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DECLARATION OF TRANSLATOR

I, COREY COLLING, hereby declare as follows:

1. My name is COREY COLLING. I provide this declaration on behalf of Park IP at the request of Unified Patents, LLC.

2. I am a professional translator, fluent in Korean and English. I work as a contractor for Park IP.

3. I reviewed the original Korean version of Korean Patent KR 10-0180173 B1 and prepared the English translation attached hereto. The English translation is a true, complete, and accurate translations of KR 10-0180173 B1.

4. In signing this declaration, I recognize that the declaration will be filed as evidence in a case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

5. All statements made herein of my own knowledge are true and all statements made on information and belief are believed to be true. These statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both (18 U.S.C. § 1001).

Dated: Sept. 27, 2020

COREY COLLING

(19) Korean Intellectual Property Office (KR)
(12) Publication of Registration (B1)

(51) . Int. Cl. 6 **H04N 7/24**		**(45) Publication date** **(11) Registration No.** **(24) Registration date**	**May 1, 1999** **10-0180173** **November 30, 1998**
(21) Application No.	10-1995-0005798	(65) Publication No.	Patent 1996-0036695
(22) Application date	March 20, 1995	(43) Publication date	October 28, 1996

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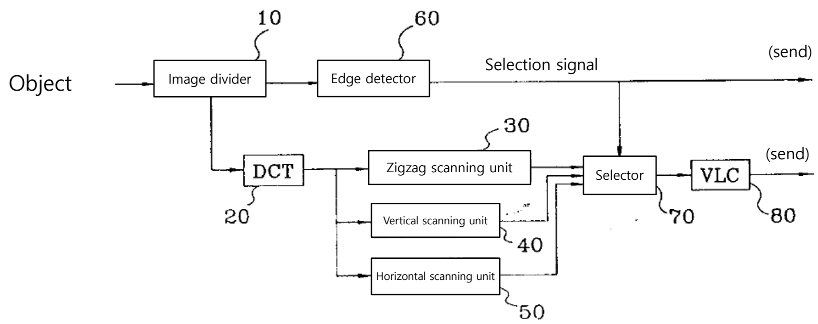
(54) OBJECT CODER

Abstract

The present invention relates to an object coder, and comprises an image dividing unit (10) for blocking the contour portion of an object into 8x8 pixel blocks; a DCT unit (20) for converting the 8x8 pixel blocks into 8x8 frequency coefficient blocks; a zigzag scanning unit (30) for zigzag-scanning the 8x8 frequency coefficient blocks to output them by performing run-length encoding; a vertical scanning unit (40) for vertically scanning the 8x8 frequency coefficient blocks to output them by performing run-length encoding; a horizontal scanning unit (50) for horizontally scanning the 8x8 frequency coefficient blocks to output them by performing run-length encoding; an edge detection unit (60) for detecting the edge of the object blocked into the 8x8 pixel blocks and outputting a scanning selection signal according to the direction of the edge; and a selector (70) for outputting after selecting an output of one of the zigzag scanning unit (30), the vertical scanning unit (40), and the horizontal scanning unit (50) according to the scanning selection signal, and performs scanning by selecting an appropriate scanning direction according to the edge direction of the object after performing DCT on the contour portion of the blocked object, thereby having an effect of reducing the amount of image data.

Representative figure



Specifications

[Title of the Invention]

Object coder

(An object coder)

[Brief description of the drawings]

FIG. 1 is a drawing showing a state in which the contour of an object is blocked.

FIG. 2 is a system diagram of an object coder according to the present invention.

FIG. 3 is a schematic diagram showing a scanning method according to the present invention.

* Description of reference numerals for major parts of the drawings

10: Image divider 20: DCT unit

30: Zigzag scanning unit 40: Vertical scanning unit

50: Horizontal scanning unit 60: Edge detector

70: Selector 80: Variable length coder (VLC)

[Detailed description of the invention]

The present invention relates to an object coder, and in particular, to an object coder for blocking the contour of an object and subsequently scanning a frequency coefficient created by performing Discrete Cosine Transform (DCT) in various directions according to the edge direction of the object to reduce the amount of image data.

Currently, a multi-media environment in which computers and multimedia, such as communications and broadcasting, are combined and integrated has developed in various ways, and starting at the end of this century, the era of multimedia, which can be considered as the crown jewel of the information communication sector, will begin. Core technologies that support such multimedia include digitalization and digital image compression technology.

To briefly discuss the necessity of such a digital image compression technology, the current NTSC type television (TV) signal has 180 Mbit of data per second, and if this is put on a single CD (Compact Disk, capacity: approximately 6.25 Gbit), it will be about 35 seconds long, therefore it is impossible to store video data of sufficient length with this level of information storage capacity. Therefore, a technology for storing a great deal of image data on a single CD has been developed, which is none other than a digital image compression technology.

In summary, the digital image compression reduces the amount of data required to display an image by removing the spatial and temporal redundancy of the image.

On the other hand, the MPEG-2 video compression method is based on two basic technologies.

First, motion estimation and compensation in blocks are used to reduce temporal redundancy, and second, the DCT compression technique is used to reduce spatial redundancy.

In other words, there are three types, I, P, and B-pictures, in the picture types specified in MPEG-2, of which I (Intra coded) pictures do not use motion compensation and simply code by performing DCT on the picture alone, and P (Predicted coded) pictures perform motion compensation using I or a different P-picture as a reference, and subsequently perform DCT coding on the remaining difference. In addition, in B (Bidirectionally predicted coded) pictures, motion compensation is used like P-pictures but unlike P-pictures, motion compensation is performed from two frames that are in front and behind on the time axis.

This motion compression is based on 16x16 blocks.

In addition, the DCT coding is an orthogonal transform with a high-speed algorithm, and since it has near-optimal performance for many types of images as well as the advantage of making it very easy for the DCT basic function to make effective use of the visual characteristic standard, it is being used to reduce spatial redundancy.

This DCT is based on 8 8 blocks.

However, in the conventional coding method, which processed in units of blocks or macroblocks using the characteristics of the mathematical statistics of an image as described above, the lower the bit rate, that is, the higher the compression rate, the more severely the blurring of the blocked shape and boundary occurs, which is visually unpleasant.

Therefore, taking into consideration the fact that human vision is sensitive to boundaries, an object coding method for coding images by dividing them by objects has been developed.

In such a conventional object coding method, the contour of an object having an irregular shape is coded, and the gray level in the object is separately coded by other methods, such as DCT.

In this case, as shown in FIG. 1, the blank portion other than the object needs to be filled with a certain value before performing DCT, and usually, DCT is performed after filling the blank portion with ‘0’.

However, when DCT is performed after filling the blank portion with ‘0’ as described above, high frequency coefficients occur, which require a large number of bits to code the frequency coefficients.

Accordingly, the present invention has been devised to solve the problems described above, and its object is to provide an object coder capable of reducing the amount of image data by blocking the contour portion of an object and subsequently scanning the frequency coefficient generated by performing DCT in a different direction according to the edge direction of the object.

To achieve said object, the object coder according to the present invention comprises an image dividing unit for blocking the contour portion of the object into 8x8 pixel blocks; a DCT unit for converting the 8x8 pixel blocks into 8x8 frequency coefficient blocks; a zigzag scanning unit for zigzag-scanning the 8x8 frequency coefficient blocks to output them by performing run-length encoding; a vertical scanning unit for vertically scanning the 8x8 frequency coefficient blocks to output them by performing run-length encoding; a horizontal scanning unit for horizontally scanning the 8x8 frequency coefficient blocks to output them by performing run-length encoding; an edge detection unit for detecting the edge of the object to output a scanning selection signal for selecting an output of the zigzag scanning unit if the direction of the edge is diagonal, an output of the vertical scanning unit if the direction of the edge is horizontal, and an output of the horizontal scanning unit if the direction of the edge is vertical; and a selector for outputting after selecting an output of one of the zigzag scanning unit, the vertical scanning unit, and the horizontal scanning unit according to the scanning selection signal.

Hereinafter, a preferred embodiment of the present invention will be described in detail with reference to the accompanying figures.

FIG. 2 is a system diagram of an object coder according to the present invention, and the object coder comprises an image divider (10) for blocking the contour portion of an object into 8x8 pixel blocks; a DCT unit (20) for converting the 8x8 pixel blocks into 8x8 frequency coefficient blocks; a zigzag scanning unit (30) for zigzag-scanning the 8x8 frequency coefficient blocks to output them by performing run-length encoding; a vertical scanning unit (40) for vertically scanning the 8x8 frequency coefficient blocks to output them by performing run-length encoding; a horizontal scanning unit (50) for horizontally scanning the 8x8 frequency coefficient blocks to output them by performing run-length encoding; an edge detector (60) for detecting the edge of the object blocked into the 8x8 pixel blocks and outputting a scanning selection signal according to the direction of the detected edge; a selector (70) for outputting after selecting an output of one of the zigzag scanning unit (30), the vertical scanning unit (40), and the horizontal scanning unit (50) according to the scanning selection signal; and a vertical length coder (VLC, 80) for allocating a short bit per code to codewords having a high probability of occurrence for the run-length coded codeword output from the selector (70) and allocating a long bit per code to codewords having a low probability of occurrence to remove statistical redundancy so that the average length of the code is close to entropy, and then transmit it to the receiving side (not shown).

The edge detector (60) detects the edge of an object, and outputs to the selector (70) the scanning selection signal for selecting an output of the zigzag scanning unit (30) if the direction of the edge is diagonal, an output of the vertical scanning unit (40) if the direction of the edge is horizontal, and an output of the horizontal scanning unit (50) if the direction of the edge is vertical.

The operation and effect of the object coder according to the present invention configured as described above will be described in more detail as follows.

First, when the image divider (10) blocks the contour portion of the object into 8x8 pixel blocks and outputs them to the DCT unit (20), the DCT unit (20) converts the received 8x8 pixel blocks into 8x8 frequency coefficient blocks and outputs them to the zigzag scanning unit (30), the vertical scanning unit (40), and the horizontal scanning unit (50).

Each of the zigzag scanning unit (30), the vertical scanning unit (40), and the horizontal scanning unit (50) performs run-length encoding on the received 8x8 frequency coefficient blocks and outputs them to the selector (70).

The selector (70) selects run-length encoded codewords output from one of the zigzag scanning unit (50), the vertical scanning unit (40) and the horizontal scanning unit (30) according to the scanning selection signal provided by the edge detector (60), and outputs them to the variable length encoder (80).

In other words, as shown in FIG. 3, the selector (70) selects and outputs a run-length encoded codeword that is zigzag-scanned and output after DCT is performed when the edge of the object is a diagonal line, it selects and outputs a run-length encoded codeword that is horizontally scanned and output after DCT is performed when the edge of the object is a vertical line, and it selects and outputs a run-length encoded codeword that is vertically scanned and output after DCT is performed when the edge of the object is a horizontal line.

For example, the frequency coefficient after DCT is performed is as shown in Table 1 below, and

Table 1

276	59	89	39	7	-13	-12	-7
137	-94	-35	4	17	16	7	2
51	25	-42	-20	-14	1	5	7
-12	40	-8	-16	-4	-4	-5	-5
-8	3	17	-13	-4	0	-1	0
2	14	14	5	-7	0	-1	0
-1	-3	-2	12	0	-4	-2	1
-6	2	-6	6	8	-5	-1	0

If the first contour edge that is blocked into 8x8 is a diagonal line, select and output the run-length encoded codeword by performing zigzag scanning in the order of (276, 137, 59, 89, -94, 51, -12, 25,-35, 39 ...), if the second contour edge that is blocked into 8x8 is a vertical line, select and output the run-length encoded codeword by performing horizontal scanning in the order of (276, 59, 89, 39, 7, -13, -12, -7, 137 ...), and if the third contour edge that is blocked into 8x8 is a horizontal line, select and output the run-length encoded codeword by performing vertical scanning in the order of (276, 137, 51, -12, -8, 2, 1, -1, -6, 59 ...).

In this case, if DCT is performed after filling the blank portion other than the object with ‘0’, a high frequency coefficient is generated and a large number of bits is required to code this frequency coefficient, but if the scanning direction is changed according to the edge direction of the object as described above, the amount of image data can be reduced.

On the other hand, for the run-length encoded codewords that have been selectively scanned as described above, a short bit per code is allocated for codewords having a high probability of occurrence in the variable length encoder (70), and a long bit per code is allocated for codewords having a low probability of occurrence, and statistical redundancy is removed so that the average length of the code is close to entropy, and then they are transmitted to the receiving side (not shown).

As described above, since the object encoder according to the present invention performs scanning by performing DCT on the contour portion of the blocked object and then selecting an appropriate scanning direction according to the edge direction of the object, there is an effect of reducing the amount of image data.

(57) Scope of claims

Claim 1

An object coder comprising an image dividing unit (10) for blocking the contour portion of an object into 8x8 pixel blocks; a DCT unit (20) for converting the 8x8 pixel blocks into 8x8 frequency coefficient blocks;

a zigzag scanning unit (30) for zigzag-scanning the 8x8 frequency coefficient blocks to output them by performing run-length encoding;

a vertical scanning unit (40) for vertically scanning the 8x8 frequency coefficient blocks to output them by performing run-length encoding;

a horizontal scanning unit (50) for horizontally scanning the 8x8 frequency coefficient blocks to output them by performing run-length encoding;

an edge detection unit (60) for detecting the edge of the object to output a scanning selection signal for selecting an output of the zigzag scanning unit (30) if the direction of the edge is diagonal, an output of the vertical scanning unit (40) if the direction of the edge is horizontal, and an output of the horizontal scanning unit (50) if the direction of the edge is vertical; and

a selector (70) for outputting after selecting an output of one of the zigzag scanning unit (30), the vertical scanning unit (40), and the horizontal scanning unit (50) according to the scanning selection signal.

Figures

Figure 1

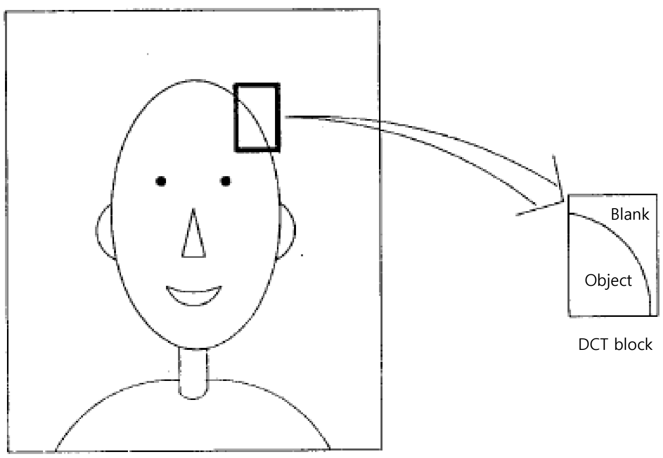
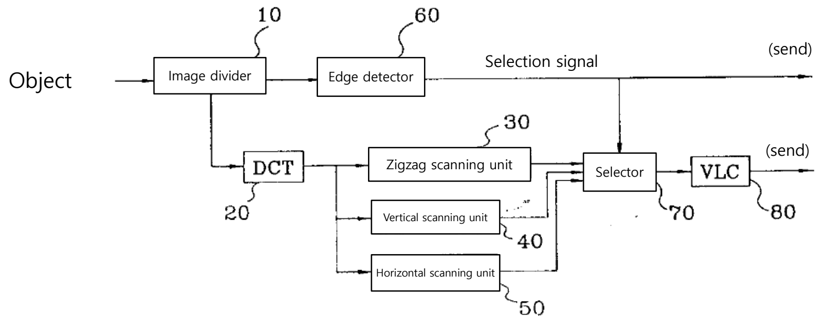


Figure 2



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