

Description

The invention relates to an image encoding/decoding system comprising a transmission apparatus for encoding and compressing data to be transmitted and a receiving apparatus for decoding and reproducing the data.

The invention utilizes the so-called vector quantization technique and is applicable to fields such as TV conference systems and TV telephone systems.

As a result of the remarkable advance of the image processing technology in recent years, there have been made various attempts to put, for example, TV conference systems and TV telephone systems to practical use by mutually and bidirectionally transmitting image information. In such technological fields, the quantization technique has been used in which the image signals as the analog quantity are classified into a finite number of levels changing in a discrete fashion within a fixed width and a unique value is assigned to each of these levels. Particularly, there has been a considerable advance in the vector quantization technique in which a plurality of samples of the image signals are grouped in blocks and each block thereof is mapped onto a pattern most similar thereto in a multidimensional signal space; thereby accomplishing the quantization.

The study of the vector quantization technology has been described in the following reference materials, for example.

- (1) "An Algorithm for Vector Quantizer Design" by Y. Linde, A. Buzo, and R. M. Gray (IEEE TRANSACTION ON COMMUNICATIONS, Vol. COM.28, No. 1, January 1980, pp. 84 - 95)
- (2) "On the Structure of Vector Quantizers" by A. Gersho (IEEE TRANSACTION ON INFORMATION THEORY, Vol. IT28, No. 2, March 1982, pp. 157 - 166)
- (3) "Speech Coding Based Upon Vector Quantization" by A. Buzo, A. H. Gray Jr., R. M. Gray and J. D. Markel (IEEE TRANSACTION ON ACOUSTICS, SPEECH, AND SIGNAL PROCESSING, Vol. ASSP28, No. 5, October 1980, pp. 562 - 574)

Moreover, the following U.S. Patents have been obtained by the assignee of the present invention.

- (4) US-A- 4,558,350 "VECTOR QUANTIZER", Murakami
- (5) US-A- 4,560,977 "VECTOR QUANTIZER", Murakami et al.

Further references describe differential pulse code modulation systems (DPCM systems), namely

- (6) US-A-4,562,468 and
- (7) DE-A-33 31 426.

Finally, the vector quantization technology, as described in the above references numbers (1) to (5) have been applied to an image encoding apparatus of the applicants described in EP-A-188 269, to be considered under article 54(3) EPC. A transmission apparatus and a receiving apparatus for an image encoding/decoding system using details of the systems as described in EP-A-188 269 will now be described in connection with Figs. 1 to 3D of the accompanying drawings.

The conventional image encoding/transmitting apparatus, as shown in FIG. 1, includes a subtractor 1 for obtaining a difference between an input signal S_1 such as an image signal and an estimation signal S_3 for outputting an estimated error signal S_2 , a movement detecting circuit 2 for comparing a threshold value T with the estimated error signal S_2 to detect a movement or a change and for generating and outputting a movement or change detect signal S_3 and a differential signal S_4 , a quantization circuit 3 for quantizing the movement or change detect signal S_3 and the differential signal S_4 to output a quantization signal S_5 , a variable length encoder 4 for generating from the quantization signal S_5 an encoded signal S_6 with a variable length and for outputting the encoded signal S_6 , a transmission data buffer circuit 5 for temporarily storing the encoded signal S_6 and for outputting the encoded signal S_6 to the transmission side, a local decoding circuit 6 for generating a reproduced differential signal S_7 from the quantization signal S_5 delivered from the quantization circuit 3 and outputting the reproduced or regenerated differential signal S_7 , an adder 7 for achieving an addition on the reproduced differential signal S_7 and the estimation signal S_3 and for outputting a reproduced input signal S_8 , an estimating circuit 8 for outputting an estimation signal S_9 based on the reproduced input signal S_8 , and a threshold generating circuit 9 for monitoring the amount of the encoded signal S_6 accumulated in the transmission data buffer circuit 5 and for generating an appropriate threshold value T .

The movement detecting circuit 2 comprises, as shown in FIG. 2, an absolute value circuit 10 for calculating the absolute value $|S_2|$ of the estimated error signal S_2 , a comparing circuit 11 for effecting a comparison between the absolute value $|S_2|$ of the estimated error signal S_2 and the threshold value T and for outputting the movement or change detect signal S_3 , and a zero allocator 12 for allotting 0 and outputting 0 as the differential signal S_4 when the movement or change is not detected as a result of the comparison in the comparing circuit 11. The movement detect signal S_3 is converted into a running record R by use of the running length encode table 4a to generate serial data. In addition, only when the movement detect signal S_3

is indicating the validness, the quantization signal S_5 is converted into a variable-length record through the variable-length encode table 4b to generate serial data (FIGS. 2B - 2C). Reference numeral 4C indicates a multiplex operation control section.

In contrast to the configuration on the transmission side of FIGS. 1 - 2B, the configuration on the reception side is shown in FIGS. 3A - 3B. In FIG. 3A, the equipment on the reception side includes a receiving data buffer circuit 13 for receiving and for temporarily storing the encoded signal S_6 delivered from the transmission data buffer circuit 5 on the transmission side, a variable length decoder 14 for decoding the encoded signal S_6 stored in the receiving data buffer 13 to output a reproduced quantization signal S_{11} , a local decoding circuit 15 for outputting a reproduced differential signal S_{12} based on the reproduced quantization signal S_{11} , an adder circuit 16 for obtaining the difference between the reproduced differential signal S_{12} and the reproduced estimation signal S_{13} and for reproducing the input signal S_{14} which corresponds to the reproduced input signal S_8 on the transmission side, and an estimating circuit 17 for outputting the reproduced estimation signal S_{13} .

After the encoded signal S_6 (which has undergone multiplexing in the variable-length encode circuit 4) is received by the receive buffer circuit 13, the data is distributed to the respective decode tables of variable codes under control of the multiplex separation control circuit 14d. As a result of the decoding, the movement detect signal and the quantization signal are attained. Moreover, when the decoded movement detect signal indicates the invalidness (= "0"), the quantization signal is reset to "0" by the flip-flop 14c, thereby outputting the output S_{11} (FIG. 3B).

Next, the operation on the transmission side will be described with reference to FIGS. 1 - 2.

Assuming first the non-effective error in the movement detecting circuit 2 to be d , the estimation coefficient to be applied to the reproduced input signal S_8 in the estimating circuit 8 to be A , and the delay of the time t to be Z^{-1} , the following relationships are satisfied.

$$\begin{aligned} S_2 &= S_1 - S_9 \\ S_4 &= S_2 + d \\ S_7 &= S_4 + Q \\ S_8 &= S_7 + S_9 = S_1 + Q + d \\ S_9 &= A \cdot S_8 \cdot Z^{-1} \end{aligned}$$

The subtractor 1 calculates the estimated error signal S_2 representing the difference between the input signal S_1 and the estimated signal S_9 , whereas the movement detecting circuit 2 outputs the movement or change detection signal S_3 and the

differential signal S_4 based on the estimated error signal S_2 calculated by the subtractor 1.

A detailed description will be given of the operation of the movement detecting circuit 2 by referring to FIG. 2. The allotting absolute value circuit 10 obtains the absolute value of the estimated error signal S_2 and then the comparison circuit 11 achieves a comparison between the absolute value $|S_2|$ of the estimated error signal S_2 and the threshold value T generated by the threshold value generating circuit 9.

The movement detection signal S_3 is output in conformity with the following conditions.

$$\begin{aligned} S_3 &= 0 \text{ (invalid)} & |S_2| < T \\ S_3 &= 1 \text{ (valid)} & |S_2| \geq T \end{aligned}$$

When the movement or change is not detected, namely, for " $S_3 = 0$ ", zero allocator 12 outputs "0" for the differential signal S_4 .

On the other hand, the quantization circuit 3 converts the inputted differential signal S_4 according to an arbitrary characteristic. The variable encoding circuit 4 receives the quantization signal S_5 only when the movement detection signal S_3 is valid, namely, for " $S_3 = 1$ " and, for example, conducts a run-length encoding on the movement detection signal S_3 . For the quantization signal S_5 , a code having a smaller code length is assigned to a value in the neighborhood of "0" for which the generation frequency is high and then the code is stored in the transmission data buffer circuit 5. The transmission data buffer circuit 5 outputs the accumulated datum as the encoded signal S_6 to a transmission line. The threshold generating circuit 9 monitors the accumulated amount of the transmission data buffer circuit 5 and further controls the generation amount of the encoded data by generating an appropriate threshold value.

Next, the operation on the reception side will be described with reference to FIG. 3. The receiving data buffer circuit 13 first receives the encoded signal S_6 (undergone the variable length encoding on the transmission signal) and outputs the signal S_6 to the variable length decoder 14. Only when the movement detection signal S_3 (undergone the decoding operation) indicates the validness, the variable length decoder 14 outputs the reproduced quantization signal S_{11} . If the movement detection signal S_3 indicates the invalidness, the variable length decoder 14 outputs "0". Next, the local decoding circuit 15 decodes the reproduced quantization signal S_{11} and outputs the reproduced differential signal S_{12} to the adder 16. The adder 16 adds the reproduced differential signal S_{12} to the reproduced estimation signal S_{13} from the estimation circuit 17 thereby to reproduce the input signal S_{14} .

The operation to effect the data compression and transmission by use of the differential signal is referred to as the differential pulse code modulation (to be abbreviated as DPCM herebelow) system.

However, in the image encoding/transmitting apparatus using the DPCM system, the variable length encoding is achieved on the datum which is judged to be effective at the step of the variable length encoding; consequently, as the threshold value increases, the code having a short code length to be assigned in the neighborhood of "0" cannot be generated and hence the efficiency of the encoding is deteriorated; moreover, there has been a problem that as the threshold value becomes greater, the precision of the quantization is not improved for the quantization characteristic of the quantization circuit in the circuitry on the transmission side even when the dynamic range of the effective datum is narrowed.

It is therefore an object of the present invention to provide an image encoding/decoding system comprising a transmission apparatus for encoding and compressing data to be transmitted and a receiving apparatus for decoding and reproducing the data, utilizing a code with a short code length regardless of the magnitude of the threshold value, and in which the quantization error is minimized by use of a quantization characteristic corresponding to the threshold value.

According to the invention the transmission apparatus for such a system comprising a transmission data buffer circuit for storing data to be transmitted; a threshold generating circuit for generating a threshold value for motion detection responsive to an amount value in said transmission data buffer circuit; a motion detecting circuit for outputting a differential signal based on a predicted error signal and a motion detection signal based on a comparing result between the predicted error signal and the threshold value; a quantization circuit for quantizing input signals; a variable length encoder for encoding the output of said quantization circuit and said motion detection signal; is characterized by a threshold compensation circuit for judging the polarity of said differential signal, changing said threshold value into a modified threshold value having a polarity corresponding to the judged polarity, and outputting a compensated differential signal representing the difference between the value of said differential signal and the value of said modified threshold value; wherein said quantization circuit quantizes the compensated differential signal, and said variable length encoder encodes the output of said quantization circuit, the motion detection signal and said threshold value.

According to the invention the receiving apparatus of the system comprising a receiving data

buffer circuit for storing received data; a variable length decoder for decoding coded motion detecting signals and coded quantized signals which are included in the received data, and outputting a regenerated quantized signal in case the motion detecting signal is in active condition; a local decoding circuit for decoding said regenerated quantized signal; is characterized by a threshold compensation regeneration circuit for judging the polarity of a regenerated compensated difference signal regenerated by said local decoding circuit, and regenerating a differential signal by adding a regenerated modified threshold value attached the judged polarity to a value of said regenerated compensated differential signal; wherein said variable length decoder regenerates a motion detecting signal, a quantized signal and a threshold value for the threshold compensation regeneration circuit, and said local decoder regenerates the compensated differential signal by decoding the quantized signal.

The present invention will be apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a block diagram showing the configuration on the transmission side of the prior art image encoding/transmitting apparatus utilizing the DPCM system;

FIG. 2A is a block diagram illustrating a detailed configuration of the movement detecting circuit of FIG. 1, FIG. 2B is a block diagram illustrating a detailed configuration of the variable-length encode circuit 4, FIG. 2C is a schematic diagram illustrating an example of the multiplexing of the circuit of FIG. 1;

FIG. 3A is a block configuration diagram depicting the reception side of the prior art image encoding/transmitting apparatus, FIG. 3B is a block diagram showing the details of the variable-length decode circuit of FIG. 3A;

FIG. 4A is a block configuration diagram showing the configuration of the apparatus on the transmission side of the first embodiment of the image encoding/transmitting apparatus using the DPCM system according to the present invention, FIG. 4B is a block configuration diagram showing in detail the variable-length encode circuit 4, FIG. 4C is a schematic diagram illustrating an example of the encoding format of FIG. 4A;

FIG. 5A is a schematic block diagram illustrating the details of the threshold compensation circuit of FIG. 4A, FIG. 5B is a block diagram illustrating in detail the polarity judge circuit 19 of FIG. 5A, FIG. 5C is a block diagram showing in detail the polarity adder circuit of FIG. 5A;

FIG. 6A is a block configuration diagram showing the construction of the apparatus on the

reception side according to the first embodiment of FIG. 4A, FIG. 6B is a block diagram showing the configuration of the variable-length decoder as an apparatus on the reception side;

FIG. 7A is a schematic block diagram depicting the configuration of the threshold compensation regeneration circuit of FIG. 6A, FIGS. 7B - 7C are a table of threshold values with polarity and the characteristic diagram, respectively for explaining the operation of the threshold compensation regenerator circuit;

In FIG. 4A, reference numeral 18 indicates a threshold compensation circuit for assigning a polarity to the threshold value T output from the threshold generating circuit 9 according to the differential signal S_4 supplied from the movement detecting circuit 2, for generating the compensated differential signal S_{15} by effecting a subtraction between the threshold value T_1 to which the polarity is assigned and the differential signal S_4 , and for outputting the compensated differential signal S_{15} .

As shown in FIG. 4B, the movement detect signal S_3 is converted into a run length code R by use of the run length encode table 4a to generate the serial data. On when the movement detect signal S_3 is indicating the validness, the threshold value T and the quantization signal S_5 are respectively converted into variable-length records by use of the variable-length encode tables 4b - 4c; thereafter, the records are converted into serial data. The encode tables each are constituted from a storage device such as an ROM. Reference numeral 4d indicates a multiplexing control section. In this case, the multiplexing is accomplished as shown in FIG. 4C.

In FIG. 5A, reference numeral 19 denotes a polarity judgment circuit for judging the polarity of the difference signal S_4 and for outputting the polarity signal S_{16} , reference numeral 20 is a polarity adding circuit for assigning the polarity to the threshold value T output from the threshold generating circuit 9 according to the polarity signal S_{16} , and reference numeral 21 is a subtractor for achieving a subtraction between the threshold value T_1 with the polarity and the differential signal S_4 and for outputting the compensated differential signal S_{15} . The polarity judgment circuit 19 includes a comparator 19a as shown in FIG. 5B. Moreover, the subtractor 20 comprises a flip-flop 20a of FIG. 5C. In FIG. 5B, the following condition is satisfied.

If $A < B$ (= "0") then $S_{16} = "1"$
else $S_{16} = "0"$

In FIG. 5C, the polarity signal S_{16} is used as the sign bit of the threshold value T so as to be fetched by the FF. This FF is reset to "0" when the movement detect signal S_3 is indicating the invalidness (= "0").

In FIG. 6A, reference numeral 22 denotes a threshold compensation regeneration circuit for generating the regenerated differential signal S_{21} from the detection signal S_{17} output from the variable length decoding circuit 14, the threshold value T, and the regenerated, compensated difference signal S_{20} output from the local decoding circuit 15 and for outputting the regenerated differential signal S_{21} . The threshold value regeneration circuit 14, as shown in FIG. 6B, receives by means of the receive buffer circuit 13 the encoded signal S_6 undergone the multiplexing in the variable-length encode circuit 4 on the transmission side, distributes the data to the respective decode tables of the variable-length code under control of the multiplexing separation control circuit, and obtains as the results of the variable-length decoding operation the movement detect signal S_{17} , the threshold value T, and the quantization signal S_{19} . When the movement detect signal indicates the invalidness, the threshold value T and the quantization signal S_{19} are not delivered. Incidentally, the decode tables each are constituted from a memory device such as an ROM.

In addition, in FIG. 7A, reference numeral 23 is a polarity judgment circuit for judging the polarity of the regenerated, compensated differential signal S_{20} and for outputting the polarity signal S_{23} , reference numeral 24 designates a polarity adding circuit for assigning the polarity to the threshold value T according to the polarity signal S_{23} and for outputting the threshold value T_1 with the polarity, and reference numeral 25 indicates an adder for outputting the regenerated differential signal S_{21} by adding the threshold value T_1 with the polarity and the regenerated, compensated differential signal S_{20} .

Next, the operation on the transmission side of the present invention will be described with reference to FIGS. 4A - 5C.

First, assuming the non-effective error in the movement detecting circuit 2 to be d , the estimation coefficient to be applied to the regenerated input signal S_8 in the estimating circuit 8 to be A, and the delay of the time t to be Z^{-1} , the following relationships are satisfied.

$$\begin{aligned} S_2 &= S_1 - S_8 \\ S_4 &= S_2 + d \\ S_{15} &= S_4 - T \\ S_7 &= S_7 + Q \\ S_6 &= S_3 + S_7 + T = S_1 + Q + d \\ S_9 &= A \cdot S_8 \cdot Z^{-1} \end{aligned}$$

The subtractor 1 here calculates the estimated error signal S_2 representing the difference between the input signal S_1 and the estimated signal S_8 , whereas the movement detecting circuit 2 outputs

the movement detection signal S_3 and the differential signal S_4 based on the estimated error signal S_2 calculated by the subtractor 1.

The operation of the movement detecting circuit 18 in this case is the same as that of the conventional system.

On the other hand, the threshold compensation circuit 18 outputs the threshold value T_1 with the polarity and the compensated differential signal S_{15} based on the movement detection signal S_3 and the differential signal S_4 .

The operation of the threshold compensation circuit 18 in this case will be described in details with reference to FIG. 5.

In FIG. 5A, the polarity judgment circuit 19 judges the polarity of the differential signal S_4 and outputs the polarity signal S_{16} to the polarity adding circuit 20. On receiving the polarity signal S_{16} , the polarity adding circuit 20 assigns the polarity to the threshold value T from the threshold generating circuit 9 and outputs the resultant signal as the threshold value T_1 with the polarity. However, in the case where the movement detection signal S_3 indicates the invalidness, the threshold value T_1 with the polarity is set to 0. In this case, there exists also a method in which the 0 is judged in the polarity judgment circuit 19 and the polarity adding circuit 20 sets the threshold value S_1 with the polarity to 0 according to the judgment. By subtracting the threshold value S_1 with the polarity from the differential signal S_4 in the subtractor 21, the threshold value is compensated and hence the compensated differential signal S_{15} is outputted. The compensated differential signal S_{15} is converted into the quantization signal S_5 in the quantization circuit 3 and is delivered to the variable length encoding circuit 4 and the local decoding circuit 6. When the movement detection signal S_3 is valid, the variable encoding circuit 4 receives the quantization signal S_5 and the threshold value T , and for example, effects a run length encoding on the movement detection signal S_3 . For the quantization signal S_5 , the variable length encoding circuit 4 assigns a code with a short code length to a value in the vicinity of 0 for which the generation frequency is high and accumulates the code in the transmission data buffer circuit 5; thereby outputting the signal as the encoded signal S_6 to the transmission line. Moreover, in the threshold generating circuit 9, the accumulated amount of data in the transmission data buffer 5 is monitored so as to generate an appropriate threshold value T to control the generation amount of the encoded datum. On the other hand, the local decoding circuit 6 decodes the quantization signal S_5 into the regenerated, compensated differential signal S_7 , which is then fed to the adder 7. The adder 7 adds the threshold value T , the estimated signal S_2 , and the

regenerated, compensated differential signal S_7 to obtain the regenerated input signal S_8 . The estimating circuit 8 delays the regenerated input signal S_8 by a period of time t beforehand, set, multiplies the signal by the coefficient A , and outputs the resultant signal as the estimated signal S_2 . If the time t is set to the period of time of a frame when the input signal S_1 is an image signal, a frame-to-frame DPCM transmitting apparatus is implemented; whereas, if the time t is set to the period of time of a field, a field-to-field DPCM transmitting apparatus is materialized.

In addition, in the embodiment above, the same effect can be attained by reducing the threshold value for the transmission by means of a control in which the generation and update of the threshold value are conducted at an interval of an arbitrary period of time T_a .

Next, the operation on the reception side will be described with reference to FIGS. 6A - 6B. The encoded signal S_6 undergone the variable length encoding on the transmission side is received by the receiving data buffer circuit 13. Only when the decoded movement detection signal S_{17} is valid, the variable length decoding circuit 14 outputs the threshold value T and the regenerated quantization signal S_{19} . When the signal S_{17} is invalid, 0 is outputted. The local decoding circuit 15 decodes the regenerated quantization signal S_{19} into the regenerated, compensated differential signal; furthermore, the regenerated differential signal S_{21} is regenerated in the threshold compensation regeneration circuit 22. The operation will be described with reference to FIG. 7A. The polarity of the regenerated, compensated differential signal S_{20} is judged by the polarity judgment circuit 23, the polarity is assigned to the threshold value T depending on the polarity signal S_{23} representing the positive or negative polarity, and the resultant signal is delivered as the threshold value T_1 with the polarity. However, when the movement detection signal S_{17} indicates the invalidness, the threshold value T_1 with the polarity is set to 0. Moreover, the adder 25 adds the regenerated, compensated differential signal S_{20} to the threshold value T_1 with the polarity, thereby attaining the regenerated differential signal S_{21} . The adder 16 adds the estimated signal S_{22} from the estimating circuit 17 to the regenerated differential signal S_{21} so as to regenerate the objective input signal S_1 on the transmission side.

The operation of the threshold compensation circuit can be represented by numeric values as shown in FIG. 7B. This example shows a case of $T = 5$. FIG. 7C is an input/output characteristic graph corresponding thereto. The broken lines indicate the conventional example, whereas the solid lines represent the characteristic of the present inven-

tion.

As described above, even if the invalid data period (-T-O-T) occurs due to the movement detect circuit, the invalid data period can be canceled by effecting the threshold value compensation according to the present invention, which enables to increase the quantization precision as compared with the conventional apparatus.

As described above, according to the embodiment of the present invention, the polarity of the differential signal is judged, a polarity is assigned to the threshold value depending on the judgment, the compensation of the differential signal is achieved according to the threshold value to which the polarity is assigned, and the compensated differential signal undergone the quantization is used for the transmission and reception; consequently, the generation of the code with a short code length allocated in the neighborhood of 0 is suppressed and hence the efficiency of the communication is improved.

Claims

1. An image encoding/decoding system comprising a transmission apparatus for encoding and compressing data to be transmitted and a receiving apparatus for decoding and reproducing the data;
the transmission apparatus comprising:
a transmission data buffer circuit (5) for storing data to be transmitted (S6);
a threshold generating circuit (9) for generating a threshold value (T) for motion detection responsive to an amount value in said transmission data buffer circuit (5);
a motion detecting circuit (2) for outputting a differential signal (S4) based on a predicted error signal (S2) and a motion detection signal (S3) based on a comparing result between the predicted error signal (S2) and the threshold value (T);
a quantization circuit (3) for quantizing input signals;
a variable length encoder (4) for encoding the output (S5) of said quantization circuit (3) and said motion detection signal (S3);
characterized by
a threshold compensation circuit (18) for judging the polarity of said differential signal (S4), changing said threshold value (T) into a modified threshold value (T1) having a polarity corresponding to the judged polarity, and outputting a compensated differential signal (S15) representing the difference between the value of said differential signal (S4) and the value of said modified threshold value (T1);
wherein said quantization circuit (3) quantizes

the compensated differential signal (S15), and said variable length encoder (4) encodes the output (S5) of said quantization circuit (3); the motion detection signal (S3) and said threshold value (T).

2. An image encoding/decoding system comprising a transmission apparatus for encoding and compressing data to be transmitted and a receiving apparatus for decoding and reproducing the data;
the receiving apparatus comprising:
a receiving data buffer circuit (13) for storing received data (S6);
a variable length decoder (14) for decoding coded motion detecting signals and coded quantized signals which are included in the received data (S6), and outputting a regenerated quantized signal (S11) in case the motion detecting signal is in active condition;
a local decoding circuit (15) for decoding said regenerated quantized signal (S11);
characterized by
a threshold compensation regeneration circuit (22) for judging the polarity of a regenerated compensated difference signal (S20) regenerated by said local decoding circuit (15), and regenerating a differential signal (S21) by adding a regenerated modified threshold value (T1) attached the judged polarity (S23) to a value of said regenerated compensated differential signal (S20);
wherein said variable length decoder (14) regenerates a motion detecting signal (S17), a quantized signal (S19) and a threshold value (T) for the threshold compensation regeneration circuit (22), and said local decoder (15) regenerates the compensated differential signal (S20) by decoding the quantized signal (S19).

Patentansprüche

1. Bildcodier- und Decodiersystem mit einer Sendeeinrichtung zum Codieren und Komprimieren der auszusendenden Daten sowie einer Empfangseinrichtung zum Decodieren und Reproduzieren der Daten;
bei dem die Sendeeinrichtung folgende Einheiten enthält:
eine Sendedatenpufferschaltung (5) zum Speichern der auszusendenden Daten (S6);
eine Schwellwertschaltung (9) zum Erzeugen eines Schwellwertes (T) für eine Bewegungserkennung gegenüber einem Mengenwert in der Sendedatenpufferschaltung (5);
eine Bewegungsdetektorschaltung (2) zur Ausgabe eines Differentialsignals (S4) basierend



tion.

As described above, even if the invalid data period (-T-O-T) occurs due to the movement detect circuit, the invalid data period can be canceled by effecting the threshold value compensation according to the present invention, which enables to increase the quantization precision as compared with the conventional apparatus.

As described above, according to the embodiment of the present invention, the polarity of the differential signal is judged, a polarity is assigned to the threshold value depending on the judgment, the compensation of the differential signal is achieved according to the threshold value to which the polarity is assigned, and the compensated differential signal undergone the quantization is used for the transmission and reception; consequently, the generation of the code with a short code length allocated in the neighborhood of 0 is suppressed and hence the efficiency of the communication is improved.

Claims

1. An image encoding/decoding system comprising a transmission apparatus for encoding and compressing data to be transmitted and a receiving apparatus for decoding and reproducing the data;

the transmission apparatus comprising:

a transmission data buffer circuit (5) for storing data to be transmitted (S6);

a threshold generating circuit (9) for generating a threshold value (T) for motion detection responsive to an amount value in said transmission data buffer circuit (5);

a motion detecting circuit (2) for outputting a differential signal (S4) based on a predicted error signal (S2) and a motion detection signal (S3) based on a comparing result between the predicted error signal (S2) and the threshold value (T);

a quantization circuit (3) for quantizing input signals;

a variable length encoder (4) for encoding the output (S5) of said quantization circuit (3) and said motion detection signal (S3);

characterized by

a threshold compensation circuit (18) for judging the polarity of said differential signal (S4), changing said threshold value (T) into a modified threshold value (T1) having a polarity corresponding to the judged polarity, and outputting a compensated differential signal (S15) representing the difference between the value of said differential signal (S4) and the value of said modified threshold value (T1);

wherein said quantization circuit (3) quantizes

the compensated differential signal (S15), and said variable length encoder (4) encodes the output (S5) of said quantization circuit (3); the motion detection signal (S3) and said threshold value (T).

2. An image encoding/decoding system comprising a transmission apparatus for encoding and compressing data to be transmitted and a receiving apparatus for decoding and reproducing the data;

the receiving apparatus comprising:

a receiving data buffer circuit (13) for storing received data (S6);

a variable length decoder (14) for decoding coded motion detecting signals and coded quantized signals which are included in the received data (S6), and outputting a regenerated quantized signal (S11) in case the motion detecting signal is in active condition;

a local decoding circuit (15) for decoding said regenerated quantized signal (S11);

characterized by

a threshold compensation regeneration circuit (22) for judging the polarity of a regenerated compensated difference signal (S20) regenerated by said local decoding circuit (15), and regenerating a differential signal (S21) by adding a regenerated modified threshold value (T1) attached the judged polarity (S23) to a value of said regenerated compensated differential signal (S20);

wherein said variable length decoder (14) regenerates a motion detecting signal (S17), a quantized signal (S19) and a threshold value (T) for the threshold compensation regeneration circuit (22), and said local decoder (15) regenerates the compensated differential signal (S20) by decoding the quantized signal (S19).

Patentansprüche

1. Bildcodier- und Decodiersystem mit einer Sendeeinrichtung zum Codieren und Komprimieren der auszusendenden Daten sowie einer Empfangseinrichtung zum Decodieren und Reproduzieren der Daten;

bei dem die Sendeeinrichtung folgende Einheiten enthält:

eine Sendedatenpufferschaltung (5) zum Speichern der auszusendenden Daten (S6);

eine Schwellwertschaltung (9) zum Erzeugen eines Schwellwertes (T) für eine Bewegungserkennung gegenüber einem Mengenwert in der Sendedatenpufferschaltung (5);

eine Bewegungsdetektorschaltung (2) zur Ausgabe eines Differentialsignals (S4) basierend



auf einem Prediktionsfehlersignal (S2) und eines Bewegungserkennungssignals (S3) basierend auf einem Vergleichsergebnis zwischen dem Prediktionsfehlersignal (S2) und dem Schwellwert (T);

eine Quantisierungsschaltung (3) zum Quantisieren von Eingangssignalen; und einen längenvariablen Codierer (4) zum Codieren des Ausgangssignals (S5) der Quantisierungsschaltung (3) und des Bewegungserkennungssignals (S3);

dadurch gekennzeichnet, daß eine Schwellwertkompensationsschaltung (18) vorgesehen ist zum Feststellen der Polarität des Differentialsignals (S4), zum Ändern des Schwellwertes (T) in einen modifizierten Schwellwert (T1) mit einer Polarität entsprechend der festgestellten Polarität und zum Ausgeben eines kompensierten Differentialsignals (S15), das die Differenz zwischen dem Wert des Differentialsignals (S4) und dem Wert des modifizierten Schwellwertes (T1) angibt; und daß die Quantisierungsschaltung (3) das kompensierte Differentialsignal (S15) quantisiert, und der längenvariable Codierer (4) das Ausgangssignal (S5) der Quantisierungsschaltung (3), das Bewegungserkennungssignal (S3) und den Schwellwert (T) codiert.

2. Bildcodier- und Decodiersystem mit einer Sendeeinrichtung zum Codieren und Komprimieren der auszusendenden Daten sowie einer Empfangseinrichtung zum Decodieren und Reproduzieren der Daten; bei dem die Empfangseinrichtung folgende Einheiten enthält:
 - eine Empfangsdatenpufferschaltung (13) zum Speichern der empfangenen Daten (S6);
 - einen längenvariablen Decodierer (14) zum Decodieren codierter Bewegungserkennungssignale und codierter Quantisierungssignale, die in den empfangenen Daten (S6) enthalten sind, und zur Ausgabe regenerierter Quantisierungssignale (S11) für den Fall, daß das Bewegungserkennungssignal aktiv ist;
 - eine lokale Decodierschaltung (15) zum Decodieren des regenerierten Quantisierungssignals (S11);
 - dadurch gekennzeichnet, daß eine Schwellwertkompensations-Regenerierschaltung (22) vorgesehen ist zum Feststellen der Polarität eines regenerierten Kompensationsdifferenzsignals (S20), das durch die lokale Decodierschaltung (15) regeneriert wurde, und zum Regenerieren eines Differentialsignals (S21) durch Addieren eines regenerierten modifizierten Schwellwertes (T1) mit der zugeord-

neten erkannten Polarität (S23) zu einem Wert des regenerierten Kompensationsdifferenzsignals (20); und daß der längenvariable Decodierer (14) ein Bewegungserkennungssignal (S17), ein Quantisierungssignal (S19) und einen Schwellwert (T) für die Schwellwertkompensations-Regenerierschaltung (22) regeneriert, und der lokale Decodierer (15) das kompensierte Differentialsignal (S20) durch Decodieren des Quantisierungssignals (S19) regeneriert.

Revendications

1. Système de codage/décodage d'images comprenant un appareil de transmission pour coder et compresser des données à transmettre et un appareil récepteur pour décoder et reproduire les données; l'appareil de transmission comprenant:
 - un circuit tampon de transmission de données (5) pour mémoriser les données à transmettre (S6);
 - un circuit de génération de seuil (9) pour générer une valeur de seuil (T) pour la détection de mouvement en réponse à une valeur dans ledit circuit tampon de transmission de données (5);
 - un circuit de détection de mouvement (2) pour émettre un signal différentiel (S4) basé sur le signal d'erreur prédite (S2) et un signal de détection de mouvement (S3) basé sur un résultat de comparaison entre le signal d'erreur prédite (S2) et la valeur de seuil (T);
 - un circuit de quantification (3) pour quantifier les signaux d'entrée; un codeur de longueur variable (4) pour coder la sortie (S5) dudit circuit de quantification (3) et ledit signal de détection de mouvement (S3);
 - caractérisé par
 - un circuit de compensation de seuil (18) pour évaluer la polarité dudit signal différentiel (S4), changer ladite valeur de seuil (T) en une valeur de seuil modifiée (T1) présentant une polarité correspondant à la polarité évaluée, et émettre un signal différentiel compensé (S15) représentant la différence entre la valeur dudit signal différentiel (S4) et la valeur de ladite valeur de seuil modifiée (T1);
 - dans lequel ledit circuit de quantification (3) quantifie le signal différentiel compensé (S15), et ledit codeur de longueur variable (4) code la sortie (S5) dudit circuit de quantification (3), le signal de détection de mouvement (S3) et ladite valeur de seuil (T).
2. Système de codage/décodage d'image comprenant un appareil de transmission pour coder et compresser les données à transmettre et



un appareil récepteur pour décoder et reproduire les données;

l'appareil récepteur comprenant:

un circuit tampon de réception de données (13) pour mémoriser les données reçues (S6);

un décodeur de longueur variable (14) pour décoder les signaux de détection de mouvement codés et les signaux quantifiés codés qui sont inclus dans les données reçues (S6), et émettre un signal quantifié régénéré (S11) lorsque le signal de détection de mouvement est dans un état actif; un circuit de décodage local (15) pour décoder ledit signal quantifié régénéré (S11);

caractérisé par

un circuit régénérateur de compensation de seuil (22) pour évaluer la polarité d'un signal de différence compensé régénéré (S20) régénéré par ledit circuit de décodage local (15), et régénérer un signal différentiel (S21) en ajoutant une valeur de seuil modifiée régénérée (T1) la polarité évaluée (S23) étant affectée à une valeur dudit signal différentiel compensé régénéré (S20);

dans lequel ledit décodeur de longueur variable (14) régénère un signal de détection de mouvement (S17), un signal quantifié (S19) et une valeur de seuil (T) pour le circuit régénérateur de compensation de seuil (22) et ledit décodeur local (15) régénère le signal différentiel compensé (S20) en décodant le signal quantifié (S19).

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