INTERNATIONAL STANDARD

ISO/IEC 14492

First edition
2001-12-15

AMENDMENT 2
2003-12-15

Information technology — Lossy/lossless coding of bi-level images

AMENDMENT 2: Extension of adaptive templates for halftone coding

Technologies de l'information — Codage avec ou sans perte des images au trait

AMENDEMENT 2: Extensions des modèles adaptatifs pour le codage des demi-teintes

Reference number
ISO/IEC 14492:2001/Amd.2:2003(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

Amendment 2 to ISO/IEC 14492:2001 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*, in collaboration with ITU-T. The identical text is published as ITU-T Rec. T.88 (2000)/Amd.2(06/2003).

INTERNATIONAL STANDARD
ITU-T RECOMMENDATION

Information technology – Lossy/lossless coding of bi-level images

Amendment 2

Extension of adaptive templates for halftone coding

1) Subclause 4.2

a) *Eight symbols for additional adaptive template pixels (from A_5 to A_{12}) are added after A_4 as follows (with the additions underlined):*

A_1, A_2, A_3, A_4, $\underline{A_5}$, $\underline{A_6}$, $\underline{A_7}$, $\underline{A_8}$, $\underline{A_9}$, $\underline{A_{10}}$, $\underline{A_{11}}$, $\underline{A_{12}}$

Adaptive template pixels in the generic region decoding procedure

b) *A new symbol "EXTTEMPLATE" is inserted after the symbol "EXRUNLENGTH" as follows (with the additions underlined):*

EXRUNLENGTH The length of a run of identical export flag values

EXTTEMPLATE A parameter indicating whether extended reference template is used in a generic region decoding procedure

c) *New 16 symbols "GBATX$_i$" and "GBATY$_i$" (i={5,...,12}) are inserted after "GBATY$_4$" as follows (with the additions underlined):*

GBATY$_4$ The Y location of adaptive template pixel 4 in a generic region decoding procedure

$\underline{\text{GBATX}_5}$ $\underline{\text{The X location of adaptive template pixel 5 in a generic region decoding procedure}}$

$\underline{\text{GBATY}_5}$ $\underline{\text{The Y location of adaptive template pixel 5 in a generic region decoding procedure}}$

$\underline{\text{GBATX}_6}$ $\underline{\text{The X location of adaptive template pixel 6 in a generic region decoding procedure}}$

$\underline{\text{GBATY}_6}$ $\underline{\text{The Y location of adaptive template pixel 6 in a generic region decoding procedure}}$

$\underline{\text{GBATX}_7}$ $\underline{\text{The X location of adaptive template pixel 7 in a generic region decoding procedure}}$

$\underline{\text{GBATY}_7}$ $\underline{\text{The Y location of adaptive template pixel 7 in a generic region decoding procedure}}$

$\underline{\text{GBATX}_8}$ $\underline{\text{The X location of adaptive template pixel 8 in a generic region decoding procedure}}$

$\underline{\text{GBATY}_8}$ $\underline{\text{The Y location of adaptive template pixel 8 in a generic region decoding procedure}}$

$\underline{\text{GBATX}_9}$ $\underline{\text{The X location of adaptive template pixel 9 in a generic region decoding procedure}}$

$\underline{\text{GBATY}_9}$ $\underline{\text{The Y location of adaptive template pixel 9 in a generic region decoding procedure}}$

$\underline{\text{GBATX}_{10}}$ $\underline{\text{The X location of adaptive template pixel 10 in a generic region decoding procedure}}$

$\underline{\text{GBATY}_{10}}$ $\underline{\text{The Y location of adaptive template pixel 10 in a generic region decoding procedure}}$

$\underline{\text{GBATX}_{11}}$ $\underline{\text{The X location of adaptive template pixel 11 in a generic region decoding procedure}}$

$\underline{\text{GBATY}_{11}}$ $\underline{\text{The Y location of adaptive template pixel 11 in a generic region decoding procedure}}$

$\underline{\text{GBATX}_{12}}$ $\underline{\text{The X location of adaptive template pixel 12 in a generic region decoding procedure}}$

$\underline{\text{GBATY}_{12}}$ $\underline{\text{The Y location of adaptive template pixel 12 in a generic region decoding procedure}}$

2) Subclause 6.2.2

In Table 2, new symbols "EXTTEMPLATE", "GBATX$_i$" and "GBATY$_i$" (i={5,...,12}) are inserted, and the notes of the table are revised as follows (with the additions and revisions underlined):

Table 2 – Parameters for the generic region decoding procedure

Name	Type	Size (bits)	Signed?	Description and restrictions
... (Leave untouched) ...				
TPGDON	Integer	1	N	Whether typical prediction is used. [a]
EXTTEMPLATE	Integer	1	N	Whether extended reference template is used. [e]
... (Leave untouched) ...				
GBATY$_4$	Integer	8	Y	The Y location of the adaptive template pixel A_4. [b]
GBATX$_5$	Integer	8	Y	The X location of the adaptive template pixel A_5. [d]
GBATY$_5$	Integer	8	Y	The Y location of the adaptive template pixel A_5. [d]
GBATX$_6$	Integer	8	Y	The X location of the adaptive template pixel A_6. [d]
GBATY$_6$	Integer	8	Y	The Y location of the adaptive template pixel A_6. [d]
GBATX$_7$	Integer	8	Y	The X location of the adaptive template pixel A_7. [d]
GBATY$_7$	Integer	8	Y	The Y location of the adaptive template pixel A_7. [d]
GBATX$_8$	Integer	8	Y	The X location of the adaptive template pixel A_8. [d]
GBATY$_8$	Integer	8	Y	The Y location of the adaptive template pixel A_8. [d]
GBATX$_9$	Integer	8	Y	The X location of the adaptive template pixel A_9. [d]
GBATY$_9$	Integer	8	Y	The Y location of the adaptive template pixel A_9. [d]
GBATX$_{10}$	Integer	8	Y	The X location of the adaptive template pixel A_{10}. [d]
GBATY$_{10}$	Integer	8	Y	The Y location of the adaptive template pixel A_{10}. [d]
GBATX$_{11}$	Integer	8	Y	The X location of the adaptive template pixel A_{11}. [d]
GBATY$_{11}$	Integer	8	Y	The Y location of the adaptive template pixel A_{11}. [d]
GBATX$_{12}$	Integer	8	Y	The X location of the adaptive template pixel A_{12}. [d]
GBATY$_{12}$	Integer	8	Y	The Y location of the adaptive template pixel A_{12}. [d]

[a] Unused if **MMR = 1**
[b] Unused if **MMR = 1** or **GBTEMPLATE ≠ 0**
[c] Unused if **USESKIP = 0** or **MMR = 1**
[d] Used only if MMR = **0** and **GBTEMPLATE = 0** and **EXTTEMPLATE = 1**
[e] Used only if **MMR = 0** and **GBTEMPLATE = 0**

3) Subclause 6.2.5.3

a) The identification number of Figure 3 is changed to "Figure 3(a)", and its caption is revised (with the additions and revisions underlined):

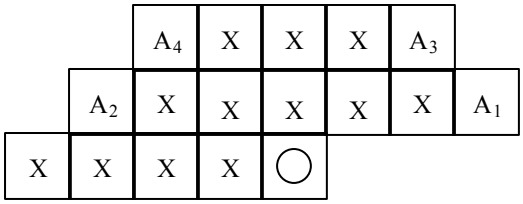

Figure 3(a) – Template when GBTEMPLATE = 0 and EXTTEMPLATE = 0, showing the AT pixels at their nominal locations

b) New Figure 3(b) is inserted as follows:

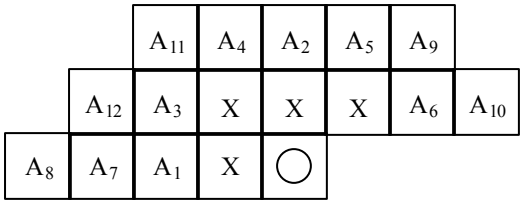

Figure 3(b) – Template when GBTEMPLATE = 0 and EXTTEMPLATE = 1, showing the AT pixels at their nominal locations

c) The second paragraph in subclause 6.2.5.3 is revised as follows (with the additions and revisions underlined):

Figure 3(a) shows the template which shall be used when **GBTEMPLATE** is 0 and **EXTTEMPLATE** is 0. Figure 3(b) shows the template which shall be used when **GBTEMPLATE** is 0 and **EXTTEMPLATE** is 1. Figure 4 shows the template which shall be used when **GBTEMPLATE** is 1. Figure 5 shows the template which shall be used when **GBTEMPLATE** is 2. Figure 6 shows the template which shall be used when **GBTEMPLATE** is 3. In each of these figures, the pixel denoted by a circle corresponds to the pixel to be coded and is not part of the template. The pixels denoted by 'X' correspond to ordinary pixels in the template. The pixels denoted A_1-A_{12} are special pixels in the template. They are denoted "adaptive" or AT pixels. These pixels are special in that their locations are not fixed, but can be placed at different locations. See 6.2.5.4 for a description of AT pixels. The legends A_1-A_{12} indicate the AT pixels 1 to 12. The pixels' actual locations are specified as parameters to this decoding procedure; Figures 3-6 show the nominal locations of these AT pixels for each template.

4) Subclause 6.2.5.4

a) The second paragraph is revised as follows (with the additions and revisions underlined):

The pixels that are allowed to change are called AT pixels. Their nominal locations are indicated by 'A_1', 'A_2', 'A_3', 'A_4', 'A_5', 'A_6', 'A_7', 'A_8', 'A_9', 'A_{10}', 'A_{11}', and 'A_{12}' in Figures 3(a), 3(b), 4, 5 and 6. Note that some templates have fewer than sixteen AT pixels. In general, an AT pixel can be located anywhere in the field shown in Figure 7, not including the current pixel. Hence, there is the possibility to use an effective template size of 15, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5, or 4 pixels by having the moved location of the AT pixel overlap a regular template pixel. The actual locations of the AT pixels for any invocation of this decoding procedure are specified as parameters to the decoding procedure. The location of the pixel A_1 is given by (**GBATX$_1$**, **GBATY$_1$**). If **GBTEMPLATE** is 0, then:

- the location of the pixel A_2 is given by (**GBATX$_2$**, **GBATY$_2$**);
- the location of the pixel A_3 is given by (**GBATX$_3$**, **GBATY$_3$**);
- and the location of the pixel A_4 is given by (**GBATX$_4$**, **GBATY$_4$**).

Additionally, if **GBTEMPLATE** is 0 and **EXTTEMPLATE** is 1, then:

- the location of the pixel A_5 is given by (**GBATX$_5$**, **GBATY$_5$**);
- the location of the pixel A_6 is given by (**GBATX$_6$**, **GBATY$_6$**);
- the location of the pixel A_7 is given by (**GBATX$_7$**, **GBATY$_7$**);
- the location of the pixel A_8 is given by (**GBATX$_8$**, **GBATY$_8$**);
- the location of the pixel A_9 is given by (**GBATX$_9$**, **GBATY$_9$**);
- the location of the pixel A_{10} is given by (**GBATX$_{10}$**, **GBATY$_{10}$**);
- the location of the pixel A_{11} is given by (**GBATX$_{11}$**, **GBATY$_{11}$**);
- the location of the pixel A_{12} is given by (**GBATX$_{12}$**, **GBATY$_{12}$**).

b) Note 2 is revised as follows (with the additions and revisions underlined):

NOTE 2 – The indices of the AT pixels in Figures 3(a) and 3(b) correspond to the expected goodness. If moving only one AT pixel from the nominal location shown in Figure 3(a), it is advisable to move A_4. The next pixel to move is A_3 and so on.

c) *Table 5 is revised as follows (with the additions and revisions underlined):*

Table 5 – The nominal values of the AT pixel locations

GBTEMPLATE		0		0		1		2		3	
EXTTEMPLATE		1		0		0		0		0	
$GBATX_1$	**$GBATY_1$**	–2	0	3	–1	3	–1	2	–1	2	–1
$GBATX_2$	**$GBATY_2$**	0	–2	–3	–1	NA	NA	NA	NA	NA	NA
$GBATX_3$	**$GBATY_3$**	–2	–1	2	–2	NA	NA	NA	NA	NA	NA
$GBATX_4$	**$GBATY_4$**	–1	–2	–2	–2	NA	NA	NA	NA	NA	NA
$GBATX_5$	**$GBATY_5$**	1	–2	NA	NA	NA	NA	NA	NA	NA	NA
$GBATX_6$	**$GBATY_6$**	2	–1	NA	NA	NA	NA	NA	NA	NA	NA
$GBATX_7$	**$GBATY_7$**	–3	0	NA	NA	NA	NA	NA	NA	NA	NA
$GBATX_8$	**$GBATY_8$**	–4	0	NA	NA	NA	NA	NA	NA	NA	NA
$GBATX_9$	**$GBATY_9$**	2	–2	NA	NA	NA	NA	NA	NA	NA	NA
$GBATX_{10}$	**$GBATY_{10}$**	3	–1	NA	NA	NA	NA	NA	NA	NA	NA
$GBATX_{11}$	**$GBATY_{11}$**	–2	–2	NA	NA	NA	NA	NA	NA	NA	NA
$GBATX_{12}$	**$GBATY_{12}$**	–3	–1	NA	NA	NA	NA	NA	NA	NA	NA
NOTE – NA means that the parameter has no nominal value.											

5) Subclause 6.2.5.7

The step d) ii) is changed as follows (with the additions and revisions underlined):

d) If LTP = **0** then, from left to right, decode each pixel of the current row of GBREG. The procedure for each pixel is as follows:

i) If **USESKIP** is **1** and the pixel in the bitmap **SKIP** at the location corresponding to the current pixel is **1**, then set the current pixel to **0**.

ii) Otherwise:

- Place the template given by parameters **GBTEMPLATE**, **$GBATX_1$** through **$GBATX_{12}$** and **$GBATY_1$** through **$GBATY_{12}$** so that the current pixel is aligned with the location denoted by a circle in the figure describing the appearance of the template with identifier **GBTEMPLATE**.

6) Subclause 7.4.6.2

a) *Figure 46 is replaced by the following figure:*

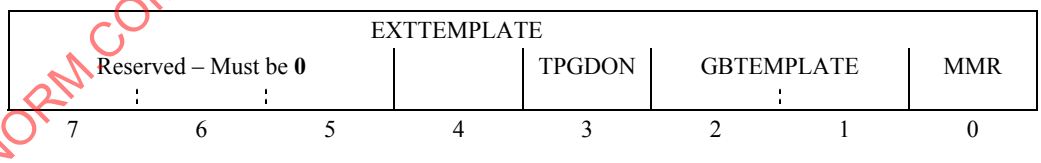

Figure 46 – Generic region segment flags field structure

7) Subclause 7.4.6.2

The notations of Bit 4 are added for EXTTEMPLATE, and reserved bits are changed to Bits 5-7 as follows (with the additions and revisions underlined):

Bit 4 **EXTTEMPLATE**

This field specifies whether extended reference template is used.

Bits 5-7 Reserved; must be zero.

8) Subclause 7.4.6.3

a) The first paragraph is changed as follows (with the additions and revisions underlined):

This field is only present if **MMR** is **0**. If **GBTEMPLATE** is **0** and **EXTTEMPLATE** is **0**, it is an eight-byte field, formatted as shown in Figure 47(a) and as described below.

b) The identification number of Figure 47 is changed to Figure 47(a) as follows (with the revision underlined):

$GBATX_1$	$GBATY_1$	$GBATX_2$	$GBATY_2$	$GBATX_3$	$GBATY_3$	$GBATX_4$	$GBATY_4$

Figure 47(a) – Generic region AT flags field structure when GBTEMPLATE is 0 and EXTTEMPLATE is 0

c) New Figure 47(b) is inserted immediately after as follows:

$GBATX_1$	$GBATY_1$	$GBATX_2$	$GBATY_2$	$GBATX_{12}$	$GBATY_{12}$

T.88Amd.2_F47(b)

Figure 47(b) – Generic region AT flags field structure when GBTEMPLATE is 0 and EXTTEMPLATE is 1

d) The last paragraph is revised as follows (with the additions and revisions underlined):

If **GBTEMPLATE** is 0 and **EXTTEMPLATE** is 1, it is a 32-byte field, formatted as shown in Figure 47(b) and as described below.

Byte 0 **$GBATX_1$**

Byte 1 **$GBATY_1$**

Byte 2 **$GBATX_2$**

Byte 3 **$GBATY_2$**

Byte 4 **$GBATX_3$**

Byte 5 **$GBATY_3$**

Byte 6 **$GBATX_4$**

Byte 7 **$GBATY_4$**

Byte 8 **$GBATX_5$**

Byte 9 **$GBATY_5$**

Byte 10 **$GBATX_6$**

Byte 11 **$GBATY_6$**

Byte 12 **$GBATX_7$**

Byte 13 **$GBATY_7$**

Byte 14 **$GBATX_8$**

Byte 15 **$GBATY_8$**

Byte 16 **$GBATX_9$**

Byte 17 **$GBATY_9$**

Byte 18 **$GBATX_{10}$**

Byte 19 **$GBATY_{10}$**