

Description

The present invention relates to coding of video signals, especially using conditional replenishment coding, where information is generally transmitted only in respect of elements of a frame of the picture which have changed relative to a previous frame; the transmitted data being used at a receiver to update a stored version of the picture.

Thus picture elements of each block of an image to be coded are compared with those of the corresponding block of a previously coded image to determine whether the block has changed between the two images; if so, picture element data are generated for output.

Such a system is described in international patent application published under WO-A-8 603 922, which also proposes that the block be compared with the corresponding block of an earlier (reference) image. If they are deemed to be the same, no picture data are generated - instead, a codeword is produced to indicate that the receiver is to obtain its data from a locally stored replica of the reference image.

According to one aspect of the present invention, there is provided a method of coding an image comprising, for each of a plurality of blocks of an image:

- (i) comparing picture elements of the block with those of the corresponding block of a previously coded image to determine which picture elements, in accordance with a predetermined criterion, changed between the two images;
- (ii) comparing picture elements of the block with those of the corresponding block of a reference image composed of blocks from at least one earlier frame to determine which picture elements have, in accordance with a predetermined criterion, changed between the two images;
- (iii) when the picture elements are identified by comparison step (ii) as being unchanged relative to the reference image, generating a codeword indicating this is the case;

CHARACTERIZED IN THAT the method includes the steps of:

- (iv) producing a matrix of values each indicating whether the corresponding picture element has changed between the two images when comparing picture elements of the block with those of the corresponding block of a previously coded image at step (ii);
- (v) matching the matrix to one of a predetermined set of such matrices each of which identifies a region of the block as being deemed to have changed, and generating a codeword identifying that one matrix of the set; and
- (vi) coding for output those picture elements within the identified region of the block, only,

unless all the elements within the identified region are identified by comparison step (ii) as being unchanged relative to the reference image, whereupon a codeword indicating that this is the case is generated.

In another aspect, the invention provides an apparatus for coding an image comprising:

(i) means for comparing, for each of a plurality of blocks, picture elements of the block with those of the corresponding block of a previously coded image to determine which picture elements, in accordance with a predetermined criterion, changed between the two images;

(ii) a store arranged to store a reference image composed of blocks from at least one earlier frame and means for comparing picture elements of the block with those of the corresponding block of a reference image composed of blocks from at least one earlier frame to determine which picture elements have, in accordance with a predetermined criterion, changed between the two images;

(iii) means for generating a codeword indicating that picture elements are unchanged relative to the reference image when so identified by comparison means;

CHARACTERIZED IN THAT the apparatus includes:

(iv) means for producing a matrix of values each indicating whether the corresponding picture element has changed between the two images when comparing picture elements of the block with those of the corresponding block of a previously coded image at step (ii);

(v) means for matching the matrix to one of a predetermined set of such matrices each of which identifies a region of the block as being deemed to have changed, and generating a codeword identifying that one matrix of the set; and

(vi) means for coding for output those picture elements within the identified region of the block, only, unless all the elements within the identified region are identified by comparison step (ii) as being unchanged relative to the reference image, whereupon a codeword indicating that this is the case is generated.

The matching step - often termed vector quantisation - of two-dimensional maps has been proposed previously for picture coding, for example in European patent application EP-A-0 239 076, where blocks of transform coefficient blocks are classified.

The present invention, however, further exploits the vector quantisation, in that not only can the classification be used (if desired) to reduce the amount of information that has to be transmitted to indicate which elements have been coded for out-

put, but also the number of occasions on which a "reference" codeword is instead generated are increased.

Some embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

- Figure 1 is a block diagram of a coder according to one embodiment of the invention;
- Figure 2 shows a typical bit map produced by the change detector of the coder of Figure 1;
- Figure 3 illustrates a few standard bit patterns used by the vector quantiser of the coder of Figure 1; and
- Figure 4 is a block diagram of a decoder according to another embodiment of the present invention.

Figure 1 shows a conditional replenishment video coder, where video signals (assumed to be in digital form) are supplied to an input 1. The current frame of a picture is compared in a change or movement detector 2 with the output of a local decoder 3. The local decoder produces a "previous frame" output which is the same as that produced by a remote decoder; the object of the comparison is to identify those parts of the picture which have changed so that only information concerning those parts needs to be sent to the decoder, to update a stored representation of the frame.

The signals are processed on a block-by-block basis - an 8 x 8 block is assumed - and the change detector 2 therefore produces an 8 x 8 bit map. A typical map is shown in figure 2, where the elements of the block corresponding to picture elements (pixels) which have changed are shown shaded.

In practice, transmission of information concerning only the changed elements involves a significant addressing overhead and therefore it is preferred to match the bit map to one of a limited number - typically forty - of standard shapes (a few are illustrated in figure 3). Since it is preferable to transmit information for an unchanged pixel than to fail to transmit information for a changed pixel, the shape chosen is the smallest (i.e. with the least number of shaded elements) which has a shaded area covering the shaded elements of the bit map. This process is termed vector quantisation (VQ) and is indicated as vector quantizer 4 in figure 1. One transmits, for the block, a VQ number identifying the chosen shape, along with information concerning pixels deemed - in accordance with the chosen shape - to have changed. The output data are combined and buffered in a buffer 5 prior to passage to an output 6. As is conventional in such systems, the buffer is used to smooth variations in the rate at which data are generated (due to the picture content dependent coding) and interface to

a regular transmitted rate and the buffer fullness state used to control the rate of generation (e.g. by varying the change detector thresholds (control line 7)).

The pixels deemed to have changed are coded in an encoder 8 (for example in the manner described in our European patent application no. 88307981.6, publication no. EP-A-0 306 250 (published 8th March 1989).

Many televised scenes - especially in a videoconference or videotelephone environment - contain moving persons or objects set against a fixed background. Pixels observed as changed by the change detector 2 will relate either to objects which have changed their position (or entered the scene) or to parts of the background uncovered by the object. In the present coder, a second change detector 30 is also shown, which compares the current frame with a reference or background frame stored in a frame store 31. Acquisition of the stored background frame will be discussed further below, but in figure 1 is assumed to have been acquired from the local decoder 3 in response to manual operation of a switch 32 at the commencement of a transmission; a code being transmitted to the receiver to initiate similar action at the remote decoder.

The change detector 30 produces a bit map identifying those pixels of the current frame which are the same as the background.

If this shows that the new image is different from the background for any of the pixels declared as changed by the VQ shape the background information cannot be used and information concerning those pixels is transmitted along with the VQ number.

If, however the changed area as given by the VQ shape covers only pixels which are identified by the detector 30 as being the same as the corresponding pixels of the stored background frame, then the VQ number is accompanied by a reserved codeword indicating "background" and no further information needs to be transmitted for the block in question.

These functions are accomplished in figure 1 by a comparator 33 whose output 34 overrides the operation of the encoder 8.

Figure 4 shows a decoder. An input processor 40 receives the coded input signals. The background frame is stored in a background store 41. In normal operation, the processor 40 uses the pixel information received to update via line 42 the contents of a frame store 43, using the received VQ numbers via line 44 to control the frame store addressing. When, however, it receives the reserved "background" codeword (via line 45), it recovers the relevant pixels (identified by the VQ number) from the background store 41 and enters

then into the frame store 43. This is illustrated schematically by a changeover switch 46. The frame store 43 is read out (by output control means 47) to produce the received video at an output 48. As in the coder, the background store 41 is loaded from the decoded image in store 43 when a 'load background' instruction is received (line 49).

Note that the local decoder 3 of Figure 1 can be of the same construction as the decoder of Figure 4, although, of course, in practice the local decoder would use the background store 31 rather than contain one of its own.

The change detectors 2,30 can in principle be any conventionally used, or may both be as described in our above-mentioned patent applications. The vector quantiser 4 can again be a known device. One possibility is that described in our International patent application no. PCT/GB87/00816 (publication no. W088/04084) and European patent application EP-A-0 272 794.

Simpler but cruder, another option is to convert the 8x8 matrix to a 4x4 matrix by creating each 'new' element as an OR function of four 'old' elements; this reduces the number of elements in the matrix to a size (16) which can be used to address a look-up table - in the form of a 64 Kbyte read only memory in which the appropriate VQ numbers are stored.

The background scene may be 'frozen' manually at the commencement of a transmission. It may, but does not have to, consist solely of a fixed background. For example it may include seated figures (thereby covering the situation where a person momentarily passes his hand over his face if the face forms part of the "background", the face does not have to be retransmitted).

It may be desirable to include provision for updating the background. For example, the incoming video could be monitored at the coder (by a unit 35 shown dotted in Figure 1) and parts of the picture which differ from the original background but have remained unchanged for a predetermined period of time inserted into the frame store, a signal being sent (via line 36) to the decoder to instruct it to do likewise.

An alternative method of updating the background store abandons any attempt at identifying genuine background, but instead forms a reference image which is a composite of blocks taken from preceding images over a period. Each frame period, data for a few (e.g. eight) selected blocks scattered over the image area is entered into the background stores, the block selection being such that different blocks are selected from each frame until the whole image area has been covered. Assuming 1024 blocks per frame at 25 frames per second, this represents a period of approximately 40 seconds. The blocks could be loaded from the

frame store 43 of the decoder, and a corresponding store in the local decoder 3, the change monitor then being replaced by a simple address generator 35 to select the appropriate blocks. Clearly, this is less effective, in that some blocks of the reference image will not represent background material, but a significant coding advantage is still obtained, and it has the merit of simplicity.

A variation of this approach provides that data for selected blocks, instead of being drawn from the decoded image, are actually transmitted - i.e. transmission of the whole block is forced even if only a part, or none, of it is indicated by the detector 2 and quantiser 4 as moving. In this case, the frame stores 31, 41 take their input from the input 1 and processor 40 respectively. This also has the benefit of ensuring that transmission errors on blocks which rarely change do not persist in the decoded image.

Claims

1. A method of coding an image comprising, for each of a plurality of blocks of an image:

(i) comparing picture elements of the block with those of the corresponding block of a previously coded image to determine which picture elements, in accordance with a predetermined criterion, changed between the two images;

(ii) comparing picture elements of the block with those of the corresponding block of a reference image composed of blocks from at least one earlier frame to determine which picture elements have, in accordance with a predetermined criterion, changed between the two images;

(iii) when the picture elements are identified by comparison step (ii) as being unchanged relative to the reference image, generating a codeword indicating this is the case;

CHARACTERIZED IN THAT the method includes the steps of:

(iv) producing a matrix of values each indicating whether the corresponding picture element has changed between the two images when comparing picture elements of the block with those of the corresponding block of a previously coded image at step (i);

(v) matching the matrix to one of a predetermined set of such matrices each of which identifies a region of the block as being deemed to have changed, and generating a codeword identifying that one matrix of the set; and

(vi) coding for output those picture elements within the identified region of the block,

then into the frame store 43. This is illustrated schematically by a changeover switch 46. The frame store 43 is read out (by output control means 47) to produce the received video at an output 48. As in the coder, the background store 41 is loaded from the decoded image in store 43 when a 'load background' instruction is received (line 49).

Note that the local decoder 3 of Figure 1 can be of the same construction as the decoder of Figure 4, although, of course, in practice the local decoder would use the background store 31 rather than contain one of its own.

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The background scene may be 'frozen' manually at the commencement of a transmission. It may, but does not have to, consist solely of a fixed background. For example it may include seated figures (thereby covering the situation where a person momentarily passes his hand over his face if the face forms part of the "background", the face does not have to be retransmitted).

It may be desirable to include provision for updating the background. For example, the incoming video could be monitored at the coder (by a unit 35 shown dotted in Figure 1) and parts of the picture which differ from the original background but have remained unchanged for a predetermined period of time inserted into the frame store, a signal being sent (via line 36) to the decoder to instruct it to do likewise.

An alternative method of updating the background store abandons any attempt at identifying genuine background, but instead forms a reference image which is a composite of blocks taken from preceding images over a period. Each frame period, data for a few (e.g. eight) selected blocks scattered over the image area is entered into the background stores, the block selection being such that different blocks are selected from each frame until the whole image area has been covered. Assuming 1024 blocks per frame at 25 frames per second, this represents a period of approximately 40 seconds. The blocks could be loaded from the

frame store 43 of the decoder, and a corresponding store in the local decoder 3, the change monitor then being replaced by a simple address generator 35 to select the appropriate blocks. Clearly, this is less effective, in that some blocks of the reference image will not represent background material, but a significant coding advantage is still obtained, and it has the merit of simplicity.

A variation of this approach provides that data for selected blocks, instead of being drawn from the decoded image, are actually transmitted - i.e. transmission of the whole block is forced even if only a part, or none, of it is indicated by the detector 2 and quantiser 4 as moving. In this case, the frame stores 31, 41 take their input from the input 1 and processor 40 respectively. This also has the benefit of ensuring that transmission errors on blocks which rarely change do not persist in the decoded image.

Claims

1. A method of coding an image comprising, for each of a plurality of blocks of an image:

(i) comparing picture elements of the block with those of the corresponding block of a previously coded image to determine which picture elements, in accordance with a predetermined criterion, changed between the two images;

(ii) comparing picture elements of the block with those of the corresponding block of a reference image composed of blocks from at least one earlier frame to determine which picture elements have, in accordance with a predetermined criterion, changed between the two images;

(iii) when the picture elements are identified by comparison step (ii) as being unchanged relative to the reference image, generating a codeword indicating this is the case;

CHARACTERIZED IN THAT the method includes the steps of:

(iv) producing a matrix of values each indicating whether the corresponding picture element has changed between the two images when comparing picture elements of the block with those of the corresponding block of a previously coded image at step (i);

(v) matching the matrix to one of a predetermined set of such matrices each of which identifies a region of the block as being deemed to have changed, and generating a codeword identifying that one matrix of the set; and

(vi) coding for output those picture elements within the identified region of the block,



only, unless all the elements within the identified region are identified by comparison step (ii) as being unchanged relative to the reference image, whereupon a codeword indicating that this is the case is generated.

2. A method according to claim 1 in which, in the coding of the picture elements within the identified region, at least some of the picture elements are coded as the difference between that picture element and a predicted value for that picture element derived from one or more previously coded elements of the block, the sequence of coding of the picture elements being dependent on the orientation of the identified region.

3. Apparatus for coding an image comprising:
- (i) means (2) for comparing, for each of a plurality of blocks, picture elements of the block with those of the corresponding block of a previously coded image to determine which picture elements, in accordance with a predetermined criterion, changed between the two images;
 - (ii) a store (31) arranged to store a reference image composed of blocks from at least one earlier frame and means (30) for comparing picture elements of the block with those of the corresponding block of a reference image composed of blocks from at least one earlier frame to determine which picture elements have, in accordance with a predetermined criterion, changed between the two images;
 - (iii) means (33) for generating a codeword indicating that picture elements are unchanged relative to the reference image when so identified by comparison means;

CHARACTERIZED IN THAT the apparatus includes:

- (iv) means (2) for producing a matrix of values each indicating whether the corresponding picture element has changed between the two images when comparing picture elements of the block with those of the corresponding block of a previously coded image at step (i);
- (v) means (4) for matching the matrix to one of a predetermined set of such matrices each of which identifies a region of the block as being deemed to have changed, and generating a codeword identifying that one matrix of the set; and
- (vi) means (8,33) for coding for output those picture elements within the identified region of the block, only, unless all the elements

within the identified region are identified by comparison step (ii) as being unchanged relative to the reference image, whereupon a codeword indicating that this is the case is generated.

4. An apparatus according to claim 3, including means (35) for comparing successive images to identify parts of the image which have remained unchanged for a predetermined period of time, and in the event of such parts being identified, to:
- (a) update the stored reference image; and
 - (b) code for output data indicating which parts of the reference image have been thus updated.
5. An apparatus according to claim 3, including means (35) arranged in operation to effect periodic replacement of a minority of the blocks of the reference image stored in the store (31) by the corresponding blocks of a recent image, the blocks being differently selected for successive replacements such that the store (31) always contains a composite image made up of blocks from a plurality of frames of the image being coded.
6. A coding system comprising apparatus as claimed in any one of claims 3 and 5 including a decoder comprising:
- (a) a frame store (43) for storing a received image;
 - (b) a second frame store (41);
 - (c) control means (41) responsive to received data to update the contents of the second frame store (41) using the received data and responsive to a received codeword to update the second frame store (41) with information from the first frame store (43);
 - (d) means (47) repetitively reading the contents of the second frame store to produce a video output signal.

Patentansprüche

1. Verfahren zum Codieren eines Bildes für jeden aus einer Vielzahl von Blöcken eines Bildes, das aufweist:
- (i) Vergleichen von Bildelementen des Blocks mit jenen des entsprechenden Blocks eines vorher codierten Bildes, um zu bestimmen, welche Bildelemente gemäß einem vorherbestimmten Kriterium sich zwischen zwei Bildern änderten;
 - (ii) Vergleichen von Bildelementen des Blocks mit jenen des entsprechenden Blocks eines Referenzbildes, das aus



Blocks von mindestens einem früheren Rahmen zusammengesetzt ist um zu bestimmen, welche Bildelemente gemäß einem vorbestimmten Kriterium sich zwischen zwei Bildern geändert haben;

(iii) wenn die Bildelemente durch den Vergleichsschritt (ii) als unverändert bezüglich des Referenzbildes identifiziert sind, Erzeugen eines Codewortes, das anzeigt, daß dies der Fall ist;

dadurch gekennzeichnet, daß

das Verfahren die Schritte aufweist:

(iv) Erzeugen einer Matrix von Werten, von denen jeder anzeigt, ob das entsprechende Bildelement sich zwischen den zwei Bildern geändert hat, wenn Bildelemente des Blocks mit jenen des entsprechenden Blocks eines vorher codierten Bildes bei Schritt (i) verglichen werden;

(v) gegenüberstellen der Matrix, und zwar einer aus einer vorbestimmten Menge solcher Matrizen, von denen jede einen Bereich des Blocks identifiziert, der erachtet wird, sich geändert zu haben, und Erzeugen eines Codewortes, das diese eine Matrix der Menge identifiziert; und

(vi) Codieren zur Ausgabe nur jener Bildelemente innerhalb des identifizierten Bereichs des Blocks, außer wenn alle Elemente innerhalb des identifizierten Bereichs durch den Vergleichsschritt (ii) als unverändert relativ zu dem Bezugsbild identifiziert sind, woraufhin ein Codewort erzeugt wird, das anzeigt, daß dies der Fall ist.

2. Verfahren gemäß Anspruch 1, in dem beim Kopieren der Bildelemente innerhalb des identifizierten Bereichs mindestens einige der Bildelemente als die Differenz zwischen jenem Bildelement und einem vorausgesagten Wert für jenes Bildelement codiert werden, abgeleitet von einem oder mehreren vorher codierter Elemente des Blocks, wobei die Reihenfolge des Codierens der Bildelemente abhängig von der Orientierung des identifizierten Bereichs ist.

3. Vorrichtung zum Codieren eines Bildes, die aufweist:

(i) eine Einrichtung (2) zum Vergleichen von Bildelementen des Blocks für jeden aus einer Vielzahl von Blöcken mit jenen des entsprechenden Blocks eines vorher codierten Bildes, um zu bestimmen, welche Bildelemente gemäß einem vorbestimmten Kriterium sich zwischen zwei Bildern änderten;

(ii) einen Speicher (31), der angeordnet ist, um ein Referenzbild zu speichern, das aus

Blöcken von mindestens einem früheren Rahmen zusammengesetzt ist, und eine Einrichtung (30) zum Vergleichen von Bildelementen des Blocks mit jenen des entsprechenden Blocks eines Referenzbildes, das aus Blöcken von mindestens einem früheren Rahmen zusammengesetzt ist, um zu bestimmen, welche Bildelemente gemäß einem vorbestimmten Kriterium sich zwischen zwei Bildern geändert haben;

(iii) eine Einrichtung (33) zum Erzeugen eines Codewortes, das anzeigt, daß Bildelemente relativ zu einem Referenzbild unverändert sind, wenn sie durch die Vergleichseinrichtung so identifiziert sind:

dadurch gekennzeichnet, daß die Vorrichtung aufweist:

(iv) eine Einrichtung zum Erzeugen einer Matrix von Werten, von denen jeder anzeigt, ob das entsprechende Bildelement sich zwischen zwei Bildern geändert hat, wenn Bildelemente des Blocks mit jenen des entsprechenden Blocks eines vorher codierten Bildes bei Schritt (i) verglichen werden;

(v) eine Einrichtung (4) zum Gegenüberstellen der Matrix, und zwar einer aus einer vorbestimmten Menge solcher Matrizen, von denen jede einen Bereich des Blocks identifiziert, der erachtet wird, sich geändert zu haben, und zum Erzeugen eines Codewortes, daß diese eine Matrix aus der Menge identifiziert; und

(vi) eine Einrichtung (8, 33) zum Codieren zur Ausgabe nur jener Bildelemente innerhalb des identifizierten Bereichs des Blocks, außer wenn alle Elemente innerhalb des identifizierten Bereichs durch den Vergleichsschritt (ii) identifiziert sind, relativ zu dem Referenzbild unverändert zu sein, woraufhin ein Codewort erzeugt wird, das anzeigt, daß dies der Fall ist.

4. Vorrichtung gemäß Anspruch 3, die eine Einrichtung (35) zum Vergleichen aufeinanderfolgender Bilder aufweist, um Teile des Bildes zu identifizieren, die für eine vorbestimmte Zeitperiode unverändert geblieben sind, und im Falle, daß solche Teile identifiziert sind,

(a) das gespeicherte Referenzbild zu erneuern; und

(b) Daten zur Ausgabe zu codieren, die anzeigen, welche Teile des Referenzbildes somit erneuert worden sind.

5. Vorrichtung gemäß Anspruch 3, die eine Einrichtung (35) aufweist, die bei Betrieb angeordnet ist, ein periodisches Ersetzen einer Minderheit der Blöcke des Referenzbildes, das



in dem Speicher (31) gespeichert ist, durch die entsprechenden Blöcke eines vorhergehenden Bildes zu bewirken, wobei die Blöcke für aufeinanderfolgende Ersetzungen unterschiedlich ausgewählt werden, so daß der Speicher (31) immer ein zusammengesetztes Bild enthält, das aus Blöcken von einer Vielzahl von Rahmen des Bildes aufgebaut ist, das codiert wird.

6. Codiersystem, das eine Vorrichtung nach einem der Ansprüche 3 und 5 aufweist, wobei das System einen Decodierer aufweist, der aufweist:

- (a) einen Rahmenspeicher (43) zum Speichern eines empfangenen Bildes;
- (b) einen zweiten Rahmenspeicher (41);
- (c) eine Steuereinrichtung (41), die auf empfangene Daten antwortet, um den Inhalt des zweiten Rahmenspeichers (41) zu erneuern unter Verwendung der empfangenen Daten, und die auf ein empfangenes Codewort antwortet, um den zweiten Rahmenspeicher (41) mit einer Information von dem ersten Rahmenspeicher (43) zu erneuern;
- (d) eine Einrichtung (47), die den Inhalt des zweiten Rahmenspeichers wiederholt liest, um ein Videoausgabesignal zu erzeugen.

Revendications

1. Un procédé de codage d'une image comprenant, pour chacun des blocs d'une série de blocs d'une image les étapes consistant à :

- (i) comparer des éléments de représentation du bloc avec ceux du bloc correspondant d'une image codée précédemment afin de déterminer, selon un critère prédéterminé, quels éléments de représentation ont changé entre les deux images;
- (ii) comparer des éléments de représentation du bloc avec ceux du bloc correspondant d'une image de référence composée de blocs provenant d'au moins une trame précédente afin de déterminer, selon un critère prédéterminé, quels éléments de représentation ont changé entre les deux images;
- (iii) engendrer, lorsque les éléments de représentation sont identifiés par l'étape de comparaison (ii) comme étant inchangés par rapport à l'image de référence, un mot de code indiquant que tel est le cas;

CARACTERISE EN CE QUE le procédé inclut les étapes consistant à :

- (iv) produire une matrice de valeurs indiquant chacune si l'élément correspondant de représentation a changé entre les deux images, lors d'une comparaison d'éléments de représentation du bloc avec ceux du

bloc correspondant d'une image précédemment codée à l'étape (i);

(v) faire concorder la matrice avec l'une des matrices d'un ensemble prédéterminé de telles matrices qui identifient chacune une région du bloc comme étant supposée avoir changé, et engendrer un mot de code identifiant cette matrice de l'ensemble; et

(vi) coder, en vue de les sortir, ces éléments de représentation à l'intérieur de la région identifiée du bloc seulement, à moins que tous les éléments situés à l'intérieur de la région identifiée ne soient identifiés par l'étape de la comparaison (ii) comme étant inchangés par rapport à l'image de référence, à la suite de quoi un mot de code indiquant que tel est le cas est engendré.

2. Un procédé selon la revendication 1 dans lequel, dans le codage des éléments de représentation situés à l'intérieur de la région identifiée, au moins certains des éléments de représentation sont codés comme étant la différence entre cet élément de représentation et une valeur prédite de cet élément de représentation dérivée d'un ou plusieurs éléments précédemment codés du bloc, la séquence de codage des éléments de représentation étant fonction de l'orientation de la région identifiée.

3. Appareil de codage d'une image comprenant :
- (i) un moyen (2) permettant de comparer, pour chaque bloc d'une série de blocs, des éléments de représentation du bloc avec ceux du bloc correspondant d'une image codée précédemment afin de déterminer, selon un critère prédéterminé, quels éléments de représentation ont changé entre les deux images;
 - (ii) une mémoire (31) agencée pour mémoriser une image de référence composée de blocs provenant d'au moins une trame précédente et un moyen (30) permettant de comparer des éléments de représentation du bloc avec ceux du bloc correspondant d'une image de référence composée de blocs provenant d'au moins une trame précédente afin de déterminer, selon un critère prédéterminé, quels éléments de représentation ont changé entre les deux images;
 - (iii) un moyen (3) de génération d'un mot de code indiquant que des éléments de représentation sont inchangés par rapport à l'image de référence lorsqu'ils ont été identifiés de cette manière par le moyen de comparaison;

CARACTERISE EN CE QUE l'appareil inclut



:

(iv) un moyen de production d'une matrice de valeurs indiquant chacune si l'élément correspondant de représentation a changé entre les deux images, lors d'une comparaison d'éléments de représentation du bloc avec ceux du bloc correspondant d'une image précédemment codée à l'étape (i);

(v) un moyen (4) de mise en concordance de la matrice avec une matrice d'un ensemble prédéterminé de telles matrices dont chacune identifie une région du bloc comme étant supposée avoir changé, et engendrer un mot de code identifiant cette matrice de l'ensemble; et

(vi) un moyen (8, 33) permettant de coder, pour les sortir, ces éléments de représentation à l'intérieur de la région identifiée du bloc, seulement, à moins que tous les éléments situés à l'intérieur de la région identifiée ne soient identifiés par l'étape de la comparaison (ii) comme étant inchangés par rapport à l'image de référence, à la suite de quoi un mot de code indiquant que tel est le cas est engendré.

4. Un appareil selon la revendication 3, incluant un moyen (35) de comparaison d'images successives permettant d'identifier des éléments de l'image qui sont restés inchangés pendant un laps de temps prédéterminé et, dans le cas où de tels éléments sont identifiés,

(a) de mettre à jour l'image de référence mémorisée; et

(b) de coder, en vue de la sortir, une donnée indiquant quels éléments de l'image de référence ont été mis à jour de cette manière.

5. Un appareil selon la revendication 3, incluant un moyen (35) agencé pour effectuer, en fonctionnement, un remplacement périodique d'une minorité des blocs de l'image de référence mémorisée dans la mémoire (31) par les blocs correspondants d'une image récente, les blocs étant choisis différemment pour des remplacements successifs d'une manière telle que la mémoire (31) contient toujours une image composite constituée de blocs provenant d'une série de trames de l'image en cours de codage.

6. Un système de codage comprenant un appareil selon l'une quelconque des revendications 3 à 5 incluant un décodeur comprenant :

(a) une mémoire de trame (43) pour mémoriser une image de référence;

(b) une deuxième mémoire de trame (41);

(c) un moyen de commande (41), sensible à une donnée reçue pour mettre à jour le contenu de la deuxième mémoire de trame (41) en utilisant la donnée reçue, et sensible à un mot de code reçu pour mettre à jour la deuxième mémoire de trame (41) à l'aide d'une information provenant de la première mémoire de trame (43);

(d) un moyen (47) lisant respectivement le contenu de la deuxième mémoire de trame pour produire un signal vidéo de sortie.

