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Information technology — JPEG XR image coding system —

Part 1: System architecture

*Technologies de l'information — Système de codage d'image JPEG
XR —*

Partie 1: Architecture du système



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Contents

Page

Foreword.....	v
1 Scope	1
2 Terms and definitions.....	1
3 Abbreviations	6
4 The JPEG XR image coding system.....	7
5 General overview of technical design.....	7
5.1 Basic technology structure	7
5.2 Supported image format types.....	8
5.3 Decoded image structure and interpretation.....	9
5.4 Data processing hierarchy and structures	10
5.5 The JPEG XR transform structure and hierarchy	11
5.6 Handling of image and tile boundaries	13
5.7 Quantization and lossless representation.....	13
5.7.1 Overall quantization design concepts.....	13
5.7.2 Quantization control on a spatial region basis	14
5.7.3 Quantization control on a frequency band basis.....	14
5.7.4 Quantization control on a colour plane component basis	14
5.7.5 Quantization control type combinations.....	14
5.8 Prediction of transform coefficients and coded block patterns	14
5.9 Adaptive ordering of coefficient scanning pattern.....	15
5.10 Entropy coding of transform coefficients	15
5.11 Codestream structure	16
6 JPEG XR design in relation to baseline JPEG and JPEG 2000	17
6.1 General	17
6.2 Image area partitions.....	18
6.3 Image fidelity refinement	18
7 High dynamic range (HDR) image coding.....	18
7.1 HDR formats supported in JPEG XR.....	18
7.2 HDR signal processing design in JPEG XR.....	19
7.3 Examples of HDR applications for JPEG XR.....	19
8 JPEG XR profiles and levels.....	19
8.1 Overview of profiles and levels	19
8.2 Sub-Baseline profile.....	20
8.3 Baseline profile.....	20
8.4 Main profile.....	20
8.5 Advanced profile.....	20
8.6 Levels	21
9 JPEG XR encoding practices.....	21
9.1 General encoding guidelines	21
9.2 Encoding for random access	21
9.3 Guidelines for tile size selection	22
10 The JPEG XR decoding process functionality	23
10.1 JPEG XR decoding process structure.....	23
10.2 Output colour conversion.....	24
10.3 Resolution scalability at decoder	24
10.3.1 General	24
10.3.2 DC-only image decoding	24

10.3.3	DC plus LP image decoding	24
10.4	Quality scalability at decoder	25
10.5	Spatial random access at decoder	25
11	JPEG XR codestream compressed-domain manipulation.....	25
11.1	General.....	25
11.2	Flexbits trimming	26
11.3	Flexbits and HP band elimination	26
11.4	Flexbits and HP and LP band elimination	26
11.5	Spatial versus frequency codestream mode switching	26
11.6	Rotation and flip.....	26
11.7	Compressed-domain region of interest extraction.....	26
11.8	Switching between interleaved and planar alpha planes	27
11.9	Compressed-domain retiling	27

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.

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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.

In exceptional circumstances, when the joint technical committee has collected data of a different kind from that which is normally published as an International Standard (“state of the art”, for example), it may decide to publish a Technical Report. A Technical Report is entirely informative in nature and shall be subject to review every five years in the same manner as an International Standard.

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ISO/IEC TR 29199 consists of the following parts, under the general title *Information technology — JPEG XR image coding system*:

- *Part 1: System architecture* [Technical Report]
- *Part 2: Image coding specification*
- *Part 3: Motion JPEG XR*
- *Part 4: Conformance testing*
- *Part 5: Reference software*

Information technology — JPEG XR image coding system —

Part 1: System architecture

1 Scope

This document is a non-normative Supplement | Technical Report providing a technical overview and encoding and decoding practice guidelines for the JPEG XR image coding system as normatively specified in ITU-T Rec. T.832 | ISO/IEC 29199-2, ITU-T Rec. T.833 | ISO/IEC 29199-3, ITU-T Rec. T.834 | ISO/IEC 29199-4, and ITU-T Rec. T.835 | ISO/IEC 29199-5.

2 Terms and definitions

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

2.1

adaptive coefficient normalization

parsing sub-process where **transform coefficients** are dynamically partitioned into a **VLC-coded** part and a **fixed-length coded** part, in a manner designed to control (i.e., "normalize") bits used to represent the **VLC-coded** part

NOTE The **fixed-length coded** part of **DC coefficients** and **low-pass coefficients** is called **FLC refinement** and the **fixed-length coded** part of **high-pass coefficients** is called **flexbits**.

2.2

adaptive inverse scanning

parsing sub-process where the **zigzag scan order** associated with a set of **transform coefficients** is dynamically modified, based on the statistics of previously-parsed **transform coefficients**

2.3

adaptive VLC

parsing sub-process where the code table associated with **VLC** parsing of a particular **syntax element** is switched, among a finite set of fixed tables, based on the statistics of previously-parsed instances of this syntax element

2.4

alpha image plane

optional secondary image plane associated with an image of the same dimensions as the luma component of the primary image plane

NOTE The alpha image plane has one component, a luma component.

2.5

block

$m \times n$ array of **samples**, or an $m \times n$ array of **transform coefficients**

2.6

block index

integer in the range 0 to 15 identifying, by its position in **raster scan order**, a particular 4×4 **block** within a partition of a 16×16 **block** into 16 4×4 **blocks**

2.7

byte

sequence of 8 bits

2.8

chroma

component of the **primary image plane** with non-zero index, or the **transform coefficients** and sample values associated with this **component**

2.9

codestream

sequence of bits contained in a sequence of **bytes** from which syntax elements are parsed, such that the most significant bit of the first **byte** is the first bit of the **codestream**, the next most significant bit of the first **byte** is the second bit of the **codestream**, and so on, to the least significant bit of the first **byte** (which is the eighth bit of the **codestream**), followed by the most significant bit of the second **byte** (which is the ninth bit of the **codestream**), and so on, up to and including the least significant bit of the last **byte** of the sequence of **bytes** (which is the last bit of the **codestream**)

2.10

component

array of samples associated with an **image plane**

2.11

context

possible value of a specific instance of a **context variable**

2.12

context variable

variable used in the **parsing process** to select which data structure is to be used for the **adaptive VLC** parsing of a given syntax element

2.13

DC coefficient

first subset when the **transform coefficients**, that are contained in a specific **macroblock** and a specific **component**, are partitioned into 3 subsets

2.14

DC-LP array

array of all DC and low-pass **transform coefficients**, for all **macroblocks** associated with a specific **component**

2.15

decoder

embodiment of a **parsing process** and **decoding process**

2.16

decoding process

process of computing output sample values from the parsed syntax elements of the **codestream**

2.17

dequantization

process of rescaling the quantized **transform coefficients** after their value has been parsed from the **codestream** and before they are presented to the **inverse transform process**

2.18

encoder

embodiment of an **encoding process**

2.19

encoding process

process of converting source sample values into a **codestream**

2.20**file**

finite-length sequence of **bytes** that is accessible to a **decoder** in a manner such that the **decoder** can obtain access to the data at specified positions within the sequence of **bytes** (e.g. by storing the entire sequence of **bytes** in random access memory or by performing "position seek" operations to specified positions within the sequence of **bytes**)

2.21**file format**

specified structure for the content of a **file**

2.22**fixed-length code (FLC)**

code which assigns a finite set of allowable bit patterns to a specific set of values, where each bit pattern has the same length

2.23**FLC refinement**

fixed-length coded part of a **DC coefficient** or **low-pass coefficient** that is parsed using adaptive **fixed-length codes**

2.24**flexbits**

fixed-length coded part of the **high-pass coefficient** information which is parsed using adaptive **fixed-length codes**

2.25**frequency band**

collective term for one of the following three subsets of the **transform coefficients** for an **image**, which are separately parsed: **DC coefficients**, **low-pass coefficients**, and **high-pass coefficients**

2.26**frequency mode**

codestream structure mode where the DC, low-pass, high-pass and **flexbits frequency bands** for each **tile** are grouped separately

2.27**hard tiles**

codestream structure mode where the overlap operators are not applied across tile boundaries; instead, boundary overlap operators are applied at tile boundaries

2.28**high-pass coefficient**

third subset, when the **transform coefficients** that are contained in a specific **macroblock** and a specific **component** are partitioned into 3 subsets

2.29**image**

result of the **decoding process**, consisting of a **primary image plane** and an optional **alpha image plane**

2.30**image plane**

collective term for a grouping of the **components** of the **image**

2.31**internal colour format**

colour format associated with the spatial-domain samples obtained through the **inverse transform process** and the **sample reconstruction process**, and distinguished from the **output colour format** associated with the **output formatting process**

2.32

inverse core transform (ICT)

two steps of the **inverse transform process** that involve processing of **transform coefficients** associated with each **macroblock** independently, with no **overlap filtering**

2.33

inverse transform process

part of the **decoding process** by which a set of **dequantized transform coefficients** are converted into spatial-domain values

2.34

inverse scanning

process of reordering an ordered set of parsed **syntax elements** from the **codestream** to form an array of **transform coefficients** associated with a specific **component** and **macroblock**

2.35

low-pass coefficient

second subset, when the **transform coefficients** that are contained in a specific **macroblock** and a specific **component** are partitioned into 3 subsets

2.36

luma

component of an **image plane** with index zero, and the **transform coefficients** and sample values associated with this **component**

NOTE Although this term is commonly associated with a signal that conveys perceptual brightness information, as used in this International Standard the term is primarily an identifier of a particular array of samples or **transform coefficients** for an **image**.

2.37

macroblock

collection of **transform coefficients** or samples, across all **components**, that have the same indices i and j with respect to a **macroblock partition**

2.38

macroblock partition

partitioning of each **component**, into 16×16 , 8×8 , or 16×8 **blocks**, depending on the **internal colour format**

2.39

output bit depth

representation, including the number of bits and the interpretation of the bit pattern, used for the sample values of the output **image** that are the result of the **decoding process**

2.40

output colour format

colour format associated with the output **image** that is the result of the **decoding process**

2.41

output formatting process

process of converting the arrays of samples (that are the result of the **sample reconstruction process**) into the output samples that constitute the output of the **decoding process**

NOTE This specifies a conversion (if necessary) into the appropriate **output colour format** and **output bit depth**.

2.42

overlap filtering

steps of the **inverse transform process** that involve processing of **transform coefficients** across adjacent **blocks** and **macroblocks**

NOTE When **overlap filtering** is applied, it is applied across **macroblock** boundaries as well as **block** boundaries. When the **codestream** uses **soft tiles**, the **overlap filtering** is also applied across **tile** boundaries. Otherwise, **overlap filtering** does not occur across **tile** boundaries.

2.43

parsing process

process of extracting bit sequences from the **codestream**, converting these bit sequences to syntax element values, and setting the values of global variables for use in the **decoding process**

2.44

prediction

process of computing an estimate of the sample value or data element that is currently being decoded

2.45

primary image plane

image plane that consists of all **image components** that are not a part of the **alpha image plane**

2.46

quantization parameter (QP)

value used to compute the scaling factor for the **dequantization** of a **transform coefficient**, before the **inverse transform process** is applied

2.47

raster scan order

scan order in which a two-dimensional array of values is scanned row-wise from left to right, and the rows are scanned from the top row to the bottom

2.48

refinement

process of modifying a predicted or partially-computed **transform coefficient**

2.49

run

number of zero valued coefficient levels that precede a non-zero valued coefficient level in the **zigzag scan order** during the **inverse scanning** process

2.50

sample reconstruction process

process of converting dequantized **transform coefficients** into samples of the **image**

2.51

soft tiles

codestream structure mode where the overlap operators are applied across tile boundaries

2.52

spatial mode

codestream structure mode where the **DC**, **low-pass**, **high-pass** and **flexbits frequency bands** for each specific **macroblock** are grouped together

2.53

spatial transformation

element in the **codestream** indicating the preferred final displayed orientation of the decoded **image**, as specified in ISO/IEC 29199-2

NOTE The **spatial transformation** is only a suggestion, and **decoder** conformance is checked only for the decoded **image** prior to the application of this transformation (i.e. for orientation 0).