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(54) **Title**: CODING AND DECODING METHODS OF A PICTURE BLOCK, CORRESPONDING DEVICES AND DATA STREAM

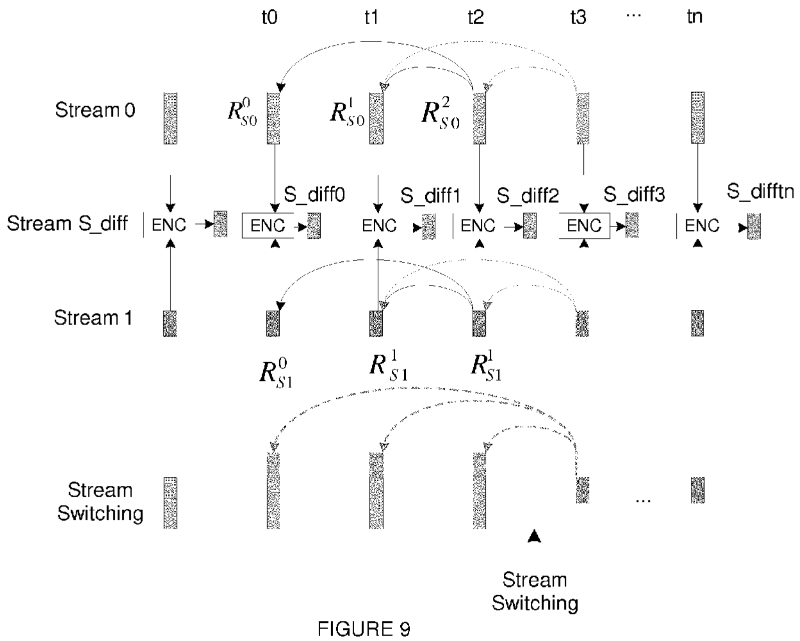

FIGURE 9

(57) **Abstract**: A method for decoding a picture block is disclosed. The decoding method comprises: - decoding (10) at least one stream S_diff into decoded data and into one information for identifying a reconstructed reference picture in a decoder picture buffer; - reconstructing (12) a special reference picture from at least the identified reconstructed reference picture and from the decoded data; - replacing (14) in the decoder picture buffer one reconstructed reference picture by the special reference picture; and - reconstructing (16) the picture block from at least the special reference picture.

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CODING AND DECODING METHODS OF A PICTURE BLOCK, CORRESPONDING DEVICES AND DATA STREAM

1. FIELD OF THE INVENTION

A method for decoding a picture block from a special reconstructed reference picture is disclosed. A corresponding coding method and corresponding encoding and decoding devices are further disclosed.

2. BACKGROUND OF THE INVENTION

During video streaming, the bandwidth available may change over time. Consequently, the outgoing bit rate of the streaming application needs to be adjusted to fit the available bandwidth in real time in order to avoid congestion. One way to enable real-time bit rate adjustments is the use of a real-time encoder, but it needs to allocate one encoding system per client that may be unacceptable in case of numerous clients as for VOD services for example. Another way to enable real-time bit rate adjustments is the use of scalable video coding. In scalable coding, a video source is encoded into several layers. During the transmission in order to adjust the outgoing bit rate, the server selects the layers to be sent (mode “push”) or the decoder asks for the layers to be sent (mode “pull”). The method is suitable for streaming over heterogeneous channels, but scalable video coding degrades the overall compression efficiency and increases the computational complexity of both the encoder and the decoder compared to single layer video coding. A simple method to realize bit rate adjustment is to encode multiple versions of the same video sequence. These versions have different resolution and/or quality levels and thus different bit rates. During the streaming, when there is a need to adjust the outgoing bit rate, the stream to be transmitted can be switched dynamically from one version to the other in order to fit the bandwidth requirement or user’s capability as depicted on **Figure 1**. This solution is known as “stream switching”. However, directly switching between streams at inter-coded pictures (P or B pictures) may cause the mismatch of reconstructed reference pictures and results in incorrect pictures reconstruction. The quality of reconstructed video may be degraded significantly. One method to solve the problem is to use Random Access

Points (RAP) in the bit-stream (typically I pictures or IDR pictures or CRA pictures). IDR is the English acronym of “Instantaneous Decoder Refresh” and CRA of “Clean Random Access“. As switching can take place at these RAP only, the RAP need to be assigned frequently in the bit stream in order to realize prompt stream switching. However, encoding such I/IDR pictures introduce a substantial bit rate overhead. In addition, the pictures after the RAP that uses reconstructed reference pictures located before the RAP are either skipped or not decoded correctly because they use reconstructed reference picture(s) which is/are different from the one(s) used in the encoding as depicted on **Figure 2**. On Figure 2, Ic is reconstructed from reconstructed reference picture I1 and I2 while it was encoded from reconstructed reference picture i1 and i2.

In AVC, special picture types (SI/SP) were designed that allow for identical reconstruction of a picture from another stream and thus facilitate stream switching. Video pictures are thus encoded into SP pictures at switching points instead of intra-coded pictures as depicted on **Figure 3**. The coding efficiency of the SP pictures is higher than that of intra-coded pictures, but they are still less efficient than normal P pictures. Therefore, the overall coding efficiency is still degraded if many switching points are assigned.

In the document from Zhou et al entitled “*Efficient bit stream switching of H.264 coded video*” and published in proc. of SPIE vol.5909 (2005), a solution is disclosed that makes it possible to switch at any time without a substantial bit rate overhead. The solution is provided only for IPPP GOP structure. In addition to the multiple versions of the same video sequence at different bit rate, a DIFF picture is encoded for the reconstructed reference picture of the current picture on which the switch occurs as depicted on **Figure 4**. The DIFF picture is the difference of the reconstructed reference picture of the current picture and the timely corresponding picture in the other stream. The difference picture is transmitted to the decoder to compensate the mismatch. As the DIFF picture is only transmitted when switching occurs as mentioned on page 5 of the document, the bit rate overhead introduced by the above scheme is small. On the other hand, the solution only works for P-picture predicted from a single reconstructed reference picture. In addition, this solution requires that the encoding order and the display order are identical.

3. BRIEF SUMMARY OF THE INVENTION

A method for decoding a picture block is disclosed. The decoding method comprises:

- decoding at least one stream S_diff into decoded data and into one information for identifying a reconstructed reference picture in a decoder picture buffer;
- reconstructing a special reference picture from at least the identified reconstructed reference picture and from the decoded data ;
- replacing in the decoder picture buffer one reconstructed reference picture by the special reference picture; and
- reconstructing the picture block from at least the special reference picture.

According to a specific characteristic, the one reconstructed reference picture replaced in the decoder picture buffer is the identified reconstructed reference picture.

Advantageously, the decoding method further comprises decoding an information representative of an instant in time at which the one reconstructed reference picture is replaced by the special reference picture in the decoder picture buffer.

According to another aspect of the invention, the decoding method further comprises decoding a flag indicating whether or not the special reference picture is displayed.

According to a specific characteristic, the identified reconstructed reference picture is decoded from a base layer of a layered stream.

Advantageously, the decoded data and the information identifying the reconstructed reference picture in the decoder picture buffer are decoded from an enhancement layer of the layered stream.

A method for encoding a picture block is also disclosed. The encoding method comprises:

- encoding the picture block from at least one reconstructed reference picture; and

- encoding the at least one reconstructed reference picture as a special reference picture from another reconstructed reference picture and an information for identifying the another reconstructed reference picture in a decoder picture buffer, wherein the special reference picture when reconstructed replaces one reconstructed reference picture in a decoder picture buffer.

According to a specific characteristic, the one reconstructed reference picture replaced in the decoder picture buffer is the identified another reconstructed reference picture.

Advantageously, the encoding method further comprises encoding an information representative of an instant in time at which the one reconstructed reference picture is replaced by the special reference picture in the decoder picture buffer.

According to another aspect of the invention, the encoding method further comprises encoding a flag indicating whether or not the special reference picture is displayed.

According to a specific characteristic, the identified reconstructed reference picture is encoded in a base layer of a layered stream.

Advantageously, the at least one reconstructed reference picture and the information for identifying another reconstructed reference picture in the decoder picture buffer are encoded in an enhancement layer of the layered stream.

A decoding device for decoding a picture block is further disclosed. The decoding device comprises:

- means for decoding at least one stream S_diff into decoded data and into one information for identifying a reconstructed reference picture in a decoder picture buffer;
- means for reconstructing a special reference picture from at least the identified reconstructed reference picture and from the decoded data;
- means for replacing in the decoder picture buffer one reconstructed reference picture by the special reference picture; and
- means for reconstructing the picture block from at least the special reference picture.

The decoding device is configured to execute the steps of the decoding method.

A coding device for encoding a picture block is disclosed. The coding device comprises:

- means for encoding the picture block from at least one reconstructed reference picture; and
- means for encoding the at least one reconstructed reference picture as a special reference picture from another reconstructed reference picture and an information for identifying the another reconstructed reference picture in a decoder picture buffer, wherein the special reference picture when reconstructed replaces one reconstructed reference picture in a decoder picture buffer.

The coding device is configured to execute the steps of the encoding.

Finally, a data stream is disclosed that comprises encoded in it one information for identifying a reconstructed reference picture in a decoder picture buffer and data allowing for the reconstruction of a special reference picture from the identified reconstructed reference picture, the special reference picture being for replacing a reconstructed reference picture in a decoder picture buffer.

4. BRIEF DESCRIPTION OF THE DRAWINGS

Other features and advantages of the invention will appear with the following description of some of its embodiments, this description being made in connection with the drawings in which:

-Figures 1 and 2 illustrate the general principles of stream switching;

-Figure 3 illustrates the principles of stream switching using SI/SP pictures according to the state of the art;

- Figure 4 illustrates the principles of stream switching using a DIFF picture according to the state of the art;

- Figure 5 depicts the flowchart of a decoding method according to the invention;

-Figure 6 depicts the flowchart of an encoding method according to the invention;

-Figure 7 depicts a mono-layer video decoder according to the invention;

-Figure 8 depicts a mono-layer video encoder according to the invention;

-Figure 9 illustrates the principles of stream switching using SRP pictures according to the invention;

-Figure 10 illustrates a further embodiment of the decoding method according to the invention;

- Figure 11 depicts a multi-layer video decoder according to the invention;

- Figure 12 depicts a multi-layer video encoder according to the invention; and

- Figure 13 represents a multi-layered stream according to the invention.

5. DETAILED DESCRIPTION OF THE INVENTION

The invention relates to a method for decoding a picture block of pixels and a method for coding such a picture block. The picture block belongs to a picture of a sequence of pictures. Each picture comprises pixels or picture points with each of which at least one item of picture data is associated. An item of picture data is for example an item of luminance data or an item of chrominance data. Hereafter, the coding and decoding methods are described with reference to a picture block. It is clear that these methods can be applied on several picture blocks of a picture and on several pictures of a sequence with a view to the coding respectively the decoding of one or more pictures. A picture block is a set of pixels of any form. It can be a square, a rectangle. But the invention is not limited to such forms. In the following section the word block is used for picture block. In HEVC, the block refers to a Coding Unit (CU).

The “predictor” term designates data used to predict other data. A predictor is used to predict a picture block. A predictor or prediction block is obtained from one or several reconstructed reference sample(s) of the same picture as the picture to which belongs the block that it predicts (spatial prediction or intra-picture prediction) or from one (mono-directional prediction) or several reference blocks (bi-directional prediction or bi-prediction) of reconstructed reference pictures (temporal prediction or inter-picture prediction). A reference block is identified in a reconstructed reference picture by a motion vector. The prediction can also be weighted to account for an illumination variation model (a.k.a weighted prediction).

The term “residue” signifies data obtained after subtraction of a predictor from source data.

The term “reconstruction” designates data (e.g. pixels, blocks) obtained after merging a residue with a predictor. The merging is generally a sum of a predictor with a residue. However, the merging is more general and notably comprises an additional post filtering stage of reconstructed samples and/or an additional step of addition of offsets to the reconstructed samples. When a reference picture is reconstructed, it is stored in the DPB (English acronym of “Decoder Picture Buffer“) as a newly reconstructed reference picture.

In reference to the decoding of pictures, the terms "reconstruction" and "decoding" are very often used as synonyms. Hence, a "reconstructed block" is also designated under the terminology "decoded block".

The term coding is to be taken in the widest sense. The coding possibly comprises applying a transform and/or quantizing data. It can also designate only the entropy coding. A DCT ("Discrete Cosine Transform) is an example of such a transform. In the same way, the term decoding possibly comprises in addition to the entropy decoding, applying a transform and/or an inverse quantization. The transform applied on the decoder side is an inverse transform of the one applied on the encoder side.

A stream is a sequence of bits that forms the representation of coded pictures and associated data forming one or more coded video sequences. Stream is a collective term used to refer either to a NAL unit stream or a byte stream.

A NAL (English acronym of “Network Abstraction Layer”) unit is a syntax structure containing an indication of the type of data to follow and bytes containing that data. The NAL is specified to format that data and provide header information in a manner appropriate for conveyance on a variety of communication channels or storage media. All data are contained in NAL units, each of which contains an integer number of bytes. A NAL unit specifies a generic format for use in both packet-oriented and stream systems. The format of NAL units for both packet-oriented transport and byte stream is identical except that each NAL unit can be preceded by a start code prefix and extra padding bytes in the byte stream format.

An AU (English acronym of “Access Unit”) is set of NAL units that are associated with each other according to a specified classification rule, are consecutive in decoding order, and contain exactly one coded picture. The decoding of an access unit always results in a decoded picture.

In the Figures 5 and 6, the represented boxes are purely functional entities, which do not necessarily correspond to physical separated entities. As will be appreciated by one skilled in the art, aspects of the present principles can be embodied as a system, method or computer readable medium. Accordingly, aspects of the present principles can take the form of an entirely hardware embodiment, an entirely software embodiment (including firmware, resident software, micro-code, and so forth), or an embodiment combining software and hardware aspects that can all generally be referred to herein as a “circuit,” “module”, or “system.” Furthermore, aspects of the present principles can take the form of a computer readable storage medium. Any combination of one or more computer readable storage medium(s) may be utilized.

The flowchart and/or block diagrams in the figures illustrate the configuration, operation and functionality of possible implementations of systems, methods and computer program products according to various embodiments of the present invention. In this regard, each block in the flowchart or block diagrams may represent a module, segment, or portion of code, which comprises one or more executable instructions for implementing the specified logical function(s). It should also be noted that, in some alternative implementations, the functions noted in the block may occur out of the order noted in the figures. For example, two blocks shown in succession may, in fact, be executed substantially concurrently, or the blocks may sometimes be executed in the reverse order, or blocks may be executed in an alternative order, depending upon the functionality involved. It will also be noted that each block of the block diagrams and/or flowchart illustration, and combinations of the blocks in the block diagrams and/or flowchart illustration, can be implemented by special purpose hardware-based systems that perform the specified functions or acts, or combinations of special purpose hardware and computer instructions. While not explicitly described, the present embodiments may be employed in any combination or sub-combination.

Figure 5 depicts the flowchart of a decoding method according to a specific and non-limitative embodiment. The method is for decoding a current picture block Bc encoded in a stream S. The picture block Bc belongs to a slice Sc of a current picture Ic. A slice is a part of a picture such as a set of picture blocks.

In a step 10, at least one stream S_diff is decoded into decoded data (e.g. residues and coding modes) and into an information INFO for identifying a reconstructed reference picture R2 stored in a DPB.

In a step 12, a special reference picture (whose English acronym is SRP) R1' is reconstructed from the identified reconstructed reference picture R2 and from the decoded data. Reconstructing the SRP R1' comprises, for each picture block of R1', determining a predictor and adding a residue. The predictor may be determined from the identified reconstructed reference picture R2 (either as a block in R2 co-located to Bc or as a motion compensated block in R2 thus identified by a motion vector) or from neighboring reconstructed samples as in classical intra prediction. A block in R2 is co-located to Bc if its spatial position in R2 is identical to the spatial position of Bc in Ic. According to a variant, if the size of the reconstructed reference picture R2 is different from the size of the current picture Ic, then R2 is rescaled for the reconstruction of the special reference picture so that the rescaled R2 picture (possibly with appropriate padding) has the same size as Ic. In this case, R1' is reconstructed from F(R2), where F is a rescaling filter. The stream S_diff may be a part of stream S or may be independent of stream S.

As an example, the stream S_diff encodes the pixel by pixel difference between another reconstructed reference picture R1 different from R2 and the reconstructed reference picture R2. R1 is for example the reconstructed reference picture from which the current picture block Bc is encoded. In this case, decoding the stream S_diff comprises decoding a difference picture DIFF usually by entropy decoding, inverse quantization and transform. The transform is for example an inverse DCT. The difference picture is usually an approximation of the difference between the reconstructed reference picture R1 and the reconstructed reference picture R2. The approximation is due to the loss during encoding (e.g. because of the quantization). If the difference picture DIFF is lossless encoded, then the decoded difference picture DIFF equals the difference between the reconstructed reference picture R1 and the reconstructed reference picture R2. According to a variant, if R1 and R2 are of different sizes, the difference picture is the difference between the reconstructed reference picture R1 and the rescaled reconstructed reference picture R2. As an example, if R2 is larger than R1 then R2 is downscaled and if R2 is smaller than R1 then R2 is up-scaled. In this case, the special reference picture R1' equals F(R2)+DIFF, F is the identity if R2 and Ic are of same size or F is a rescaling function otherwise.

According to a variant, the decoding method further comprises an optional decoding of a sign associated with the difference picture DIFF. If such a sign is decoded, the special reference picture R1' equals F(R2)+DIFF when the sign is positive and equals F(R2)-DIFF when the sign is negative.

According to another variant, the stream S_diff encodes for some blocks of R1 the difference between these blocks and co-located blocks in R2. The other blocks of R1 are encoded in S_diff using classical intra prediction, i.e. from neighboring reconstructed samples.

According to another variant, the stream S_diff encodes for some blocks of R1 the difference between these blocks and corresponding blocks in R2. The corresponding blocks in R2 are either co-located blocks or motion compensated blocks. The other blocks of R1 are encoded in S_diff using classical intra prediction, i.e. from neighboring reconstructed samples.

Decoding the information INFO makes it possible to handle different use cases. As an example, if the current picture block Bc is encoded from two reconstructed reference pictures R1 and r1, then two special reference pictures R1' and r1' and two information INFO and info are decoded at step 10. The special reference pictures R1' and r1' correspond respectively to R2 and r2, where R2 and r2 are two reconstructed reference pictures stored in the DPB from which Bc is to be reconstructed. Consequently, INFO indicates to the decoder that R1' is to be reconstructed from R2 while info indicates that r1' is to be reconstructed from r2.

Each special picture is for example identified in the stream S_diff with a dedicated flag indicating a picture/slice type different from the classical I, P, B picture/slice type. This picture/slice type indicates that the current AU contains a special reference picture that is to be used for replacing a picture in the DPB. According to a variant, each special picture is identified with a dedicated flag in the slice header.

The information INFO for identifying in the DPB a reconstructed reference picture R2 is for example a POC (English acronym of “Picture Order Count”) as defined in the document ISO/IEC 14496-10 (section 3.104). According to a variant, the information for identifying a reconstructed reference picture is a reconstructed reference picture index.

In a step 14, the special reference picture R1’ replaces one of the reconstructed reference picture in the DPB. According to a specific embodiment, the reconstructed reference picture in the DPB that is replaced by the special reference picture R1’ is R2. The special reference picture R1’ is thus stored in the DPB in the place of R2. If Bc is bi-predicted from two reference blocks belonging to two reconstructed reference pictures R2 and r2 which may be different from the reconstructed reference pictures R1 and r1 used in the encoding, then both R2 and r2 are replaced in the DPB by R1’ and r1’. The special reference pictures R1’ and r1’ are thus used as reference pictures for Bc. Bc can also be reconstructed from one special reference pictures R1’ and from r1, if r1 is available in the DPB when reconstructing Bc.

In a step 16, the current picture block Bc is reconstructed from the special reference picture R1’ instead of R2. Usually, since the special reference picture is closer in terms of content to R1 than was R2, the drift is thus decreased. If the replacement of step 14 is not made, then Bc is reconstructed from R2 instead of R1’. Usually, reconstructing a picture block comprises decoding a residue from the stream S and adding the residue to a predictor. The residue can be zero in case of skip mode. Decoding the residue comprises entropy decoding, inverse quantization and applying a transform inverse of the transform applied on the encoder side. These steps are well known to those skilled in the art of video compression/coding and are not disclosed further. A reference block in the special reference picture R1’ is identified by a motion vector decoded from the stream S. The reference block is used as a predictor. In case of bi-prediction, two reference blocks are identified in two reconstructed reference pictures which are possibly one and the same reconstructed reference picture. The predictor is a weighted sum of these two reference blocks.

According to another variant, the decoding method further comprises an optional step 13 wherein an information is decoded from the stream S representative of a time instant Ts or to a decoding order number indicating when the reconstructed reference picture R2 is replaced by the special reference picture R1'. This data is useful in particular when the stream S_Diff is transported using separate means from the ones used to transport the stream S. This data is for example the POC of the first picture that uses this special reference picture in the DPB for its reconstruction. In this case, the reconstructed reference picture R2 is replaced by the special reference picture just before starting the decoding of this first picture. According to a variant, this data is for example the POC of the last picture that uses the reconstructed reference picture R2 in the DPB for its reconstruction. In this case, the reconstructed reference picture R2 is replaced by the special reference picture just after completion of the decoding of this last picture.

According to yet another variant, a flag FG is decoded from the stream S_diff to indicate whether or not the special reference pictures are displayed. According to another variant, the flag is not decoded and the SRP are by definition not displayed. INFO, sign, flag FG, timing information can be decoded for each special reference picture (in a slice header or in a slice segment header) or may be grouped for several special reference pictures in one single header. INFO, sign, flag FG, timing information are for example decoded from a SEI message, VPS (Video Parameter Set HEVC) or from the slice header of Sc.

Figure 6 depicts the flowchart of an encoding method according to a specific and non-limitative embodiment. The method is for encoding a current picture block Bc in a stream S.

In a step 20, a current picture block Bc is encoded from at least one first reconstructed reference picture R1 in a stream S. Usually, encoding the current picture block comprises determining a residue, transforming the residue and quantizing the transformed residue into quantized data. The quantized data are further entropy coded in the stream S. The residue is obtained by subtracting from the current picture block Bc a predictor. The predictor is determined from the first reconstructed reference picture R1. More precisely, a predictor is determined in the reconstructed reference picture R1 by a motion vector. If the current block is bi-predicted from two reference blocks, a predictor is obtained by averaging these two reference blocks. The two reference blocks either belong to two different reconstructed reference pictures R1 and r1 or to one and the same reconstructed reference picture. Motion vectors are also encoded in the stream S. These steps are well known to those skilled in the art of video compression and are not disclosed further.

In a step 24, the reconstructed reference picture R1 and an information INFO are encoded into the stream S_diff. The decoding of S_diff is a SRP. The stream S_diff may be a part of stream S or may be independent of stream S. The reconstructed reference picture R1 is encoded in S_diff from a second reconstructed reference picture R2 different from R1 that is identified by INFO. According to a variant, if the size of the reconstructed reference picture R2 is different from the size of the current picture Ic and thus from the size of R1, then R2 is rescaled for the encoding of the reconstructed reference picture R1 so that the rescaled R2 picture (possibly with appropriate padding) has the same size as Ic. In this case, R1 is encoded from F(R2), where F is an rescaling filter.

As an example, the stream S_diff encodes the pixel by pixel difference DIFF between R1 and R2. The DIFF picture is encoded by transformation (e.g. using a DCT), quantization and entropy coding. According to a variant, if R1 and R2 are of different sizes, the difference picture is the difference between the reconstructed reference picture R1 and the rescaled second reconstructed reference picture R2. As an example, if R2 is larger than R1 then R2 is downscaled and if R2 is smaller than R1 then R2 is up-scaled. In this case, DIFF= R1-F(R2), F is the identity function when R2 and Ic are of the same size and is a rescaling function otherwise.

According to a variant, the decoding method further comprises an optional decoding of a sign associated with the difference picture. If such a sign is decoded, the special reference picture R1' equals F(R2)+DIFF when the sign is positive and equals F(R2)-DIFF when the sign is negative.

According to another variant, the stream S_diff encodes for some blocks of R1 the difference between these blocks and blocks in R2 (i.e. either blocks co-located to Bc or motion compensated blocks). The other blocks of R1 are encoded in S_diff using classical intra prediction, i.e. from neighboring reconstructed samples.

Encoding the information INFO makes it possible to handle different use case. As an example, if the current picture block Bc is encoded from two reconstructed reference pictures R1 and r1, then the two reconstructed reference pictures are encoded from two other reconstructed reference pictures R2 and r2. INFO indicates to a decoder that a special reference picture R1' is to be reconstructed from R2 while info indicates that another special reference picture r1' is to be reconstructed from r2. Each special reference picture is for example identified in the stream S_diff with a dedicated flag indicating a picture/slice type different from the classical I, P, B picture/slice type. This picture/slice type indicates the current AU is a special reference picture that is to be used for replacing a picture in the DPB. According to a variant, each special picture is identified with a dedicated flag in the slice header. In a specific embodiment, one special reference picture and an information INFO are encoded for several or each possible pairs of reconstructed reference picture of the DPB. Consequently at any time a block Bc can be decoded from any picture of the DPB even if it is not the one from which it was encoded while limiting the drift. Indeed, when reconstructing Bc, if R1 is not available in the DPB, Bc can be reconstructed from the special reference picture R1' instead of R2. The drift is thus limited because R1' is closer in terms of content to R1 than is R2.

The information identifying a second reconstructed reference picture is for example a POC. According to a variant, the information identifying a second reconstructed reference picture is a reconstructed reference picture index.

All the variants and options disclosed for the decoding method are applicable to the encoding method. In particular, the encoding method comprises an optional encoding of a sign associated with the difference picture. According to another variant, the encoding method further comprises an optional step 22 wherein an information is encoded that is representative of a time instant Ts or to a decoding order number indicating when the reconstructed reference picture R2 is to be replaced by the special reference picture in the DPB. This data is for example the POC of the first picture that uses this special reference picture in the DPB for its reconstruction.

According to yet another variant, a flag FG is encoded to indicate whether or not the special reference pictures are to be displayed. This flag can be coded for each special reference picture (in a slice header or in a slice segment header) or may be grouped for several special reference pictures in one single header. According to another variant, the flag is not encoded if by definition the SRP are not displayed.

INFO, sign, flag FG, timing information are for example decoded from a SEI message, VPS (Video Parameter Set HEVC) or from the slice header of Sc.

A decoder according to a specific and non-limitative embodiment is depicted on **Figure 7**. The decoder is adapted to implement the decoding method disclosed with respect to Figure 5. A stream S is received by a decoding module DEC0. The decoding module DEC0 is adapted to decode a residue for the current picture block Bc. The residue can be zero in case of skip mode. The decoding module DEC0 is connected to an adder ADD adapted to add a predictor to the residue. The predictor is determined by a prediction module PRED from a reference picture previously reconstructed and stored in a DPB. The prediction module PRED determines a predictor for the current picture block from at least one motion vector decoded by the decoding module DEC0. The DPB is connected to a decoding module DEC1 adapted to decode the stream S_diff into a decoded data and into the information INFO. The decoding module DEC1 is further adapted to reconstruct special reference pictures from the decoded stream and from the reconstructed reference pictures stored in the DPB and identified by INFO. The special reference picture reconstructed by the module DEC1 are used to replace in the DPB the picture identified by INFO. According to a variant not represented on figure 7, S_diff is a part of stream S.

An encoder according to a specific and non-limitative embodiment is depicted on **Figure 8**. The encoder is adapted to implement the encoding method disclosed with respect to Figure 6. A subtraction module SUBT subtracts a predictor from the current picture block Bc. The output of the subtraction module is a residue. The predictor is determined by a prediction module PRED from a reference picture previously reconstructed and stored in a DPB. The prediction module PRED determines a predictor for the current picture block from at least one motion vector determined by a motion estimation module ME. The residue is then coded by a coding module ENC0 into a stream S. The reference picture when encoded are further reconstructed by a module REC and stored in the DPB. The DPB is connected to a module ENC1 adapted to encode in the stream S_diff the reconstructed reference picture R1 from another reconstructed reference picture R2, e.g. by encoding a difference picture R1-R2, and the information INFO identifying R2. According to a variant not represented on the figure, S_diff is a part of the stream S.

According to a variant, the encoding and decoding methods are used in the context of stream switching as illustrated by **Figure 9**. In this case, a first sequence of pictures is encoded in a stream S0. A second sequence of pictures is encoded in a stream S1. Usually, the second sequence of pictures is identical to the first sequence but encoded at a different bit rate, i.e. by using different quantization step. According to a variant, the second sequence of pictures is a rescaled version of the first sequence, i.e. either an up-scaled or a downscaled version. According to a specific embodiment, S0 and S1 have same GOP structure (i.e. same decoding order and same reference picture lists as defined in sections 8.3.1 and 8.3.2 of the HEVC standard).

In addition to the streams S0 and S1, at each time instant tn a reconstructed reference picture R_{S1}^{tn} of S1 is further encoded in a stream S_diff as a SRP from a timely corresponding, i.e. temporally aligned, (e.g. identical picture order count or identical display time) reconstructed reference picture R_{S0}^{tn} of S0 as depicted on Figure 9. The reconstructed reference picture R_{S1}^{tn} is encoded in S_diff with an information info_tn for identifying the corresponding reconstructed reference picture R_{S0}^{tn}. Note that the source picture that corresponds to R_{S1}^{tn} is encoded in S1 and the source picture that corresponds to R_{S0}^{tn} is encoded in S0.

The decoding method disclosed with respect to Figure 5 is used for decoding a picture block Bc after switching from the first stream S0 to the second stream S1. With respect to Figure 9, the pictures are decoded and displayed from the stream S0 until time t2. The switch occurs between t2 and t3. After the switch the pictures are decoded and displayed from the stream S1. At the time of the switch the DBP comprises several reconstructed reference pictures which where decoded from S0. With respect to Figure 9, the DPB comprises three reconstructed reference pictures R_{S0}^{0}, R_{S0}^{1} and R_{S0}^{2} at the switching time.

In the step 10, S_diff1, S_diff2 and S_diff3 are decoded into decoded data (e.g. residues and coding modes) and into information info_t0, info_t1 info_t2 identifying the reconstructed reference pictures R_{S0}^{0} , R_{S0}^{1} and R_{S0}^{2} stored in the DPB.

In the step 12, three special reference pictures SRP_t0, SRP_t1, SRP_t2 are reconstructed from corresponding decoded data and from corresponding reconstructed reference pictures R_{S0}^{0} , R_{S0}^{1} and R_{S0}^{2}. According to a first specific embodiment, S_diff encodes the pixel by pixel difference between R_{S1}^{tn} and the timely corresponding picture R_{S0}^{tn} possibly rescaled. In this case, the reconstructed SRP are SRP_t0= $diff\_t0+F(R_{S0}^{0})$, SRP_t1= $diff\_t1+F(R_{S0}^{1})$, SRP_t2= $diff\_t2+F(R_{S0}^{2})$, wherein $diff\_t0$, $diff\_t1$, $diff\_t2$ are decoded from S_diff. If necessary, R_{S0}^{0} is rescaled by F so that its size is the same as the size of the current picture Ic. If no rescaling occurs then F is the identity function. According to a second specific embodiment, S_diff encodes R_{S1}^{tn} using R_{S0}^{tn} possibly rescaled by F. In this case, the predictor of a block in R_{S1}^{tn} is either a spatially co-located block in the picture R_{S0}^{tn} or a motion compensated block in R_{S0}^{tn} or derived from spatially neighboring blocks in R_{S1}^{tn} (spatial intra prediction). In the case of the first specific embodiment, when no rescaling is necessary, i.e. when the sizes of the pictures of the first and second stream are identical, then the same difference pictures diff_t0, diff_t1 and diff_t2 can be used to switch from S0 to S1 or from S1 to S0. In the previous example, if diff_t0 encodes the difference between R_{S0}^{0} and the timely corresponding picture R_{S1}^{0} in the stream S1 instead of the inverse diff_t0 is subtracted from R_{S0}^{0} instead of being added in order to reconstruct SRP_t0. A sign is thus decoded to specify if the reconstructed reference pictures are modified by adding or by subtracting the difference picture.

At step 16, the pictures in the DPB are replaced with the special reference pictures. The information info_t0 indicates that SRP_t0 is used to replace R_{S0}^{0} in the DPB, info_t1 indicates that SRP_t1 is used to replace R_{S0}^{1} in the DPB and info_t2 indicates that SRP_t2 is used to replace R_{S0}^{2} in the DPB. In this case, each SRP thus replaces in the DPB the reconstructed reference picture from which it is reconstructed. The invention is clearly not limited to the case of 3 reconstructed reference pictures. According to a specific embodiment of the invention, all reconstructed reference pictures in the DPB that comes from the stream S0 are replaced in step 16 with special reference pictures. According to a variant, only the reconstructed reference pictures in the DPB that are to be used as reference pictures after the switch are replaced in step 16 with special reference pictures.

Figure 10 illustrates a further specific and non-limitative embodiment of the decoding method according to the invention. The decoder receives different Access Units. The Access Unit AU1 is first received and decoded. A first picture I1 is reconstructed from the decoded AU1. Then, a second Access Unit AU2 is received and decoded. A second picture I2 is reconstructed from the decoded AU2. The picture I1 and I2 belongs to the same stream S0 and are stored in the DPB if they are signaled as used as reference pictures. Then, a switch occurs. The switch can be requested by the decoder that sends a request to the encoder for receiving the S_diff stream. According to a variant, the switch is initiated by the encoder. Following the switch, the decoder receives two AU units S_diff1 and S_diff2. S_diff1 and S_diff2 (step 10) are decoded in order to reconstruct (step 12) SRP1 and SRP2 using the picture I1 and I2 respectively. SRP1 and SRP2 are two special reference pictures. SRP1 and SRP2 are then stored in the DPB in the place of the pictures I1 and I2 respectively (step 14). Then the decoder receives AU3 and decodes it. A picture I3 is reconstructed from the decoded AU3 and possibly from at least one picture of the DPB (temporal prediction), i.e. either SRP1 or SRP2. I3 belongs to the second stream S1 and is possibly stored in the DPB for future use as a reconstructed reference picture. The decoder then receives AU4 and decodes it. A picture I4 is reconstructed from the decoded AU4 and possibly from at least one picture of the DPB (temporal prediction).

According to a specific embodiment of the invention, the pictures of the first and second sequences and the special reference pictures are encoded into a multi-layered stream. As a specific example, the picture identified as special reference pictures are encoded as an enhancement layer of a scalable stream. S0 stream is a base layer. The enhancement layer allows to reconstruct from reconstructed reference pictures of S0, special reference pictures to be used for reconstructing pictures of S1. This enhancement layer is for example compliant with SVC or SHVC coding standard. According to a specific embodiment of the invention, the special reference pictures are encoded with a subset of the encoding tools/modes provided by SVC or SHVC for encoding enhancement layer. In particular, intra-layer motion vector prediction (temporal prediction) is disabled in SVC or SHVC coding standard. On the contrary, intra prediction from the base layer is activated. The intra picture prediction may be activated too. According to another specific embodiment of the invention, the temporal mv prediction is disabled for coding S0 and S1 for example by setting the HEVC flag slice_temporal_mvp_enable_flag to false. This means that the motion vector prediction (MV prediction) is built using MV from reconstructed neighboring coding units, but not using the MVs of previously reconstructed reference pictures.

In the following figures 11 and 12, encoding and decoding modules are referred to as encoder and decoder.

Figure 11 depicts a multi-layer encoder according to a specific and non-limitative embodiment. The pictures of the first sequence are encoded in S0 using a first encoder ENC0 which is a mono-layer encoder for example an MPEG2, an H.264 or an HEVC compliant encoder. The invention is not limited by the mono-layer encoder used. The reference pictures encoded with ENC0 are reconstructed as R2 and provided as input to a third encoder ENC2 possibly after being rescaled by an optional rescaling module F. The rescaled picture R2 is denoted F(R2). A second encoder ENC1 is used to encode the pictures of the second sequence in S1. The second encoder can be identical to ENC0 or different. The invention is not limited by the encoder used. The reference pictures encoded with ENC1 that timely correspond to the reconstructed reference pictures R2 are reconstructed as R1 and provided as input to the third encoder ENC2. Therefore, for each reconstructed reference picture R2 in the DPB of ENC0, a timely corresponding reference picture R1 is reconstructed. The encoder ENC2 thus encodes the reconstructed reference pictures R1 from the timely corresponding reconstructed reference picture R2 possibly rescaled into the stream S_diff. According to a specific embodiment the encoder ENC2 comprises a subtracter for subtracting R2 respectively F(R2) from R1 and further an entropy coder for encoding the difference picture thus obtained possibly transformed and quantized. According to a variant, from each block of R1 a predictor is subtracted, wherein the predictor is either a spatially co-located block in the picture R2 (resp. F(R2)) or a motion compensated block in R2 (resp. F(R2)) or derived from spatially neighboring blocks in R1 (spatial intra prediction). A residue is thus obtained and is further entropy coded after possibly being transformed and quantized. In this case, what is encoded in S_diff is not a simple pixel by pixel difference between R1 and R2. An information INFO identifying the reconstructed reference picture R2 (resp. F(R2)) used to encode the reconstructed reference picture R1 is also encoded in S_diff. The encoder ENC2 is for example compliant with a scalable video encoder such as SVC or SHVC. The invention is not limited by the scalable encoder used. Scalable video codec standards define *layer_id* indicator to separate/distinguish the AUs belonging to the Base Layer (BL) from the ones belonging to the Enhancement Layers. According to a specific embodiment, the AU coming from ENC0 are encoded with a given layer_id which is different from the layer_id used to encode the AUs coming from ENC2. AUs coming from ENC0 and ENC1 have the same layer_id. ENC0 and ENCC1 are for example single layer AVC or HEVC encoders. According to an advantageous embodiment not represented on Figure 11, the encoders ENC0 and ENC1 are one and the same encoder. Therefore, pictures from the first and the second sequences are encoded with a same encoder and appropriate reconstructed reference pictures (R1, R2, F(R2)) are provided as input to the second encoder ENC2.

Figure 12 depicts a multi-layer decoder according to a specific and non-limitative embodiment the invention. The first stream S0 is decoded using a first decoder DEC0 which is a mono-layer decoder for example an MPEG2, an H.264 or an HEVC compliant decoder. The invention is not limited by the mono-layer decoder used. The decoder DEC0 reconstructs pictures from the first stream S0, in particular the reference pictures R2 which are stored in a DPB0. A second decoder DEC1 is used to reconstruct pictures from the second stream S1 which are stored in a DPB1. The second decoder can be identical to DEC0 or different. The invention is not limited by the decoder used. After a switch from S0 to S1, the reconstructed reference pictures R2 in DPB0 possibly rescaled by an optional rescaling module F, are copied into DPB1. The rescaled picture R2 is denoted F(R2). A decoder DEC2 decodes (step 10) from the stream S_diff information INFO for identifying a reconstructed reference picture R2 (resp. F(R2)) in the DPB1. The decoder DEC2 is for example compliant with a scalable video decoder such as SVC or SHVC. The invention is not limited by the scalable decoder used. The decoder DEC2 further reconstructs (step 12) a special reference picture R1' from the temporally aligned reconstructed reference picture R2 (resp. F(R2)) and from data (e.g. residues, coding modes) decoded from S_diff. According to a specific embodiment, the decoder DEC2 comprises an entropy decoder for decoding a residue from S_diff and an adder for adding the residue to a predictor, wherein the predictor is derived either from co-located or motion-compensated blocks in R2 (resp. F(R2)) or from reconstructed samples in R1' (intra picture prediction). The special reference picture R1' is then stored (step 14) in the DPB1 in the place of R2 (resp. F(R2)) identified by INFO.
DEC0 and DEC1 are for example single layer AVC or HEVC decoders. According to an advantageous embodiment not represented on Figure 11, the decoders DEC0 and DEC1 are one and the same decoder. Therefore, pictures are reconstructed from S0 and S1 with a same decoder DEC having

a same DPB. Before a switch from S0 to S1, pictures are reconstructed from S0 by DEC and are possibly stored in the DPB. After the switch, appropriate reconstructed reference pictures (R2, F(R2)) are provided as input to the second decoder DEC2 for reconstructing SRP R'1. The reconstructed SRP R1' are then stored in the DPB in the place of reconstructed reference pictures R2. Then, pictures are reconstructed from S1 by DEC using pictures stored in DPB (either classical reconstructed reference pictures or SRP).

Figure 13 represents a multi-layered stream according to a specific and non-limitative embodiment the invention. On this figure the dashed lines represents the picture dependencies. AU1 and AU2 with layer_id=Layer_A are received and decoded. Reference picture b1 and b2 are reconstructed from decoded AU and stored in the DPB. Upon switching, the AUs S_diff1 and S_diff2 with layer_id=Layer_B are received and decoded. The decoder DEC2 then reconstructs special reference pictures e'1 and e'2 from data decoded from S_diff1 and from S_diff2 and further from b1 and b2 respectively. Information info_1 and info_2 decoded from S_diff1 and S_diff2 respectively are used to identify b1 and b2 respectively. The special reference pictures e'1 and e'2 which are temporally aligned with b1 and b2 respectively are stored in the DPB in replacement of reconstructed reference picture b1 and b2. Then, an AU3 is received and decoded. A picture e3 is reconstructed from this decoded AU3 and further from the special reference pictures e'1 and e'2. The reconstructed picture e3 is stored in the DPB since e3 is used as reconstructed reference picture for e4. An AU4 is received and decoded. A picture e4 is reconstructed from the decoded AU4 and further from the special reference picture e'2 and the reconstructed reference picture e3. The following AU5 and AU6 are received and decoded. Corresponding pictures e5 and e6 are reconstructed from decoded AU5 and AU6. The DPB is possibly updated if the reconstructed pictures are used as reference pictures. e'1 is preferentially an approximation of e1 one of the reconstructed reference pictures used when encoding e3. e'2 is preferentially an approximation of e2 one of the reconstructed reference pictures used when encoding e3 and e4.

The encoding and decoding methods according to the invention makes it possible to realize flexible stream switching while having a small bit rate overhead only when switching occurs. These methods are suitable for any GOP structure, any number of reconstructed reference pictures and even when decoding order is different form display order.

An example of a syntax is provided below within the SHVC coding standard framework for the S_diff stream.

slice_type	**Name of slice_type**
0	B (B slice)
1	P (P slice)
2	I (I slice)
3	**SRP (SRP slice)**

A slice_type is added to identify a slice of a special reference picture.

slice_segment_header( ) {	**Descriptor**
first_slice_segment_in_pic_flag	u(1)
…	
if(!dependent_slice_segment_flag) {	
for (i = 0; i < num_extra_slice_header_bits; i++)	
slice_reserved_undetermined_flag[i]	u(1)
slice_type	ue(v)
…	
=== Begin No IDR ===	
if(!IdrPicFlag) {	
…	
}	
=== End No IDR ===	
…	
=== Begin P or B ===	
if(slice_type = = P || slice_type = = B) {	
…	
}	
=== End P or B ===	
=== Begin SRP ===	
If (slice_type == SRP) {	
=== i2 ===	
sign_diff_pic	u(1)
=== i4 ===	
pic_order_cnt_diffpic_apply_lsb	u(v)
***delta_poc_msb_diffpic_apply_present_flag**[i]*	u(1)
if(delta_poc_msb_diffpic_apply_present_flag[i])	

delta_poc_msb_diffpic_apply_cycle_lt[i]	ue(v)
=== i5===	
no_output_diffpic _flag	u(1)
=== i12===	
num_layer_id_diffpic_apply	u(6)
}	
=== End SRP ===	
...	
}	

sign_diff_pic equal to 1 indicates the residuals should be added to the prediction, else the residuals should be substracted to the prediction.

pic_order_cnt_diffpic_lsb specifies the picture order count modulo MaxPicOrderCntLsb for this special reference picture. Then the intra BL prediction will use the reference picture in the DPB with same pic_order_cnt. This reconstructed special reference picture will replace the reference picture in the DPB with same pic_order_cnt. The length of the pic_order_cnt_lsb syntax element is log2_max_pic_order_cnt_lsb_minus4 + 4 bits. The value of the pic_order_cnt_diffpic_lsb shall be in the range of 0 to MaxPicOrderCntLsb − 1, inclusive. When pic_order_cnt_diffpic_lsb is not present, pic_order_cnt_diffpic_lsb is inferred to be equal to 0.

delta_poc_msb_diffpic_cycle_lt is used to determine the value of the most significant bits of the picture order count value of the long-term reconstructed reference picture in the DPB that this reconstructed special reference picture will replace in the DPB. When delta_poc_msb_cycle_lt is not present, it is inferred to be equal to 0

pic_order_cnt_diffpic_apply_lsb specifies the picture order count modulo MaxPicOrderCntLsb for the current picture. Then this special reference picture will replace in the DPB the reference picture with POC equal to **pic_order_cnt_diffpic** just before decoding the picture with POC equal to **pic_order_cnt_diffpic_apply_lsb**. The length of the pic_order_cnt_lsb syntax element is log2_max_pic_order_cnt_lsb_minus4 + 4 bits. The value of the pic_order_cnt_diffpic_lsb shall be in the range of 0 to MaxPicOrderCntLsb – 1, inclusive. When pic_order_cnt_diffpic_lsb is not present, pic_order_cnt_diffpic_lsb is inferred to be equal to 0.

no_output_diffpic_flag equal to 1 indicates the picture to be replaced in the DPB should be displayed but not this special reference picture, else the this special reference picture should be displayed but not the replaced reconstructed reference picture.

num_layer_id_diffpic_apply indicates the num_layer_id of the reconstructed reference pictures used to decode this special reference picture.

Examples of syntax (vps_extension):

video_parameter_set_rbsp ( ) {	Descriptor
…	
diff_pic_flag_enabled	U(1)
if (diff_pic_flag_enabled) {	
no_output_diffpic _flag	*u(1)*
inter_layer_pred_for_non_diff_pictures_flag	***u(1)***
}	
}	

diff_pic_flag_enabled equal to 1 indicates

no_output_diffpic_flag equal to 1 indicates the picture to be replaced in the DPB should be displayed but not this special reference picture, else the this special reference picture should be displayed but not the replaced reference picture.

inter_layer_pred_for_non_diff_picture_flag equal to 1 indicates that any subsequent picture of type I,P or B does not use inter-layer prediction, but pictures of type SRP may use inter layer prediction , but not temporal intra layer prediction.

The video coders and decoders according to the invention and depicted on figures 7, 8, 11 and 12, scalable or not, are for example implemented in various forms of hardware, software, firmware, special purpose processors, or a combination thereof. Preferably, the present principles may be implemented as a combination of hardware and software. Moreover, the software is preferably implemented as an application program tangibly embodied on a program storage device. The application program may be uploaded to, and executed by, a machine comprising any suitable architecture. Preferably, the machine is implemented on a computer platform having hardware such as one or more central processing units (CPU), a random access memory (RAM), and input/output (I/O) interface(s). The computer platform also includes an operating system and microinstruction code. The various processes and functions described herein may either be part of the microinstruction code or part of the application program (or a combination thereof) that is executed via the operating system. In addition, various other peripheral devices may be connected to the computer platform such as an additional data storage device and a printing device.

According to variants, the coding and decoding devices according to the invention are implemented according to a purely hardware realisation, for example in the form of a dedicated component (for example in an ASIC (Application Specific Integrated Circuit) or FPGA (Field-Programmable Gate Array) or VLSI (Very Large Scale Integration) or of several electronic components integrated into a device or even in a form of a mix of hardware elements and software elements.

Claims

1. A method for decoding a picture block comprising:

- decoding (10) at least one stream (S_diff) into decoded data and into one information for identifying a reconstructed reference picture in a decoder picture buffer;
- reconstructing (12) a special reference picture from at least said identified reconstructed reference picture and from said decoded data;
- replacing (14) in said decoder picture buffer said identified reconstructed reference picture by said special reference picture; and
- reconstructing (16) said picture block from at least said special reference picture.

2. The method according to claim 1, wherein said identified reconstructed reference picture and said special reference picture are temporally aligned.

3. The method according to claim 1 or 2, further comprising decoding (13) an information representative of an instant in time at which said one reconstructed reference picture is replaced by the special reference picture in the decoder picture buffer.

4. The method according to any of claim 1 to 3, further comprising decoding a flag indicating whether or not the special reference picture is displayed.

5. The method according to any of claim 1 to 4, wherein the identified reconstructed reference picture is decoded from a base layer of a layered stream.

6. The method according to claim 5, wherein the decoded data and the information identifying the reconstructed reference picture in the decoder picture buffer are decoded from an enhancement layer of the layered stream.

7. A method for encoding a picture block comprising:

- encoding (20) said picture block from at least one reconstructed reference picture; and

- encoding (24) said at least one reconstructed reference picture as a special reference picture from another reconstructed reference picture and an information for identifying said another reconstructed reference picture in a decoder picture buffer, wherein said special reference picture when reconstructed replaces said identified reconstructed reference picture in the decoder picture buffer.

8. The method according to claim 7, wherein said identified reconstructed reference picture and said special reference picture are temporally aligned.

9. The method according to claim 7 or 8, further comprising encoding (22) an information representative of an instant in time at which said one reconstructed reference picture is replaced by the special reference picture in the decoder picture buffer.

10. The method according to any one of claims 7 to 9, further comprising encoding a flag indicating whether or not the special reference picture is displayed.

11. The method according to any one of claims 7 to 10, wherein the identified reconstructed reference picture is encoded in a base layer of a layered stream.

12. The method according to claim 11, wherein said at least one reconstructed reference picture and the information for identifying the another reconstructed reference picture in the decoder picture buffer are encoded in an enhancement layer of the layered stream.

13. A decoding device for decoding a picture block comprising:

- means (DEC2) for decoding at least one stream (S_diff) into decoded data and into one information for identifying a reconstructed reference picture in a decoder picture buffer;
- means (DEC2) for reconstructing a special reference picture from at least said identified reconstructed reference picture and from said decoded data;
- means (DEC2) for replacing in said decoder picture buffer said identified reconstructed reference picture by said special reference picture; and
- means (DEC0, DEC1) for reconstructing said picture block from at least said special reference picture.

14. The decoding device according to claim 13, wherein said device is configured to execute the steps of the decoding method according to any of claims 1 to 6.

15. A coding device for encoding a picture block comprising:
- means (ENC0, ENC1) for encoding said picture block from at least one reconstructed reference picture; and
- means (ENC2) for encoding said at least one reconstructed reference picture as a special reference picture from another reconstructed reference picture and an information for identifying said another reconstructed reference picture in a decoder picture buffer, wherein said special reference picture when reconstructed replaces said identified reconstructed reference picture in said decoder picture buffer.

16. The coding device according to claim 15, wherein said device is adapted to execute the steps of the encoding method according to any of claims 7 to 12.

17. A data stream comprising encoded in it one information for identifying a reconstructed reference picture in a decoder picture buffer and data allowing for the reconstruction of a special reference picture from said identified reconstructed reference picture, said special reference picture being for

replacing said identified reconstructed reference picture in said decoder picture buffer.

18. A decoding device for decoding a picture block, said decoding device comprising at least one processor configure to:

- decode at least one stream into decoded data and into one information for identifying a reconstructed reference picture in a decoder picture buffer;
- reconstruct a special reference picture from at least said identified reconstructed reference picture and from said decoded data;
- replace in said decoder picture buffer said identified reconstructed reference picture by said special reference picture; and
- means for reconstructing said picture block from at least said special reference picture.

19. A coding device for encoding a picture block, said decoding device comprising at least one processor configure to:

- encode said picture block from at least one reconstructed reference picture; and

- encode said at least one reconstructed reference picture as a special reference picture from another reconstructed reference picture and an information for identifying said another reconstructed reference picture in a decoder picture buffer, wherein said special reference picture when reconstructed replaces said identified reconstructed reference picture in said decoder picture buffer.

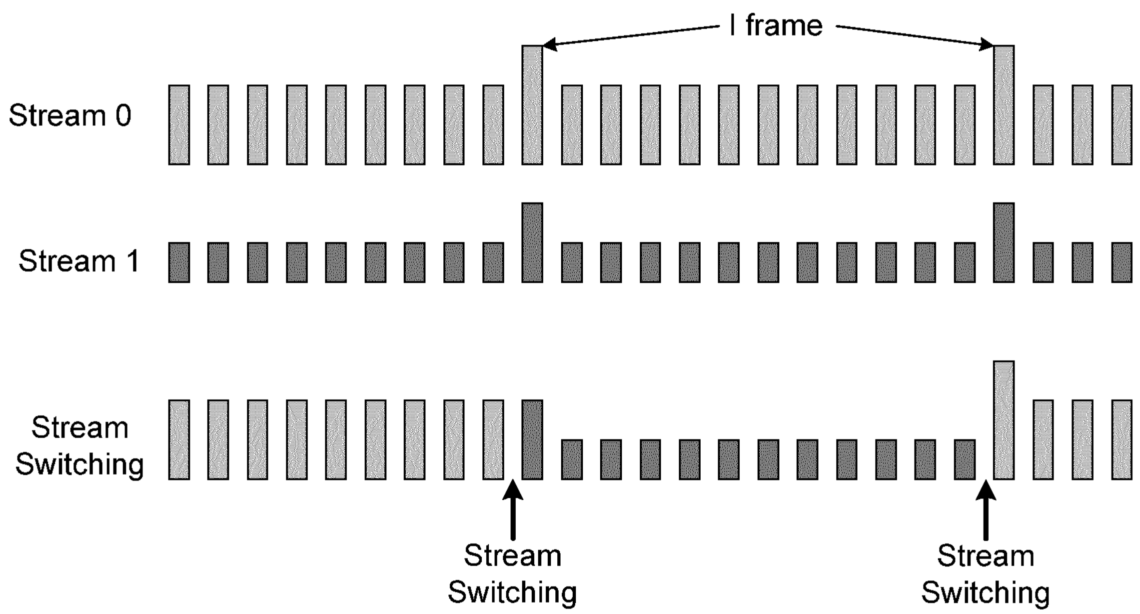

FIGURE 1 – State of the art

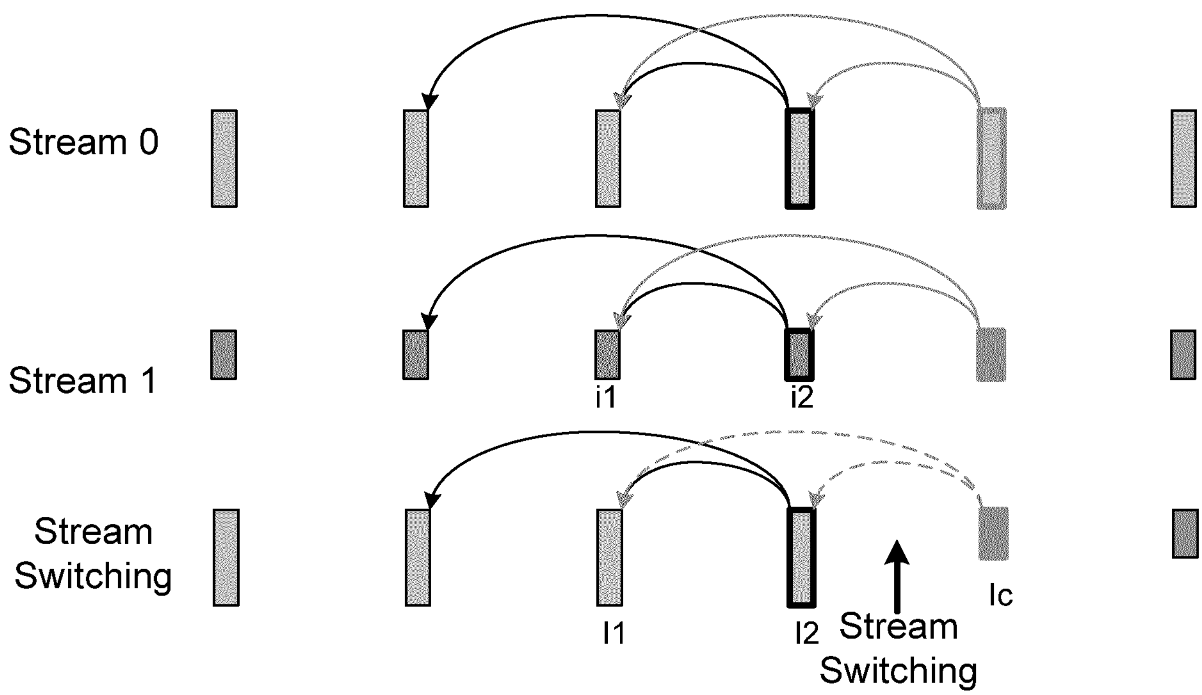

FIGURE 2– State of the art

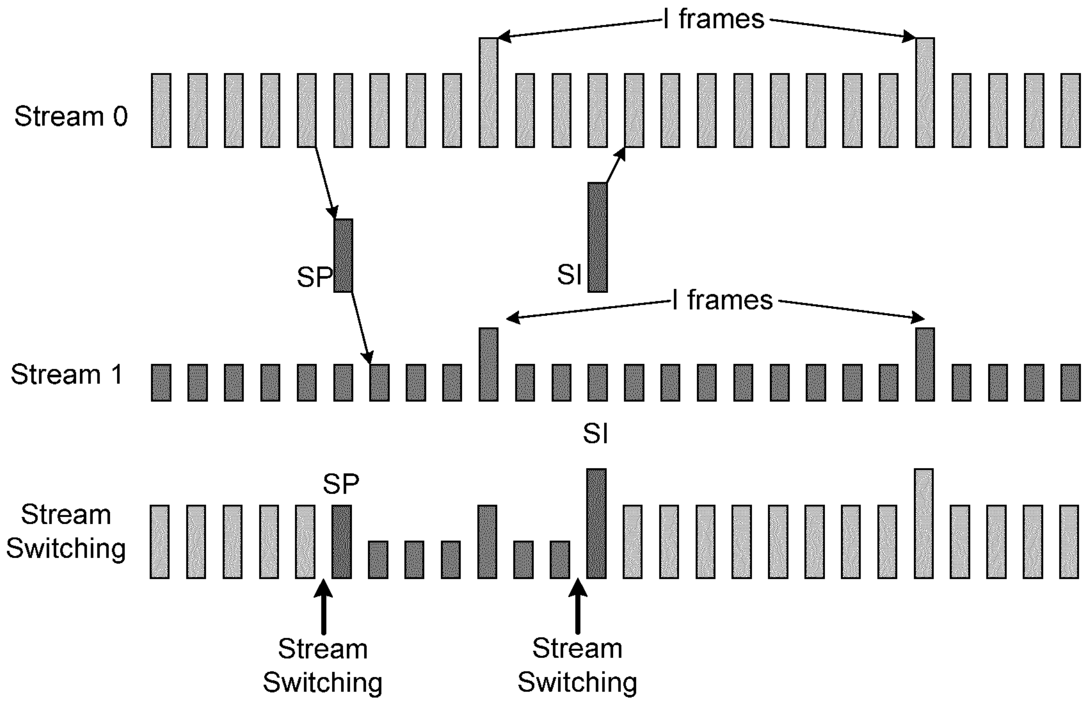

FIGURE 3– State of the art

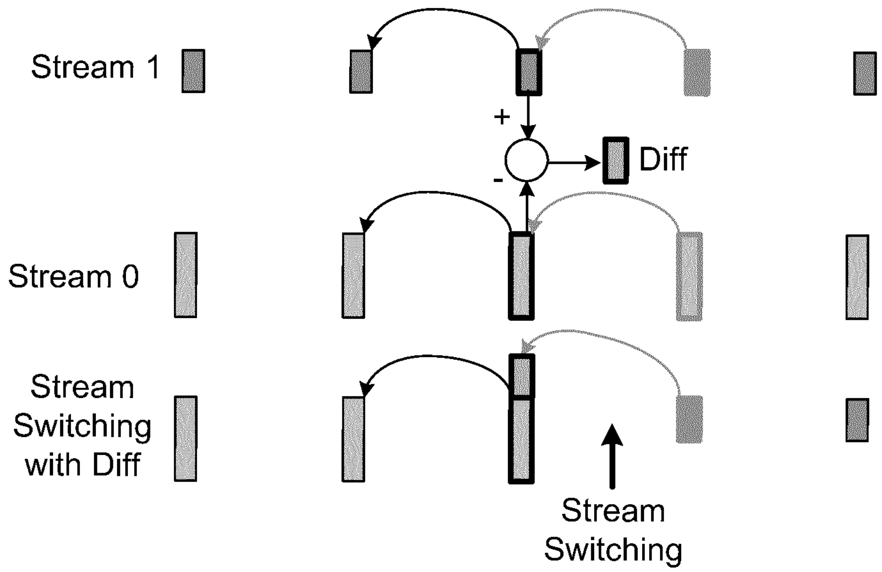

FIGURE 4– State of the art

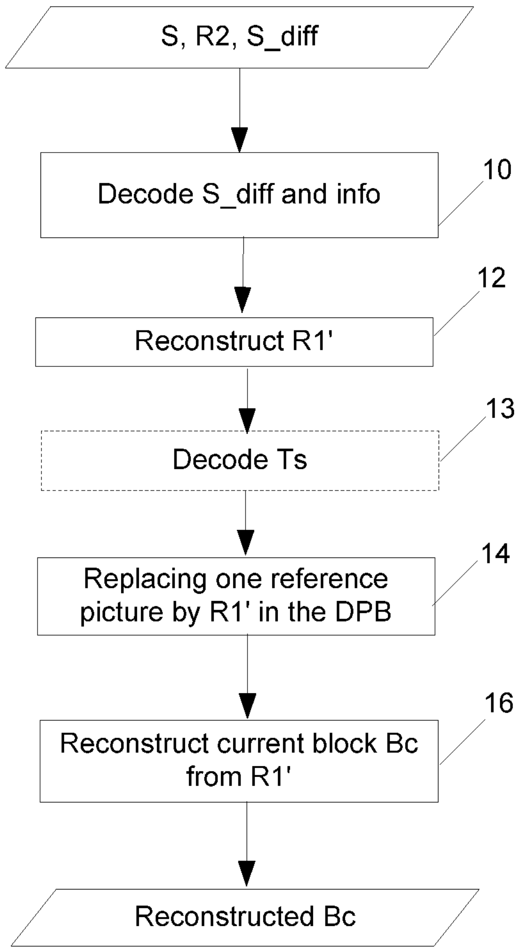
S, R2, S_diff
Decode S_diff and info
10
Reconstruct R1'
12
Decode Ts
13
Replacing one reference picture by R1' in the DPB
14
Reconstruct current block Bc from R1'
16
Reconstructed Bc

FIGURE 5

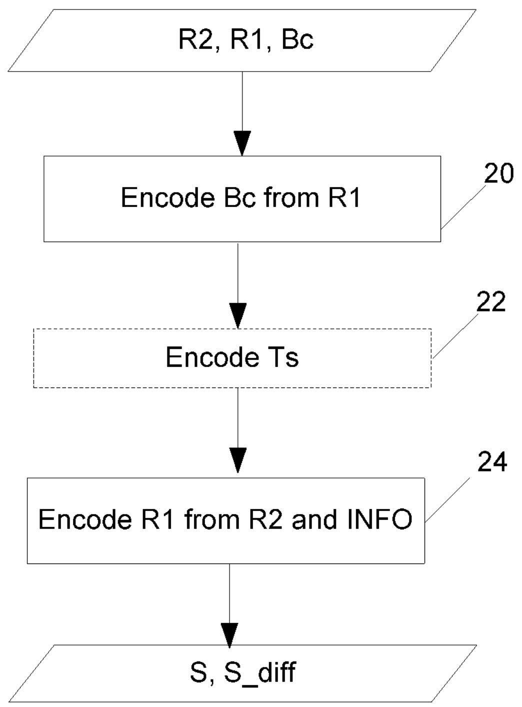

FIGURE 6

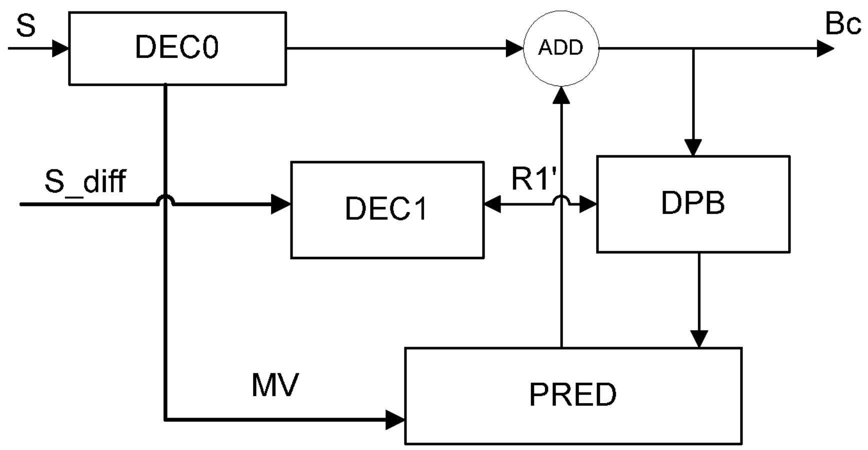

FIGURE 7

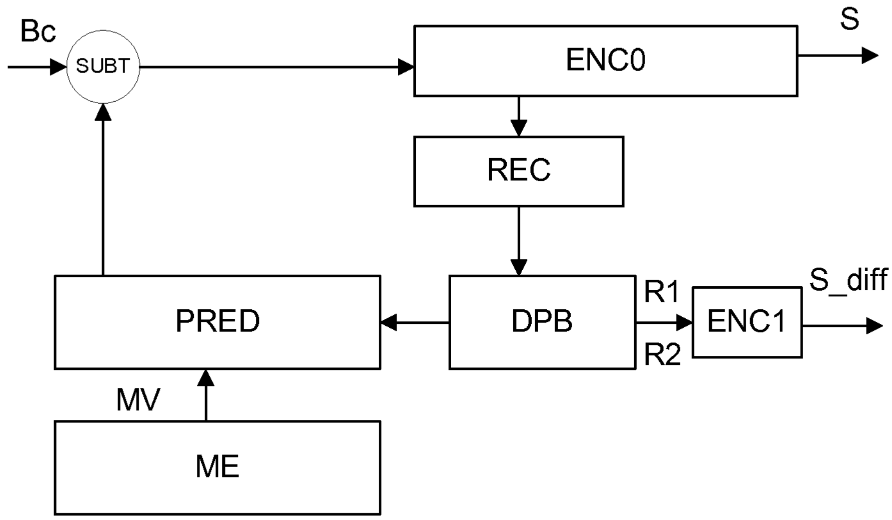

FIGURE 8

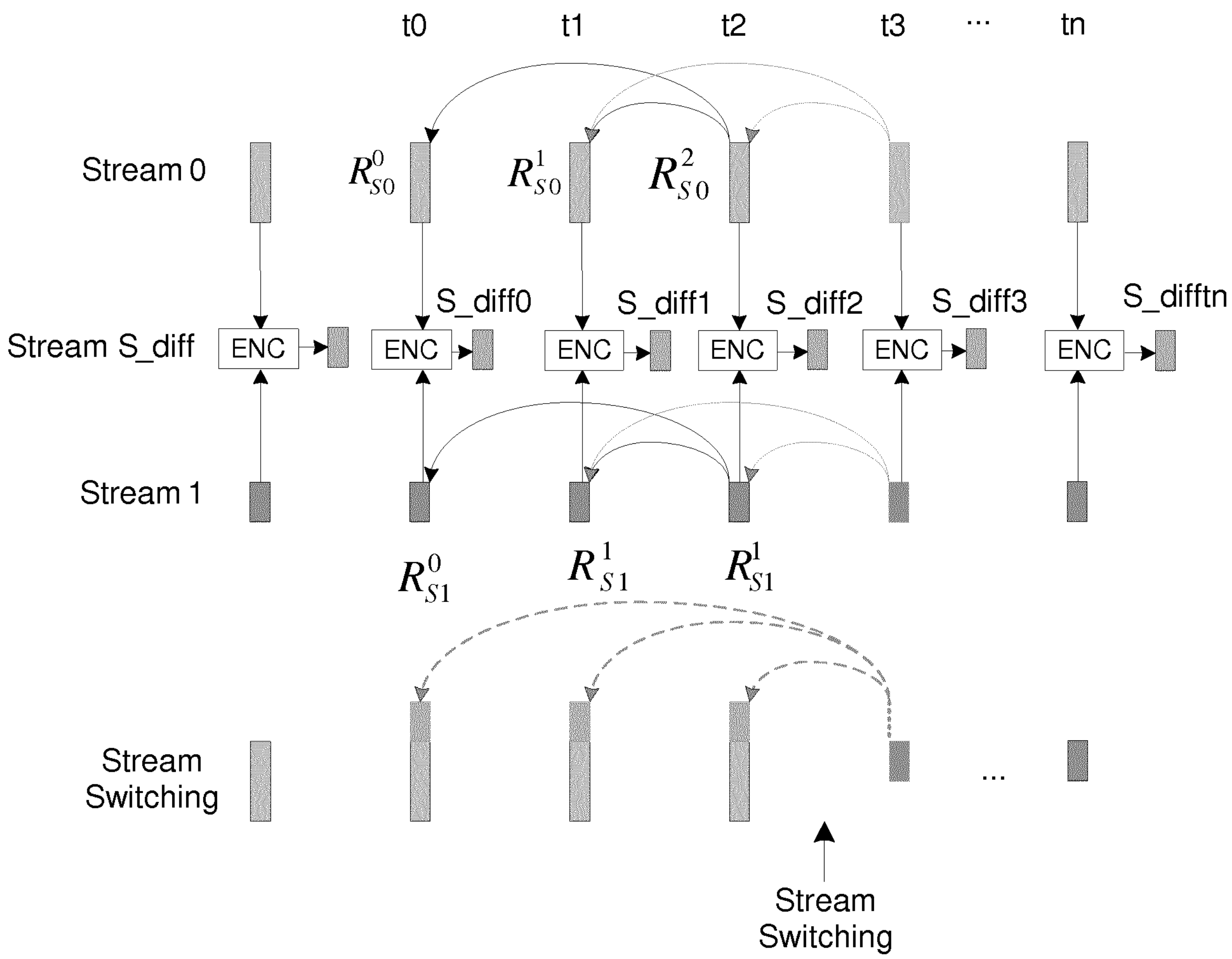

FIGURE 9

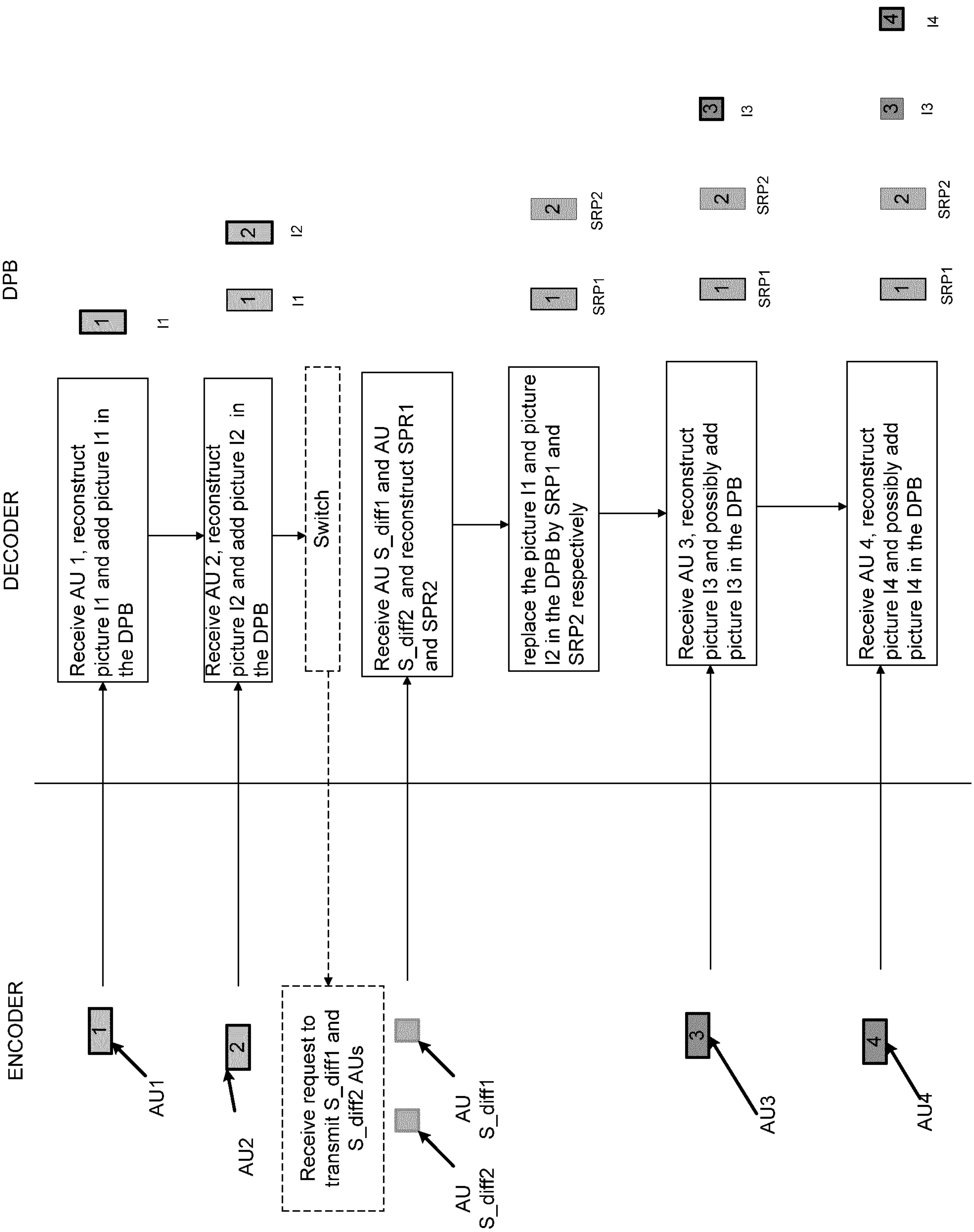
ENCODER
DECODER
DPB
AU1
1
Receive AU 1, reconstruct picture I1 and add picture I1 in the DPB
1
I1
AU2
2
Receive AU 2, reconstruct picture I2 and add picture I2 in the DPB
1
I1
2
I2
Receive request to transmit S_diff1 and S_diff2 AUs
Switch
AU S_diff1
AU S_diff2
Receive AU S_diff1 and AU S_diff2 and reconstruct SPR1 and SPR2
replace the picture I1 and picture I2 in the DPB by SRP1 and SRP2 respectively
1
SRP1
2
SRP2
AU3
3
Receive AU 3, reconstruct picture I3 and possibly add picture I3 in the DPB
1
SRP1
2
SRP2
3
I3
AU4
4
Receive AU 4, reconstruct picture I4 and possibly add picture I4 in the DPB
1
SRP1
2
SRP2
3
I3
4
I4

FIGURE 10

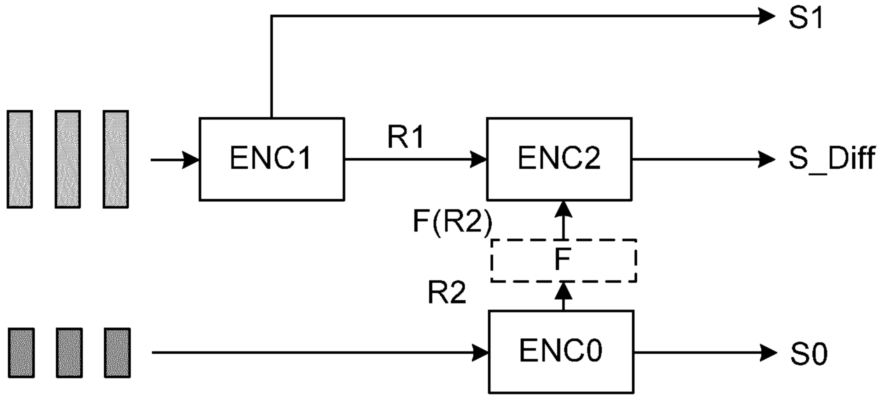

FIGURE 11

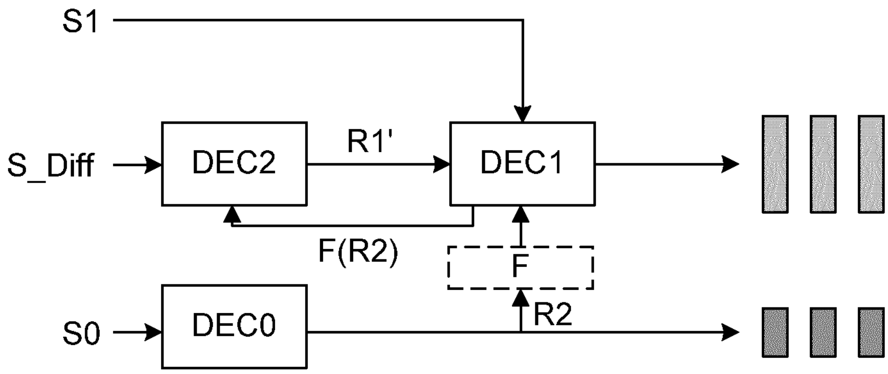

FIGURE 12

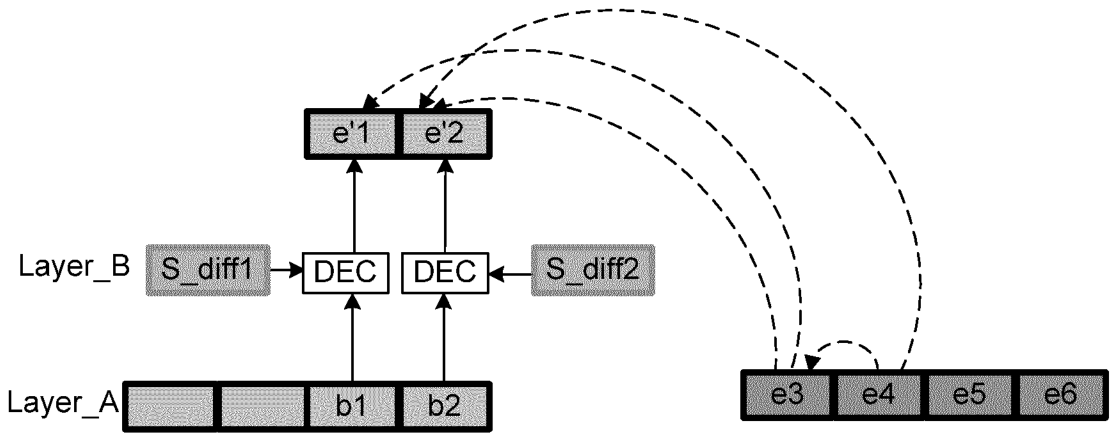

FIGURE 13

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2014/052998

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04N19/51 H04N19/30 H04N21/438
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)
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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	XIAOSONG ZHOU ET AL: "Efficient bit stream switching of H.264 coded video", PROCEEDINGS OF SPIE, vol. 5909, 18 August 2005 (2005-08-18), pages 590911-1, XP055071517, ISSN: 0277-786X, DOI: 10.1117/12.615637 cited in the application abstract sections 1, 3, 5 -----	1-19

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[X] 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

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"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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 April 2014	12/05/2014

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Streich, Sebastian

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WIEGAND T ET AL: "Overview of the H.264/AVC video coding standard", IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, IEEE SERVICE CENTER, PISCATAWAY, NJ, US, vol. 13, no. 7, 1 July 2003 (2003-07-01), pages 560-576, XP011221093, ISSN: 1051-8215, DOI: 10.1109/TCSVT.2003.815165 the whole document -----	1-19
A	RICKARD SJOBERG ET AL: "Overview of HEVC High-Level Syntax and Reference Picture Management", IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, IEEE SERVICE CENTER, PISCATAWAY, NJ, US, vol. 22, no. 12, 1 December 2012 (2012-12-01), pages 1858-1870, XP011487804, ISSN: 1051-8215, DOI: 10.1109/TCSVT.2012.2223052 the whole document -----	1-19
A	PO-CHYI SU ET AL: "A Dynamic Video Streaming Scheme Based on SP/SI Frames of H.264/AVC", 41ST INTERNATIONAL CONFERENCE ON PARALLEL PROCESSING WORKSHOPS (ICPPW), 2012 , IEEE, 10 September 2012 (2012-09-10), pages 524-529, XP032265731, DOI: 10.1109/ICPPW.2012.71 ISBN: 978-1-4673-2509-7 the whole document -----	1-19

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