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BSI Standards Publication

Information technology — Advanced image coding and evaluation

Part 2: Evaluation procedure for nearly lossless coding

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National foreword

This British Standard is the UK implementation of ISO/IEC 29170-2:2015.

The UK participation in its preparation was entrusted to Technical Committee IST/37, Coding of picture, audio, multimedia and hypermedia information.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Information technology — Advanced image coding and evaluation —

Part 2: Evaluation procedure for nearly lossless coding

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Partie 2: Mode opératoire d'évaluation pour codage presque sans perte

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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.

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 on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: Foreword — Supplementary information.

The committee responsible for this document is ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

ISO/IEC 29170 consists of the following parts, under the general title *Information technology — Advanced image coding and evaluation*:

— *Part 1: Guidelines for coding system evaluation (forthcoming)*

— *Part 2: Evaluation procedure for visually lossless coding*

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Introduction

This International Standard normalizes a procedure to evaluate coding systems by subjective methods. The procedure is particularly useful for evaluating lightly compressed coding systems used, for instance, in display stream compression where a source compresses image data sent to a display. Examples of display streams include but are not limited to a wired link between a set-top box unit and a television or between a mobile host graphics processor and a display panel module in a mobile appliance. Viewers of these displays should be unaware that a coding system is employed in the device or system. A coding system will be considered visually lossless if the test results meet a pre-defined acceptable quality level demonstrated by the performance criteria described in this Specification under the viewing conditions specified and media sets provided.

Appliances that may require visually lossless performance for compressed display streams include: computer monitor displays, televisions, mobile phone and tablet displays. Data compression for these systems allows existing display links to carry more display data than is possible with uncompressed image streams or to reduce system power consumption or both.

The types of coding systems tested by this procedure may have the following properties:

a) The presence of a coding system should be undetectable to a user who is viewing the display.

b) The coding system operates in real-time, with negligible latency, low complexity hardware and minimal memory in both the encoder and the decoder.

This procedure builds on prior standardization and best practices embodied in ISO 3664, ISO 20462-2 and ISO/IEC TR 29170-1.

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Information technology — Advanced image coding and evaluation —

Part 2: Evaluation procedure for nearly lossless coding

1 Scope

This Technical Specification normalizes evaluation and grading of a light coding system used for displays and display systems, but is independent of the display technology. This procedure measures whether an observer can distinguish between an uncompressed reference and the reconstructed image to a pre-determined, statistically meaningful level.

The procedure compares individual images with two possible forced choice comparison test methods. This procedure relies on subjective evaluation methods designed to discern image imperfections on electronic colour displays of any technology or size.

Image selections for testing a specific coding system has bearing on the results this procedure will yield, but specific images required for testing are not within scope, excluding an informative annex describing self-test certification. Image categories may vary between end-usage products. For example, content relevant to television manufacturers may or may not be relevant to computer display manufacturers. Due to the nature of this procedure as a visual psychophysical test, observer's age is considered a meaningful parameter of the results.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3664, *Graphic technology and photography — Viewing conditions*

3 Terms and definitions

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

3.1
advance time
time a reference image or test image is displayed during an interleaved pair comparison test

3.2
algorithm
unique combination of test conditions that contribute to a unique test image, for example, the combination of coding an image with one compression level and one coding method represents coding with one algorithm

Note 1 to entry: Coding an image with a different compression level and the same coding method represents a second unique algorithm.

3.3
blank time
time between trials when the display shows no stimulus

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3.4
block of trials
long experiment is logically divided into a series of trials

Note 1 to entry: There is an expectation that the observer iteratively completes each trial presented during a short block of time without stopping for breaks beyond those allocated by the software presentation timing.

3.5
control image
cropped test image coded to ensure defects are easily detectable in a paired comparison test

3.6
evaluator
expert in the field of image or compression artefact analysis or vision science, who prepares images, categorizes images or instructs the observer

3.7
expert observer
observer skilled in vision science or coding technology and image artefacts

3.8
image
still representation of pixels rendered by the display

3.9
just noticeable difference
stimulus difference that would lead to a 0,75 probability of correct responses in a two-alternative forced-choice task

3.10
non-expert observer
observer with no special skills or training in vision science or coding technology

3.11
observer
individual performing the subjective evaluation procedure by evaluating stimulus to make paired comparison task choices

3.12
picture element
pixel
smallest element that is capable of generating the full intended functionality (e.g. colour and gray scale) of the display

Note 1 to entry: In a multicolour display, the smallest addressable element capable of producing the full colour range or the smallest element that is capable of generating the full functionality of the display.

3.13
reference image
cropped original image displayed during a trial

3.14
session
description of the full time interval in which an observer participates in the experiment on a given day

Note 1 to entry: It can encompass multiple blocks of trials. A full experiment can be divided into multiple sessions.

3.15
test image
cropped version of a reconstructed image after coding displayed during a trial

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3.16
trial
single unit of the experiment

Note 1 to entry: A set of images will be presented on the screen for a defined viewing time. The trial is complete only when the observer has entered a response.

3.17
viewing time
number of seconds an observer views paired stimuli. The viewing time has a maximum value in all situations

3.18
visually lossless
fully decoded image or multimedia sample presenting a display that is visually indistinguishable from the original uncompressed data over the same spatial area and when viewed under the same conditions

4 Symbols and abbreviated terms

AQL acceptable quality level

PPD pixels per degree

RGB red-green-blue

5 Test methods

5.1 Protocol selection

The evaluator shall select the most suitable test protocol from those listed in Table 1 and contained in the listed annex. The protocol selection depends on the media under test, end display usage and the target AQL.

Table 1 — Visually lossless testing protocol

	Test Protocol	Comment
Annex A	forced choice paradigm with a non-flickering image	sensitive testing, suitable for testing images compressed and reconstructed by light coding systems, but not as sensitive as interleaved testing
Annex B	forced choice paradigm with interleaved images	most sensitive testing, suitable for testing images compressed and reconstructed by light coding systems

5.2 Media selection

Media selection takes images or other media for display rendering relevant to the display type and user applications.

Evaluators shall follow media selection procedures in Annex C after selecting a test protocol.

5.3 Observers

5.3.1 Observer selection

The observers shall be selected from a general population that may include both experts and non-experts. The observers for the experiment shall not include evaluators who participated in the media selection for the experiment being conducted.

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