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Method for video signal encoding

The invention relates to a method for video signal encoding.

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Prior Art

DE 36 42 664 specifies a transformation circuit with whose aid an 8*8 or 2*(4*8) DCT-transformation can be carried out (DCT = discrete cosine transformation). It is possible to switch over between an 8*8 and a 2*(4*8) DCT by selection of the logic level of a switching line.

Invention

The invention is based on the object of specifying a method for video encoding by means of a codec which is suitable for progressively scanned video signals and in which input signals which are scanned in interlace can also be processed. This object is achieved by the method according to the invention specified in Claim 1.

In principle, the method according to the invention consists in that, in the case of a hybrid encoder which can process the blocks of progressively scanned pixels, line sections of blocks of interlace-scanned pixels are arranged, before the encoding, within in each case two blocks, which are located vertically one above the other, such that only line sections from one field of the video signals are contained within each of these blocks.

In this case, movement in the frame content is determined and, in the event of a dynamic frame content, the line sections are resorted within the blocks which are located one above the other.

Advantageous developments of the method according to the invention result from the associated subclaims.

In the case of a method for hybrid encoding of video signals proposed by ISO-MPEG (ISO, International Organization for Standardization, MPEG: Motion Picture

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Expert Group) under the Standard Proposal Number ISO 11172, progressively scanned input signals are processed block by block using a DCT, blocks of 8*8 pixels in each case being encoded and decoded, and a sequence of inter-frame-encoded frames is passed through at regular intervals by intraframe-encoded frames. In this case, the encoder effectiveness is also based on the relatively high correlation between pixels within such blocks. If it is now also desired to process source signals scanned in interlace using such a hybrid encoder, the encoder effectiveness drops in the event of a dynamic frame content and the data rate required for encoding rises, because every other line in each case originates from a block to [sic] different movement phases and, in consequence, the correlation between pixels within such a block falls. In the case of a static frame content, the encoder effectiveness is, in contrast, maintained.

In the event of a dynamic frame content, the lines which belong to a first field from two 8*8 pixel blocks which are located one above the other are now combined to form a first 8*8 block, and the lines which belong to the corresponding second field from these two 8*8 pixel blocks which are located one above the other are combined to form a second 8*8 block and are supplied to the hybrid encoder in this form.

As a result of the reorganization of the input signals, in the case of interlace input signals, switching over need not be carried out in the hybrid encoder between an 8*8 and 2*(4*8) DCT-transformation as in DE 36 42 664, but an 8*8 DCT can also advantageously be carried out in the case of a dynamic frame content.

Movement detection is used to determine whether the frame content is static or dynamic and accordingly to carry out resorting or readdressing of the lines. This information can in this case be added to the encoded data of the respective block by means of one bit per block or double block.

During the decoding, the corresponding lines are changed back into their original sequence, the movement

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information being evaluated.

In the case of the abovementioned Standard Proposal, four luminance pixel blocks which are arranged in a square are in each case combined to form a macro-block. Two of those blocks of such a macro-block which are located one above the other in each case advantageously belong together in the sense described above. In this case, one bit per macro-block can also indicate the resorting.

Drawings

Exemplary embodiments of the invention are described with reference to the drawings, in which:

Fig. 1 shows the line arrangement within blocks in the case of a static and dynamic frame content;

Fig. 2 shows a block diagram, having additional circuits according to the invention, to form a codec.

Exemplary Embodiments

Fig. 1a and Fig. 1b each show two blocks, which are located one above the other, of luminance or chrominance pixels in the x-y plane. In order to simplify the illustration, the blocks each have a size of 4*4 pixels instead of the size of 8*8 pixels. Instead of 8*8, the blocks can in general also have a size of (2*n)*(2*m), where n=1,2,3..., m=1,2,3,... . The two-digit numbers in each case mark the physical position of a pixel. The first digit in these numbers represents the block number, and the second the line number within a block.

Those pixels of the known hybrid encoder which are to be encoded and decoded are arranged in progressively scanned form in accordance with Fig. 1a. This likewise applies to pixels having a static frame content in the case of interlace-scanned pixels. In the case of a dynamic frame content, the lines of in each case two blocks which are located one above the other are interchanged in accordance with Fig. 1b before encoding and

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are arranged in accordance with Fig. 1a again after decoding.

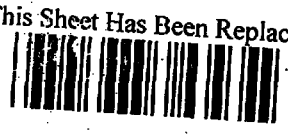
Fig. 2 shows a hybrid encoder 25 in accordance with the abovementioned Standard Proposal. Interlace-scanned video signals from frame n are supplied to the input 21 and pass into a frame memory 22 and a movement detector 24. Data (two blocks which are located one above the other) which are required by the movement detector 24 from frame n-1, and the line sections of the two blocks which are in each case involved are read into a block memory 23 from the frame memory 22, from which block memory 23 the hybrid encoder can in each case pick off 8*8 blocks. In the block memory 23, the pixels are buffer-stored in accordance with Fig. 1a in the case of a static frame content, and in accordance with Fig. 1b in the case of a dynamic frame content.

The movement detector can be implemented in accordance with various known methods. For example, the absolute-value differences between pixels from blocks in the same physical position from frame n and frame n-1 can be formed for each block or double block to be encoded. Alternatively, movement vectors formed by the hybrid encoder 25 (for example in each case for two blocks which are located one above the other) can be used instead of the movement detector. If the respective sum of these absolute-value differences and/or the magnitude of the corresponding movement vector for this block or these blocks exceeds a predetermined threshold (that is to say a dynamic frame content is present), the pixels are buffer-stored in the block memory 23 in accordance with Fig. 1b, and if not they are buffer-stored in the block memory 23 in accordance with Fig. 1a.

The resorting can be carried out in accordance with the following instruction:

```
DO y=1,N/2
DO x=1,N
    Bout1(x,y) = Bin1(x,2*y-1)
    Bout1(x,y) = Bin1(x,2*y)
    ENDDO
```

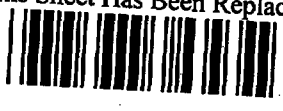
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ENDDO
DO y=1,N/2
      DO x=1,N
      B_out1(x,y+N/2) = B_in2(x,2*y-1)
      B_out1(x,y+N/2) = B_in2(x,2*y)
      ENDDO
ENDDO,
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B_{in1} being that block which is locally located higher, and N being an even number.

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Patent Claims

1. Method for video signal encoding using a hybrid encoder (25) which can process blocks of progressively sampled pixels, characterized in that, before the encoding, line sections of blocks of interlace-scanned pixels (11-14, 21-24) are arranged within in each case two blocks, which are located vertically one above the other, such that only line sections from one field of the video signals are obtained within each of these blocks.

2. Method according to Claim 1, characterized in that movement in the frame content is determined and the line sections in the case of a dynamic frame content are resorted within the blocks which are located one above the other.

3. Method according to Claim 1 or 2, characterized in that information is added to the encoded video signals for each pair of blocks which are located one above the other, which information indicates whether resorting of line sections has taken place.

4. Method according to Claim 3, characterized in that, after the decoding, the line sections are arranged in their original sequence again, the information which was added to the encoded video signals being evaluated.

5. Method according to one or more of Claims 1 to 4, characterized in that the blocks have the size of 8*8 pixels.

6. Method according to Claim 5, characterized in that four blocks having a size of 8*8 luminance pixels in square form are in each case combined, the blocks, which are located one above the other, in each case being arranged within these combined blocks.

7. Method according to one or more of Claims 3 to 6, characterized in that the information which is added to the encoded video signals in each case applies jointly to four combined blocks.

8. Method according to one or more of Claims 1 to 7, characterized in that the resorting of the line sections is controlled by the output signal of a movement detector

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(24) and/or by movement vectors which are generated in the hybrid encoder (25).

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