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Part 1: Core coding system

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

This 2nd edition adds coding tools for compressing colour filter array images (CFA images), to code images without any loss, and it also adds support for 420 sampled images.

A list of all parts in the ISO/IEC 21122 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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INTERNATIONAL STANDARD

**INFORMATION TECHNOLOGY –
JPEG XS LOW-LATENCY LIGHTWEIGHT IMAGE CODING SYSTEM**

1 Scope

This document defines the syntax and an accompanying decompression process that is capable to represent continuous-tone grey-scale, or continuous-tone colour digital images without visual loss at moderate compression rates. Typical compression rates are between 2:1 and 6:1 but can also be higher depending on the nature of the image. In particular, the syntax and the decoding process specified in this document allow lightweight encoder and decoder implementations that limit the end-to-end latency to a fraction of the frame size. However, the definition of transmission channel buffer models necessary to ensure such latency is beyond the scope of this document.

This document:

- specifies a decoding processes for converting compressed image data to reconstructed image data;
- specifies a codestream syntax containing information for interpreting the compressed image data;
- provides guidance on encoding processes for converting source image data to compressed image data.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 10646 *Information Technology – Universal Multiple-Octet Coded Character Set (UCS)*

3 Terms and definitions, abbreviated terms and symbols**3.1 Terms and definitions**

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1.1

band

input data to a specific wavelet filter type that contributes to the generation of one of the components of the image

3.1.2

band type

single number collapsing the information on the component, and horizontal and vertical wavelet filter types that are applied in the filter cascade reconstructing spatial image samples from inversely quantized wavelet coefficients

3.1.3

bit

binary choice encoded as either 0 or 1

3.1.4

bitplane

array of bits having all the same significance

3.1.5

bitplane count

number of significant bitplanes of a code group, counting from the LSB up to the most significant, non-empty bitplane

3.1.6

bitplane count subpacket

subset of a packet which decodes to the bitplane counts of all code groups within a packet, followed by padding and optional filler bytes

Note 1 to entry: See subclause C.5.3.

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3.1.7

byte

group of 8 bits

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3.1.8

color filter array

CFA

rectangular array of sensor elements yielding a 1-component picture in which the color a sensor element is sensitive to is depending on its position

3.1.9

codestream

compressed image data representation that includes all necessary data to allow a (full or approximate) reconstruction of the sample values of a digital image

3.1.10

coefficient group

number of horizontally adjacent wavelet coefficients from the same band

3.1.11

code group

group of quantization indices in sign-magnitude representation before inverse quantization

3.1.12

coefficient

input value to the inverse wavelet transformation resulting from inverse quantization

3.1.13

column

set of vertically aligned precincts

3.1.14

compression

process of reducing the number of bits used to represent source image data

3.1.15

component

two-dimensional array of samples having the same designation such as red, green or blue in the output or display device

3.1.16

continuous-tone image

image whose components have more than one bit per sample

3.1.17

data subpacket

subset of a packet which consists of the quantization index magnitudes, followed by padding and optional filler bytes

Note 1 to entry: See subclause C.5.4.

3.1.18

(inverse) deadzone quantizer

(inverse) quantizer whose zero bucket has a size different from all other buckets

3.1.19

decoder

embodiment of a decoding process

3.1.20

decoding process

process which takes as its input a codestream and outputs a continuous-tone image

3.1.21

decomposition level

set of wavelet coefficients resulting from a particular level of recursive application of a wavelet transform

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3.1.22

downsampling

procedure by which the spatial resolution of a component is reduced

3.1.23

encoder

embodiment of an encoding process.

3.1.24

encoding process

process which outputs compressed image data in the form of a codestream

3.1.25

entropy decoder

embodiment of an entropy decoding procedure

3.1.26

entropy decoding

lossless procedure which recovers the sequence of symbols from the sequence of bits produced by the entropy encoder

3.1.27

entropy encoder

embodiment of an entropy encoding procedure

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3.1.28

entropy encoding

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lossless procedure which converts a sequence of input symbols into a sequence of bits such that the average number of bits per symbol approaches the entropy of the input symbols

3.1.29

grayscale image

continuous-tone image that has only one component

3.1.30

filler bytes

integer number of bytes a decoder will skip over on decoding without interpreting the values of the bytes itself

3.1.31

inverse quantization

inverse procedure to quantization by which the decoder recovers a representation of the coefficients

3.1.32

inverse reversible multi component transformation**inverse RCT**

inverse transformation across multiple component sample values located at the same sample grid point that is invertible without loss

Note 1 to entry: See subclauses F.3 and F.4.

3.1.33

Joint Photographic Experts Group**JPEG**

informal name of the committee which created this document

3.1.34

JPEG XS

informal name of this standard where XS stands for “extra speed”

3.1.35

LL band

input to a series of wavelet filters where only inverse low-pass filters are applied in horizontal and vertical direction

3.1.36

lossless

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descriptive term for encoding and decoding processes and procedures in which the output of the decoding procedure(s) is identical to the input to the encoding procedure(s) [ISO/IEC DIS 21122-1](https://standards.iteh.ai/catalog/standards/sist/b50caca3-4cd0-45d3-b997-89810527d922/iso-iec-dis-21122-1)

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3.1.37

lossless coding

mode of operation which refers to any one of the coding processes defined in this Specification in which all of the procedures are lossless

3.1.38

lossy

descriptive term for encoding and decoding processes which are not lossless

3.1.39

sign subpacket

subset of a packet that consists of the sign information of all non-zero quantization indices within a packet, followed by padding and optional filler bytes

Note 1 to entry: See subclause C.5.5.

3.1.40

significance

attribute of code groups that applies if, depending on the Run Mode flag in the picture header, either at least one of coefficients in the code group is non-zero, or the bitplane count prediction residual of the code group is non-zero