

Picture signal processing.

The invention relates to a picture signal processing method and device, a picture signal supplying method and device, a television receiver, a record player and a picture signal receiver.

5 It is known to use motion vectors transmitted as part of an MPEG signal both in an MPEG decoder and in post-processing circuitry to enhance an MPEG decoder output signal, e.g. by doubling the field-rate. See WO-A-97/46022, section V (attorneys' docket PHN 16.112).

10 It is, inter alia, an object of the invention to provide an improved picture signal processing. To this end, the invention provides a picture signal processing method and device, a picture signal supplying method and device, a television receiver, a record player and a picture signal receiver as defined in the independent claims. Advantageous embodiments are defined in the dependent claims.

15 In a picture signal processing method in accordance with an aspect of the invention, an analog picture signal is processed in dependence on a quality indication relating to the analog picture signal and received together with the analog picture signal. Preferably, the analog picture signal has been obtained by decoding a digital picture signal that has been obtained by encoding at a bit-rate and/or at a compression ratio and/or at a quantization level,
20 wherein the quality indication is the bit-rate and/or the compression ratio and/or the quantization level and/or other information about the encoding or decoding.

These and other aspects of the invention will be apparent from and elucidated with reference to the embodiments described hereinafter.

25 The drawing shows a configuration comprising embodiments of a (DVD) record player, a picture signal receiver (set-top box) and a television receiver in accordance with the present invention.

A record player RP comprises a decoder DEC1 (such as an MPEG decoder,
30 alternatives are possible) for decoding a digital picture signal retrieved from a storage medium

such as a digital versatile disk (DVD). Other digital record media, such as tape, are alternatively possible. The record player RP may have an antenna input for receiving a digital picture signal. In that manner, the decoder DEC1 can be used both for stored signals and for signals received from air (or thru cable).

5 In accordance with the present invention, the decoder DEC1 does not just supply a decoded first analog picture signal APS1, but also a first quality indication QI1 corresponding to the first analog picture signal APS1. Preferably, the first quality indication QI1 is the bit-rate and/or the compression ratio and/or the quantization level at which the digital picture signal has been encoded and/or other information about the encoding
10 or decoding, such as information about the level of compression via inverse quantization process and/or quantizer matrix (for intra and non-intra pictures) when the default ones are not used and/or intra-dc-precision and/or information when a decoding error happened.

 The drawing further shows a picture signal receiver in the form of a set-top box STB comprising a reader for a smart card SC and a decoder DEC2 corresponding to the
15 decoder DEC1 for decoding a digital picture signal received from an antenna A2 or thru cable. The decoder DEC2 supplies a second analog picture signal APS2 and a corresponding second quality indication QI2.

 A television receiver TV includes inputs for the analog picture signals APS1, APS2 and the corresponding quality indications QI1, QI2. The connections between the record
20 player RP and the TV set may be thru a well-known SCART cable for a parallel transmission of the analog picture signal APS1/2 and the corresponding quality indication QI1/2, or thru a serial connection such as USB. As a further alternative, the quality indication QI1/2 may be transmitted within the corresponding analog picture signal APS1/2, e.g. in a teletext line of the analog picture signal APS1/2. A switch S1 selects the first analog picture signal APS1 or the
25 second analog picture signal APS2 to obtain a selected analog picture signal. A switch S2 selects the first quality indication QI1 or the second quality indication QI2 to obtain a selected quality indication. The switches S1, S2 may belong to a single electronic switch unit. The selected analog picture signal is subjected to a picture signal processing PSP, such as a picture
30 signal enhancement like a peaking operation, noise reduction operation, MPEG artifact reduction operation, coring operation or histogram operation. The picture signal processing PSP is controlled by a picture signal control in dependence on the selected analog picture signal and the selected quality indication. The resulting processed picture signal is displayed on a display device DD.

The invention is based on the recognition that sending a quality indication with an analog picture signal allows a TV to determine the characteristics of the source material and hence make an informed selection of algorithm. A better picture quality will result from the application of a more appropriate processing to the signal. Giving a picture signal processing unit the information it needs to enable it to do the appropriate optimization prevents it from "optimizing" a picture that is already OK, or from "optimizing" it in the wrong way. For example, if the quality of the analog picture signal is low, because the digital picture signal from which the analog picture signal has been retrieved had been encoded at a low quantization level, a low bit-rate and/or a high compression ratio, a picture signal enhancement operation such as a peaking or histogram operation to improve sharpness and/or contrast would only render the blocking artifacts more visible. So, if the quality indication indicates a low quality, a peaking operation is preferably switched off. On the other hand, mosquito noise present in a low-quality signal could be reduced by appropriately adjusting a noise reduction operation forming part of the picture signal processing PSP in dependence upon the quality indication. The TV can accommodate different sources, with different (and possibly dynamically changing) signal qualities. While in the embodiment, the TV receiver has two inputs (APS1, QI1) and (APS2, QI2), it is not necessary to have two sources in the system for the invention to have a benefit.

It should be noted that the above-mentioned embodiments illustrate rather than limit the invention, and that those skilled in the art will be able to design many alternative embodiments without departing from the scope of the appended claims. The record player RP may have recording facilities, and the notion record player includes any apparatus that is able to play and decode a recorded digital picture signal to obtain an analog picture signal plus a corresponding quality indication. In the claims, any reference signs placed between parentheses shall not be construed as limiting the claim. The word "comprising" does not exclude the presence of elements or steps other than those listed in a claim. The word "a" or "an" preceding an element does not exclude the presence of a plurality of such elements. The invention can be implemented by means of hardware comprising several distinct elements, and by means of a suitably programmed computer. In the device claim enumerating several means, several of these means can be embodied by one and the same item of hardware. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.

CLAIMS:

1. A picture signal processing method, comprising the steps of:
decoding a digital picture signal that has been obtained by encoding at a bit-rate and/or at a compression ratio and/or at a quantization level, to obtain an analog picture signal (APS1, APS2) and a quality indication (QI1, QI2) relating to the analog picture signal (APS1, APS2), the quality indication (QI1, QI2) being the bit-rate and/or the compression ratio and/or the quantization level and/or other information about the encoding or decoding; and
processing (PSP) the analog picture signal (APS1, APS2) in dependence on the quality indication (QI1, QI2).
2. A method as claimed in claim 1, wherein the processing step (PSP) includes a picture enhancement operation.
3. A method as claimed in claim 2, wherein the picture enhancement operation (PSP) is a sharpness and/or contrast improving operation.
4. A method as claimed in claim 2, wherein the picture enhancement operation (PSP) is a noise or encoding artifact reduction operation.
5. A picture signal processing device, comprising:
means for receiving an analog picture signal (APS1, APS2) that has been obtained by decoding a digital picture signal that has been obtained by encoding at a bit-rate and/or at a compression ratio and/or at a quantization level, and wherein;
means for receiving a quality indication (QI1, QI2) relating to the analog picture signal, the quality indication (QI1, QI2) being the bit-rate and/or the compression ratio and/or the quantization level and/or other information about the encoding or decoding; and
means (PSP) for processing the analog picture signal (APS1, APS2) in dependence on the quality indication (QI1, QI2).

6. A television receiver (TV) comprising:
a picture signal processing device (PSP) as claimed in claim 5 for furnishing a processed picture signal; and
means (DD) for displaying the processed picture signal.

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7. A picture signal supplying method, comprising the steps of:
decoding (DEC1, DEC2) a digital picture signal that has been obtained by encoding at a bit-rate and/or at a compression ratio and/or at a quantization level, to obtain an analog picture signal (APS1, APS2) and a quality indication (QI1, QI2) relating to the analog picture signal (APS1, APS2), the quality indication (QI1, QI2) being the bit-rate and/or the compression ratio and/or the quantization level and/or other information about the encoding or decoding;

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supplying the analog picture signal (APS1, APS2); and
supplying the quality indication (QI1, QI2) relating to the analog picture signal (APS1, APS2).

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8. A picture signal supplying device, comprising:
means for decoding (DEC1, DEC2) a digital picture signal that has been obtained by encoding at a bit-rate and/or at a compression ratio and/or at a quantization level, to obtain an analog picture signal (APS1, APS2) and a quality indication (QI1, QI2) relating to the analog picture signal (APS1, APS2), the quality indication (QI1, QI2) being the bit-rate and/or the compression ratio and/or the quantization level and/or other information about the encoding or decoding;

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means for supplying the analog picture signal (APS1, APS2); and
means for supplying the quality indication (QI1, QI2) relating to the analog picture signal (APS1, APS2).

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9. A record player (RP), comprising:
means for retrieving a digital picture signal from a record (DVD); and
a picture signal supplying device (DEC1) as claimed in claim 8.

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10. A picture signal receiver (STB), comprising:
means (A2) for receiving a digital picture signal; and
a picture signal supplying device (DEC2) as claimed in claim 8.