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Information technology — JPEG 2000 image coding system: Reference software

Technologies de l'information — Système de codage d'images JPEG 2000: Logiciel de référence

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Foreword

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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 15444-5 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.804.

This second edition cancels and replaces the first edition (ISO 15444-5:2003), which has been technically revised. It also incorporates ISO/IEC 15444-5:2003/Amd.1:2003 and ISO/IEC 15444-5:2003/Amd.2:2015.

ISO/IEC 15444 consists of the following parts, under the general title *Information technology — JPEG 2000 image coding system*:

— *Part 1: Core coding system*

— *Part 2: Extensions*

— *Part 3: Motion JPEG 2000*

— *Part 4: Conformance testing*

— *Part 5: Reference software*

— *Part 6: Compound image file format*

— *Part 8: Secure JPEG 2000*

— *Part 9: Interactivity tools, APIs and protocols*

— *Part 10: Extensions for three-dimensional data*

— *Part 11: Wireless*

— *Part 12: ISO base media file format*

— *Part 13: An entry level JPEG 2000 encode*

— *Part 14: XML representation and reference*

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Electronic attachment: JASPER, JJ2000, OPENJPEG reference packages

INTERNATIONAL STANDARD
ITU-T RECOMMENDATION

Information technology – JPEG 2000 image coding system: Reference software

1 Scope

Rec. ITU-T T.800 | ISO/IEC 15444-1[1] defines a set of lossless and lossy compression methods for coding continuous-tone, bi-level, greyscale or colour digital still images. This Recommendation | International Standard provides three independently created software reference implementations of Rec. ITU-T T.800 | ISO/IEC 15444-1, in order to assist implementers of Rec. ITU-T T.800 | ISO/IEC 15444-1 in testing and understanding its content. The packages are JASPER, JJ2000 and OPENJPEG.

The reference software packages are informative only. This Recommendation | International Standard does not define any additional part of the JPEG 2000 image coding system.

Each version of the reference software contains source code, which may be compiled to provide the following functionality:

- transcoding from selected, widely available image formats into a JPEG 2000 codestream;
- transcoding from selected, widely available image formats into the JP2 file format;
- selection of a wide range of JPEG 2000 encoding options (as documented in each reference software);
- decoding from a JPEG 2000 codestream to a range of selected widely available image formats;
- Processing of a JP2 file to extract a JPEG 2000 codestream for decoding and conversion to a range of selected widely available image formats.
- The ability to extract metadata from a JP2 file, including the contents of the Image Header box and the colour space.
- The decoding of JP2 files that use the Three-Component Matrix-Based form of the Restricted ICC method for the specification of colour space and the conversion of the decoded image data to the sRGB colour space for display, including limited upsampling of all decoded components to the same resolution.
- The decoding of JP2 files that use the Monochrome form of the Restricted ICC method for the specification of colour space and the conversion of the decoded image data to the sRGB based greyscale space as defined within the JP2 file format.
- The decoding of JP2 files that use the sYCC colour space and the conversion of the decoded image data to the sRGB colour space for display, including upsampling of all decoded components to the same resolution.
- some additional tools to help with evaluation and testing.

The reference software is intended for use as a testing and validation tool for other implementations of JPEG 2000, and to help in the understanding of Rec. ITU-T T.800 | ISO/IEC 15444-1. Although components of the reference software may find application in software intended for product development, this was not an objective of the development of this software, and prospective implementers are cautioned against making any estimations of performance or resource usage based on the reference software.

2 Normative references

The following Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of the 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.

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[1] This Specification includes an electronic attachment containing the JASPER, JJ2000 and OPENJPEG reference packages.

2.1 Identical Recommendations | International Standards

– ITU-T Recommendation T.800 (2002) | ISO/IEC 15444-1:2002, *Information technology – JPEG 2000 Image Coding System: Core coding system*.

2.2 Additional references

– ISO/IEC 9899:1999, *Programming languages – C*.

– ISO/IEC 9945-1:1996, *Information technology – Portable Operating System Interface (POSIX) – Part 1: System Application Program Interface (API) (C language)*.

– ISO/IEC 9945-2:1993, *Information technology – Portable Operating System Interface (POSIX) – Part 2: Shell and utilities*.

3 Definitions

For the purposes of this Recommendation | International Standard, the following definitions apply:

3.1 **big endian**: The bits of a value representation occur in order from most significant to least significant.

3.2 **bit**: A contraction of the term "binary digit"; a unit of information represented by a zero or a one.

3.3 **bit-plane**: A two-dimensional array of bits. In this Recommendation | International Standard, a bit-plane refers to all the bits of the same magnitude in all coefficients or samples. This could refer to a bit-plane in a component, tile-component, code-block, region of interest, or other.

3.4 **bit stream**: The actual sequence of bits resulting from the coding of a sequence of symbols. It does not include the markers or marker segments in the main and tile-part headers or the EOC marker. It does include any packet headers and in stream markers and marker segments not found within the main or tile-part headers.

3.5 **box**: A portion of the file format defined by a length and unique box type. Boxes of some types may contain other boxes.

3.6 **box contents**: Refers to the data wrapped within the box structure. The contents of a particular box are stored within the DBox field within the Box data structure.

3.7 **byte**: Eight bits.

3.8 **channel**: One logical component of the image. A channel may be a direct representation of one component from the codestream, or may be generated by the application of a palette to a component from the codestream.

3.9 **code-block**: A rectangular grouping of coefficients from the same subband of a tile-component.

3.10 **coder**: An embodiment of either an encoding or decoding process.

3.11 **codestream**: A collection of one or more bit streams and the main header, tile-part headers, and the EOC required for their decoding and expansion into image data. This is the image data in a compressed form with all of the signalling needed to decode.

3.12 **coefficient**: The values that are the result of a transformation.

3.13 **component**: A two-dimensional array of samples. An image typically consists of several components, for instance representing red, green and blue.

3.14 **compressed image data**: Part or all of a bit stream. Can also refer to a collection of bit streams in part or all of a codestream.

3.15 **decoder**: An embodiment of a decoding process, and optionally a colour transformation process.

3.16 **decoding process**: A process which takes as its input all or part of a codestream and outputs all or part of a reconstructed image.

3.17 **discrete wavelet transformation (DWT)**: A transformation that iteratively transforms one signal into two or more filtered and decimated signals corresponding to different frequency bands. This transformation operates on spatially discrete samples.

3.18 **encoder**: An embodiment of an encoding process.

3.19 **encoding process**: A process that takes as its input all or part of a source image data and outputs a codestream.