
**Information technology — Lossless
and near-lossless compression of
continuous-tone still images: Extensions**

*Technologies de l'information — Compression sans perte et quasi sans
perte d'images fixes à modelé continu: Extensions*



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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.

ISO/IEC 14495-2 was prepared jointly 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 Recommendation T.870.

This second edition cancels and replaces the first edition (ISO/IEC 14495-2:2002), which has been technically revised.

ISO/IEC 14495 consists of the following parts, under the general title *Information technology — Lossless and near-lossless compression of continuous-tone still images*.

- *Part 1: Baseline*
- *Part 2: Extensions*

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INTERNATIONAL STANDARD
ITU-T RECOMMENDATION

**Information technology – Lossless and near-lossless compression of
continuous-tone still images: Extensions**

1 Scope

This Recommendation | International Standard defines a set of lossless (bit-preserving) and nearly lossless (where the error for each reconstructed sample is bounded by a predefined value) compression methods for coding continuous-tone (including bi-level), gray-scale, or colour digital still images.

This Recommendation | International Standard:

- specifies extensions (including arithmetic coding, extension of near lossless coding, extension of prediction and extension of Golomb coding) to processes for converting source image data to compressed image data;
- specifies extensions to processes for converting compressed image data to reconstructed image data including an extension for sample transformation for inverse colour transforms;
- specifies coded representations for compressed image data;
- provides guidance on how to implement these processes in practice.

2 Normative references

The following Recommendations and International Standards contain provisions which, through references in this text, constitute provisions of this Recommendation | International Standard. At the time of publication, the editions indicated were valid. All Recommendations and Standards are subject to revision, and parties to agreements based on this Recommendation | International Standard are encouraged to investigate the possibility of applying the most recent edition of the Recommendations and Standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards. The Telecommunication Standardization Bureau of the ITU maintains a list of currently valid ITU-T Recommendations.

2.1 Identical Recommendations | International Standards

- CCITT Recommendation T.81 (1992) | ISO/IEC 10918-1:1994, *Information technology – Digital compression and coding of continuous-tone still images: Requirements and guidelines*.
- ITU-T Recommendation T.83 (1994) | ISO/IEC 10918-2:1995, *Information technology – Digital compression and coding of continuous-tone still images: Compliance testing*.
- ITU-T Recommendation T.84 (1996) | ISO/IEC 10918-3:1997, *Information technology – Digital compression and coding of continuous-tone still images: Extensions*.
- ITU-T Recommendation T.87 (1998) | ISO/IEC 14495-1:2000, *Information technology – Lossless and near-lossless compression of continuous-tone still images: Baseline*.

2.2 Additional references

- ISO/IEC 646:1991, *Information technology – ISO 7-bit coded character set for information interchange*.
- ISO 5807:1985, *Information processing – Documentation symbols and conventions for data, program and system flowcharts, program network charts and system resources charts*.
- ISO/IEC 9899:1999, *Programming languages – C*.

3 Definitions, abbreviations, symbols and conventions

3.1 Definitions

For the purposes of this Recommendation | International Standard, the following definitions apply in addition to the definitions used in ITU-T Rec. T.87 | ISO/IEC 14495-1.

3.1.1 arithmetic encoder: An embodiment of an arithmetic encoding procedure.

3.1.2 arithmetic encoding: A procedure which encodes a sample as a binary representation of the sequence of previously encoded samples by means of a recursive subdivision of a unit interval.

3.1.3 arithmetic decoder: An embodiment of an arithmetic decoding procedure.

3.1.4 arithmetic decoding: A procedure which recovers source data from an encoded bit stream produced by an arithmetic encoder.

3.1.5 binary context: Context used to determine the binary arithmetic coding of the present binary decision.

3.1.6 binary decision: Choice between two alternatives.

3.1.7 colour transform: A procedure for sample transformation for inverse colour transform.

3.1.8 sign flipping: The procedure which reverses the sign of a prediction error according to accumulated prediction errors.

3.1.9 symbol packing: A procedure which may be applied to source images in which sample values are sparsely distributed.

3.1.10 visual quantization: An extended function of near-lossless coding which enables to change the difference bound according to the context.

3.2 Abbreviations

In additions to the abbreviations used in ITU-T Rec. T.87 | ISO/IEC 14495-1, the abbreviations used in this Recommendation | International Standard are listed below.

FLC	Fixed length code
LPS	Less probable symbol
MPS	More probable symbol

3.3 Symbols

In addition to the symbols used in ITU-T Rec. T.87 | ISO/IEC 14495-1, the symbols used in this Recommendation | International Standard are listed below. A convention is used that parameters which are fixed in value during the encoding of a scan are indicated in **boldface** capital letters, and variables which change in value during the encoding of a scan are indicated in *italicised* letters.

Areg current numerical-line interval being renormalized

ArithmeticEncode() a function in the C programming language

Av[0..30] 31 constants corresponding to LPS probability estimate

Avd auxiliary variable storing modified **Av**

BASIC_T1, BASIC_T2, BASIC_T3, BASIC_T4 basic default threshold values

Bin binary decision

Buf[0..1] bytes stored to avoid carry-over propagation to the encoded bit stream

Creg value of code register storing the trailing bits of the encoded bit stream

ENT indication of the coding process used for the scan

Flag[0..MAXVAL] **MAXVAL**+1 flags which indicate if corresponding sample values already occurred