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Abstracts

Chromatic Adaptation in Print: The Reproduction of Images on Coloured Substrates
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Over the last 10 years there has been considerable study of chromatic adaptation between softcopy and hardcopy reproductions. Whilst this has improved understanding about chromatic adaptation particularly in practical applications, it remains a complex scenario for study. An alternative is the colour appearance of images reproduced on coloured substrates with or without comparison to an image reproduced on a white substrate. The work presented here describes the psychophysical investigation of the degree of chromatic adaptation needed to reproduce an image on a coloured substrate in accordance with observer preference. The results are compared with softcopy versus hardcopy psychophysical results.

Investigation of two methods to quantify noise in digital images based on the perception of the human eye.
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Since the signal to noise measuring method as standardized in the normative part of ISO 15739:2002(E) does not quantify noise in a way that matches the perception of the human eye, two alternative methods have been investigated which may be appropriate to quantify the noise perception in a physiological manner:
- the model of visual noise measurement proposed by Hung et al (as described in the informative annex of ISO 15739:2002(E)) which tries to simulate the process of human vision by using the opponent space and contrast sensitivity functions and uses the CIELuv1976 colour space for the determination of a so called visual noise value.
- S-CIELabDE2000 colour difference model proposed by Fairchild et al which simulates human vision approximately the same way as Hung but uses an image comparison afterwards based on DE 2000.
Both are based on the cognition of the human visual system and both use a human visual algorithm, which tries to describe the visual recognition of colour by the human visual system. After the image data has been filtered with the algorithm, the visual noise measurement model uses a weighted sum of the standard deviation along the L*, u* and v* axes of the CIELab1976 Luv colour space, while the S-CIELabDE2000 model processes a colour difference between a noise free image and a noisy image.

Evaluation of colour rendering using LED based sources

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Colour rendering is the effect of an illuminant on the colour appearance of objects by conscious or subconscious comparison with their colour appearance under a reference illuminant. The CIE standardised the method of colour rendering index calculation 30 years ago, in which the colour differences between the colours of test samples once illuminated by the test lamp and then by the reference are calculated. However, this method is outdated and problematic, especially for the LEDs.
In this work, an LED simulator consisted of 8 coloured LEDs was constructed to simulate the CIE D65. The source was designed to have small spectral difference from CIE D65 illuminant and high colour rendering index (CRI) value of 97.6 and small metamerism index (MI) value of 0.09. Besides, a fluorescent lamp with 96.4 CRI value and a cool white LED with 86.6 CRI value were also used. A psychophysical experiment using magnitude estimation method was carried out in a dark room. Sixty high colour inconstant textile samples were used as the test samples. The observer was asked to estimate the colour appearance of the test sample in terms of lightness, colourfulness and hue according to the references under the 3 light sources. The result shows that the CIE CRI method does not describe the visual performance of different light sources properly. However, if the colour rendering calculation is based on CIECAM02 colour appearance model, the result can be improved.

Investigation of the surround effects on the colour appearance of self-luminous displays

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This paper describes an investigation into the effect of a wide range of surround conditions on the colour appearance of test colours on a 42" plasma display panel. Experiments were conducted using surrounds including dark, indoor and outdoor conditions. Additionally the stimulus size was changed by controlling the viewing distance. The viewing conditions studied were two bright, two average, two dim and two dark surrounds. Each of the test colours was assessed by 10 observers using a magnitude estimation method. The study showed little visual lightness difference between a bright and dark surround, and between a dim and dark surround, unlike the expectation that the perceived lightness contrast may increase as the surround becomes brighter without reflected flare off the display. The lightness dependency of colourfulness however, was found to change with varying surround. The visual colour appearance of the surround conditions, including viewing flare, was plotted against measured data, CIELAB L*, C* values, to try to understand the surround effect. As the surround became brighter, the perceived lightness decreased, more for dark colours than light colours, and the perceived colourfulness increased, more obviously in high chroma colours. It was also found that the lightness and colourfulness contrast showed opposite trends. In the investigation of the change of stimulus size under different surround conditions, visual colour appearance was not affected by the stimulus sizes of 2° and 0.6° in the dark surround. However, the difference was found in the very dark colours with a dim surround. Finally, all of visual colour appearance data were used to test the performance of the colour appearance model CIECAM02. Minor modification was accomplished to improve the colourfulness predictor, especially for the black background.

Keywords: colour appearance, surround, lightness, colourfulness, hue, lightness contrast, CIECAM02

Evaluation of Colour Appearance Models using Transmissive Media

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Colour appearance data sets are used to derive colour appearance models. The LUTCHI data were the main data sets used to develop many colour appearance models. Very few colour appearance data are available for higher luminance levels. In this study, the colour appearance data were extended to cover transmissive media with high luminance level.
New colour appearance data set for transmissive media was collected through psychophysical experiments. Five experimental phases with different luminance levels and background luminance factors were conducted in dark surround condition. Three of the phases covered high luminance level i.e. luminance of reference white above 3300 cd/m2.
Magnitude estimation method was used with the similar experimental set-up as LUTCHI experiments. Total 16 observers participated in the experiments to give a total of 10500 estimations. Lightness, colourfulness and hue of 50 test colours were judged by the observers. Observer performance was evaluated in terms of repeatability and accuracy of the observers. Colour appearance changes due to luminance level and background luminance factor were analysed by using the colour appearance data set.
Five colour appearance models - CIELAB, Hunt94, CIECAM97s, CIECAM02 and Kwak03 - were tested by using the colour appearance data set. Except CIELAB, all models performed well in terms of the ability to predict the mean visual data. Also all models, except CIELAB, successfully predicted the lightness and colourfulness changes under different luminance levels and backgrounds. Overall, CIECAM02 has shown the best performance amongst all the models.

Complex Image Colour Difference Model (CICDM)

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A new colour difference model for evaluating complex images was developed by a JND (Just Noticeable Difference) experiment. Ten observers took part in this experiment using 19-inch IPS (In Plane Switch) LCD (Liquid Crystal Displays). The results showed that the CIELAB space and other advanced colour difference formulae do not correspond to the lightness and chroma thresholds. In order to improve the colour difference formula for complex image difference calculation, weighting functions and parametric factors were developed for lightness, chroma and hue as the results of JND image difference experiment. The developed model outperforms other conventional colour difference formulae and is useful to the study of image quality.

No further abstracts have been received to date.