



Medical Imaging Working Group meeting

SEIKO EPSON
Tokyo Office 29th floor, JR Shinjuku Miraina Tower
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25 October 2018

Craig Revie, MIWG chair, opened the meeting at 08:30. The items discussed were as follows:

1. Review of MIWG activities
2. Action items from previous meetings
3. DICOM proposal on visible light photography
4. Future of MIWG

1. MIWG review

Craig Revie summarised the charter and current status of MIWG [see attached].

1.1 WSI calibration

Revie described the problems and advantages of calibration; in particular the FDA were concerned that algorithms may not be reliable if image colours were not calibrated. Calibration methods include using a linear variable filter; dichroic filters; and a calibration slide with stains. The vendors were all now using ICC-based calibration, except for Phillips who have a direct slide – to – sRGB display system. Currently the stains used in pathology are design for visibility by humans, but it is possible that future stains may be designed for machine readability.

An outstanding issue in WSI calibration is the question of how to handle the ‘lensing effect’ which causes over-white image values. This requires some form of headroom and each vendor makes their own decision as to the value of the diffuse white point.

It was noted that Shoji Tominaga-sensei has published work on removing specular highlights from images.

1.2 Medical displays

The displays activity had participation from Barco, LG, Eizo and BenQ. One topic discussed was how to handle extended gamut displays, where medical imaging displays have traditionally been sRGB.

ICC had provided input to the FDA document on displays, and developed a White Paper (led by Tom Kimpe of Barco with input from Eizo). The proposed CSDF calibration allows display of different presentation modes on the same display. Kimpe’s AAPM paper on CSDF is available at

<https://aapm.onlinelibrary.wiley.com/doi/abs/10.1118/1.4925945> LG were also working on calibration assessment for HDR displays.

Tom Lianza noted there was also relevant activity in VESA, which will probably end up in the ICDM display measurement standard.

1.3 Retinal fundus imaging

This work is ongoing, the calibration methods are straightforward and the calibration target is the novel aspect.

1.4 Medical photography

The white paper has been completed and is published on the ICC site.

1.5 Mobile displays

Ray Cheydluer reported that iPads are becoming more widespread in clinical use. There is an X-Rite product available, but mobile OS are becoming more colour aware. There are unsolved problems in this area and it could be something for ICC to work on.

1.6 DICOM Multispectral framework

The framework has been adopted in DICOM; it is not iccMAX-related.

1.7 Petri dish calibration

This work is suspended due to the move of Jeremie Pescatore within Biomerieux.

1.8 Skin colour

There is no recent activity. The use case for prosthetics is interesting. All the skin reflectance data is on the ICC web site.

1.9 DICOM Camera RAW

This is an active area.

1.10 DICOM Open source

No recent activity

1.11 DICOM best practices

A draft document on best practice for colour in DICOM has been circulated.

2. Action items from previous meetings

It was agreed to close outstanding MIWG action items [see attached], with the exception of MIWG-17-03 on developing new areas of activity. The ICS for GSDF (MIWG-16-12) was moved to AWG, and testing the iccMAX GSDF profile to Displays WG.

3. DICOM proposal on visible light photography

Revie reviewed comments on the DICOM proposal to add Visible Light Photography Attributes corresponding to EXIF 2.31 and TIFF/EP [see attached]. It was noted that the document retained the old (1995) name Inter-Color Consortium for ICC.

The proposal to add ICC profile support to the DICOM WADO-RS document was also reviewed [see attached]. This describes a protocol for remote viewing (incorporating rights management). ICC profiles are

supported, but not specified in detail. In the case of ‘iccprofile’, the user can define what colour space to convert to. However, server support for the ICC profile is optional.

4. The future of MIWG

Although most activities had concluded, it was agreed to continue the working group, holding meetings only if there are agenda items proposed. Some topics are ongoing, including the LG proposal and feedback on DICOM to David Clunie.

The following action was agreed at the meeting|:

MIWG 2018-07 Add url to Kimpe’s paper to the minutes (Green, Revie)

There being no other business, the meeting closed at 10:30.



ICC Medical Imaging Working Group

Tokyo

25th October 2018 (08:30-10:30)

No items have been proposed for the MIWG agenda for the Tokyo meeting and so this presentation provides a summary of the current status and asks what we should do with this working group in future



ICC MIWG web page at www.color.org



International Color Consortium

MAKING COLOR SEAMLESS BETWEEN
DEVICES AND DOCUMENTS

ABOUT ICC RESOURCES INFORMATION MEMBERS GETTING STARTED V4 iccMAX

ICC: EVENTS:

All ICC Events

2018

ICC Color Symposium
Hong Kong, 22 October

Grand Rapids, MI, 30-31
May

ICC DevCon 2018

Munich, 25-26 February

Upcoming ICC Meetings

2017

Ryerson Toronto
Graphic Arts Day, 13
October

Toronto, 11-12 October

Prague Graphic Arts
Experts' Day, 29 June

Prague, 27-28 June

ICC Medical Imaging Working Group

The Working Group arose out of the **Summit on Color in Medical Imaging** held in Silver Spring, Maryland in May 2013. It exists to enable and promote the correct and effective use of ICC color management for medical imaging.

Current activities:

- Whole slide imaging
- Medical displays
- Color eye model
- Best practices for digital color photography in medicine
- Colour support for mobile devices
- Framework for multispectral imaging
- Petri plate calibration
- Imaging and reproduction of skin
- DICOM camera raw support and EXIF tags
- Open source reference implementation
- Best practice papers for colour in DICOM

Summary of all MIWG work items

Upcoming MIWG meetings

For forthcoming meetings, see the ICC **meeting schedule**.

If you wish to participate in a meeting, please contact the **ICC Secretary**

Previous meetings

Meetings and minutes

Action items

SEARCH ICC :

GO

Got a question about ICC Profiles or colour management? 
[Ask Phil...](#)

ICC: LIVE TOPICS:

iccMAX

New iccMAX version

iccMAX Reference Implementation - v2.1.14 released

ICC tech note on embedding an iccMAX profile in a v4 profile

ICC White Paper on iccMAX Calc programming

ICC video

ICC Medical Imaging Working Group

Profile security

Research fund

Medical Imaging Working Group Charter



Enable and promote the correct and effective use of ICC color management for medical imaging. Specifically the group will:

1. Identify issues with the implementation and use of color management for medical imaging.
2. Establish and maintain liaison relationships with the appropriate medical imaging standards development organizations, e.g. DICOM, AAPM, ACR, IEC and ISO.
3. Prepare white papers and other educational materials, and promotion activities to guide developers and users in the appropriate application of color management to medical imaging.
4. When necessary, propose new ICC specifications or revisions to existing ICC (and other) specifications to address the needs of the medical imaging community.
5. Promote the use of ICC color management in medical imaging.

Status of activities



- Whole slide imaging
 - FDA guidance for WSI devices recommends the use of colour calibration
 - most of the major vendors have incorporated or plan to incorporate colour calibration in their workflow
 - ICC paper Digital microscope test materials and test methods incomplete
- Medical displays
 - FDA guidance for displays recommends the use of colour calibration
 - traditionally sRGB was used for medical displays and is likely to be the most widely used colour model for some time
 - Barco and others developed ICC White Paper 44 describing a new calibration model (CSDF) – work moved to IEC/TC322 ([paper by Kimpe et al](#))
 - proposal from LG to develop a White Paper for assessment methods for HDR displays (ongoing)

Status of activities (continued)



- Color eye model
 - report on phase 1 of fundus camera calibration project complete
- Best practices for digital color photography in medicine
 - ICC White Paper 46 Improving Color Image Quality in Medical Photography published
- Colour support for mobile devices
 - proposal by XRite seems not to have been widely adopted
- Framework for multispectral imaging
 - some specification work to incorporate iccMAX seems not to have been widely adopted
- Petri plate calibration
 - Petri plates reading and viewing: a need for standardisation
 - Petri plates image acquisition: a colour calibration method
 - both papers in draft but no recent work

Status of activities (continued)



- Imaging and reproduction of skin
 - a number of useful resources are available from the ICC web site but no recent activity
- DICOM camera raw support and EXIF tags
 - draft of DICOM specification circulated for review (summary of feedback later)
- Open source reference implementation (DICOM)
 - no activity
- Best practice papers for colour in DICOM
 - draft of DICOM WADO specification circulated for review (summary of feedback later)

Action items review



MIWG-16-12	Displays	Discuss ICS for GSDF and report back to MIWG	04-05-2016	Bai, Derhak, Nagashima-san, Kimpe	Close
MIWG-17-03	General	Develop activity proposals on Viewing Environment in Pathology Imaging Automation of Detecting Anomalous Features Electro-Optical Requirements for Medical Displays	20-05-2017	Revie; Lianza; Wonseon	Open
MIWG-2017-06	General	Contact university MIWG members to invite input on future MIWG activities	28-06-2017	Revie	Close
MIWG-2017-07	DICOM	Invite ICC members to participate in DICOM Connectathon	11-10-2017	Revie	Close
MIWG-2017-10	Displays	Report on iccMAX GSDF profiles at next MIWG meeting	11-10-2017	Derhak	Close
MIWG-2017-11	Displays	Test iccMAX GSDF profile on GSDF calibrated display with ambient illuminance passed in as environmental variable	11-10-2017	Bai	Close
MIWG-2017-13	WSI	Contact CAP for details of their recommendations for viewing conditions for pathology images	11-10-2017	Revie	Close

Comments on DICOM proposal to add Visible Light Photography Attributes corresponding to EXIF 2.31 and TIFF/EP



- Page 50 line 13-16, InterColor Consortium should be International Colour Consortium
- Keep in mind that the AsShotICCProfile will only achieve its goal for certain types of rendering. Spatially-varying operations such as local tone mapping, for instance, might not be efficiently encodable in an ICC profile.
- The VL Photographic Image IOD modules listed in Table A.32.4-1 shows the ICC profile as a Module in the Image IE. This is common to several other IOD definition in PS.3-3 (2018b and earlier). However, the VL Photographic Image IOD already provides a means to include the ICC profile via the Image Pixel Module which does not change the usage requirement (U in IOD definition and 3 in Image Pixel module, i.e. both optional). I am not sure if there is a trend to extract the ICC profile from being 'embedded' in the module definition (for Image Pixel - and others?) and to 'expose' it as a module in its own right, but the VL Whole Slide Microscopy IOD does not (at least in PS3.3 2018b) define it in this way. The result is the same in terms of where any ICC profile data is present in a serialised DICOM entity so perhaps it is not that important.
Just wanted to raise for comment by David Clunie.

ICC comments on proposal to add ICC profile parameter to DICOM WADO-RS retrieve rendered (explanation)



- 6.5.8.1.2.5 ICC Profile limits to just a few profile choices. Since the profile type is easily identifiable, this limitation may be unnecessary but could sacrifice extensibility and flexibility.
- There is the potential for conflict between tag (0028,2000) and (0028,2002). If one is present, the other should not be.
- It doesn't appear that the case of scene-referred colorimetry (CIIS tag) has been considered, except as noted above.

Discussion of future of MIWG

