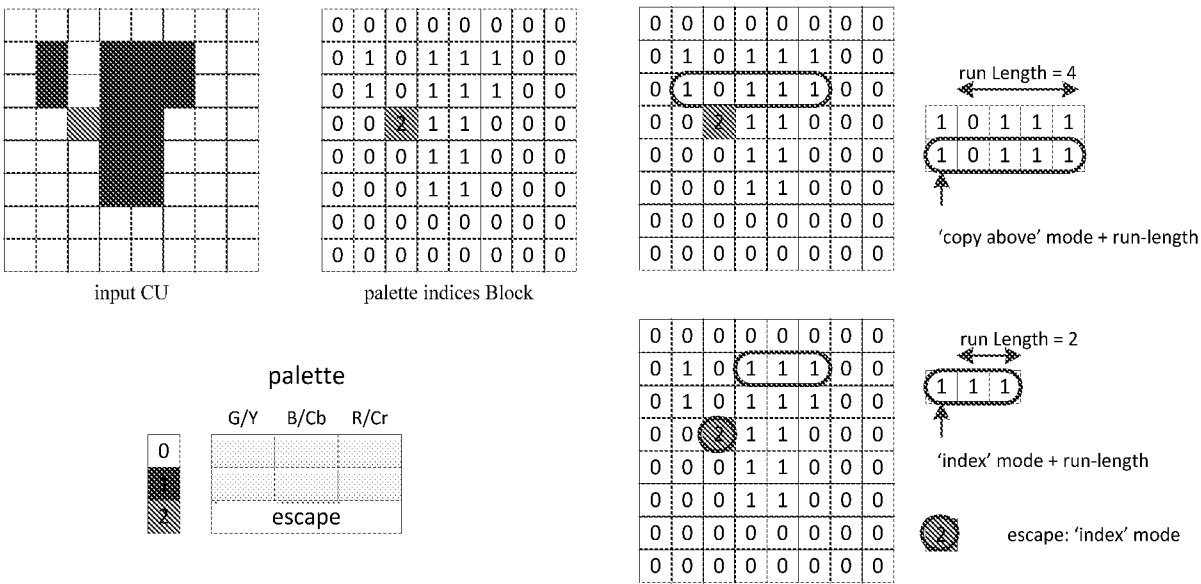


FIG.2

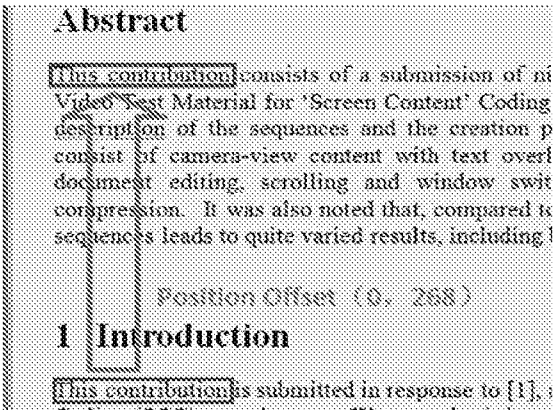


FIG.3

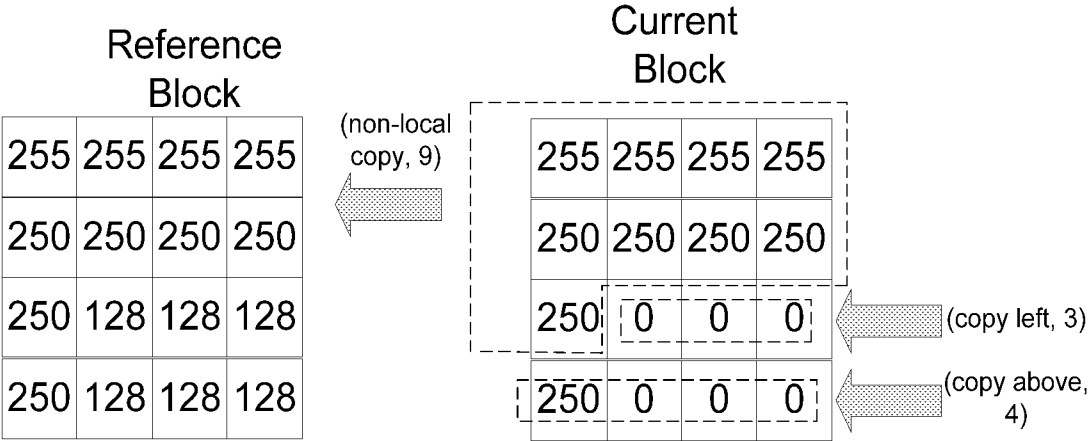


FIG.4

INTERNATIONAL SEARCH REPORT

International application No.

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A. CLASSIFICATION OF SUBJECT MATTER

H04N 19/186(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)

CNPAT, CNKI, WPI, EPODOC, IEEE, GOOGLE:palette, index, cod+, index, predict+, copy, above, map+, index, cod+, local, current, block, run, length

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Liwei, Guo et al. "Non-RCE3: Modified Palette Mode for Screen Content Coding" <i>Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11 14th Meeting: Vienna, AT.JCTVC-N0249</i> , 02 August 2013 (2013-08-02), page 1, part 1 and 2	1, 5-10
Y	Liwei, Guo et al. "Non-RCE3: Modified Palette Mode for Screen Content Coding" <i>Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11 14th Meeting: Vienna, AT.JCTVC-N0249</i> , 02 August 2013 (2013-08-02), page 1, part 1 and 2	2-4
Y	Liwei, Guo et al. "RCE3: Results of Test 3.1 on Palette Mode for Screen Content Coding" <i>Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11 14th Meeting: Vienna, AT.JCTVC-N0247</i> , 02 August 2013 (2013-08-02), page 1, part 2 and page 3, part 4.1	2-4
A	WO 2015/077720 A1 (FUTUREWEI TECHNOLOGIES, INC. ET AL.) 28 May 2015 (2015-05-28) the whole document	1-10



Further documents are listed in the continuation of Box C.



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Patent document cited in search report			Publication date (day/month/year)		Patent family member(s)			Publication date (day/month/year)	
WO	2015077720	A1	28 May 2015		US	2015146976	A1	28 May 2015	