



BSI Standards Publication

Graphic technology and photography — Colour characterization of digital still cameras (DSCs)

Part 2: Considerations for determining scene analysis transforms

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National foreword

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Graphic technology and photography — Colour characterization of digital still cameras (DSCs) —

Part 2: Considerations for determining scene analysis transforms

*Technologie graphique et photographie — Caractérisation de la
couleur des appareils photonumériques —*

*Partie 2: Considérations pour déterminer les transformations
d'analyse de scène*



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In exceptional circumstances, when a 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 by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TR 17321-2 was prepared by Technical Committee ISO/TC 42, *Photography*.

ISO 17321 consists of the following parts, under the general title *Graphic technology and photography — Colour characterization of digital still cameras (DSCs)*:

- *Part 1: Stimuli, metrology and test procedures*
- *Part 2: Considerations for determining scene analysis transforms*

Introduction

Digital still cameras (DSCs) have become the predominant means of photographic image capture, but the nature of the image data produced by different cameras, or even by the same camera operating in different modes, is quite variable. This variability can cause problems in workflows, miscommunications and interoperability issues.

This Technical Report provides information about methods for determining scene analysis transforms, which are transforms that convert raw image data to scene-referred image data. This information is provided in the form of a Technical Report because there are a number of choices to be made when determining scene analysis transforms. These choices are influenced by the subject matter being photographed (including the scene illumination), the scene adopted white and the adopted white of the scene-referred colour encoding to be used, aesthetic choices regarding scene analysis colour error minimization, and other considerations. It is not possible to provide more specific recommendations because the spectral responses of DSC colour analysis channels do not, in general, match those of a typical human observer, such as defined by a CIE standard colourimetric observer. Nor do the responses of different DSCs ordinarily match each other. This Technical Report outlines considerations relevant to the determination of scene analysis transforms based on the minimization of errors in specified colour spaces. The DSC characterization data obtained using ISO 17321-1 serve as the raw DSC image data.

Good understanding of this Technical Report requires that the three fundamental modes of DSC operation be distinguished: the raw mode, the scene-referred mode, and the output-referred mode. When operating in the raw mode, a DSC records image data that is most closely related to the sensor response. Some types of processing may have been performed, such as dark current subtraction, defect removal and colour filter array interpolation, but neither a scene analysis nor a colour rendering transform has been applied. Any encoding transform typically consists of only a non-linearity to better align the quantization intervals with the image noise characteristics, and possibly some form of compression.

When operating in the scene-referred mode, a DSC records image data that represents an estimate of the scene or focal plane image relative colourimetry, typically with white balancing to the encoding adopted white. The image data has not undergone colour rendering for some anticipated output medium and viewing conditions. In order to produce output-referred images intended for reproduction, it is necessary to either apply a colour rendering transform directly to the scene-referred images, or convert them to a working colour space where the desired colour rendering is applied. Camera controls or raw processing software can offer some aesthetic choices when converting to scene-referred, but the results of such choices need to be viewed through the intended colour rendering transform in order to see their effect on the final output. The image data are encoded prior to applying the colour rendering transform, and are therefore not an encoding of the intended output colourimetry. At present, few DSCs offer an in-camera scene-referred mode, although some camera raw processing applications have this capability.

When operating in the output-referred mode, the DSC controls are set to achieve the desired output directly, thereby incorporating the colour rendering, and in many cases a reference output device encoding (such as for a CRT monitor) in the image file. When operating in this mode the DSC encodes the colourimetry of the intended output on the reference medium, not scene-referred colourimetry. Also, the output-referred colourimetry can be in different encodings, with different reference media, and in some cases will need to be colour re-rendered and/or re-encoded to produce different reproductions.

The information provided in this Technical Report is intended to help camera and raw processing software manufacturers, professional photographers and colour measurement applications to determine, communicate about, and select DSC scene analysis transforms. However, it will often not be practical for end users to determine scene analysis transforms themselves. In addition to the requirement for raw DSC image data, relatively sophisticated and expensive measurement equipment is required to obtain chart patch spectral reflectance or radiance, illumination source spectral power, and DSC spectral sensitivity (as described in ISO 17321-1).

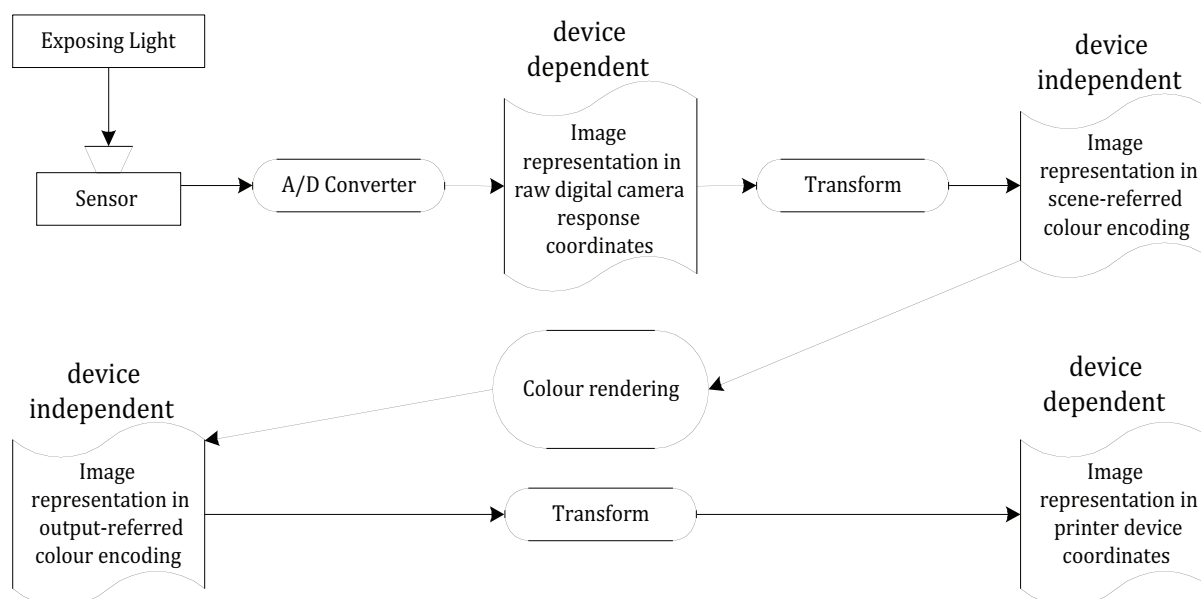


Figure 1 — Generic image workflow for digital photography

Graphic technology and photography — Colour characterization of digital still cameras (DSCs) —

Part 2: Considerations for determining scene analysis transforms

1 Scope

This Technical Report provides information about methods for determining scene analysis transforms based on the minimization of errors in estimated scene or focal-plane colourimetry, including corresponding colourimetry. These transforms are limited in applicability to raw DSC image data.

This Technical Report concerns only the creation and encoding of scene-referred and focal-plane-referred image data. It does not address the encoding of output-referred image data. It also does not provide information relating to the specification of metadata items describing intended artistic adjustments, colour rendering and viewing.

This Technical Report does not address how to choose adopted white points or how to process scene-referred image data to produce output-referred image data.

This Technical Report is not intended to be comprehensive or complete; it is an overview intended to enable improved practices and communications.

2 Definitions

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

2.1

absolute colorimetric coordinates

tristimulus values, or other colorimetric coordinates derived from tristimulus values, where the numerical values correspond to the magnitude of the physical stimulus

EXAMPLE If the colourimetric coordinates used are CIE 1931 standard 2° observer tristimulus values, the Y value should correspond to the luminance, not the luminance factor (or some scaled value thereof).

2.2

adapted white

colour stimulus that an observer who is adapted to the viewing environment would judge to be perfectly achromatic and to have a luminance factor of unity; i.e. absolute colorimetric coordinates that an observer would consider to be a perfect white diffuser

NOTE 1 The adapted white can vary within a scene.

NOTE 2 No assumptions should be made concerning the relation between the adapted white and measurements of near perfectly reflecting diffusers in a scene, because measurements of such diffusers will depend on the illumination and viewing geometry, and other elements in the scene that can affect perception. It is easy to arrange conditions for which a near perfectly reflecting diffuser will appear to be grey or coloured.

NOTE 3 See adopted white (2.3).