

Spectral Color Research

Spectral color research focuses on accurate and light-independent physical measurement and analysis of color and seeks to understand color vision. Computational methods of pattern recognition and image analysis are applied to the processing of spectral data. The InFotonics Center Joensuu is a global pioneer in applied spectral color research.



University of Joensuu
InFotonics Center Joensuu
P.O. Box 111
FI-80101 Joensuu, FINLAND
Tel. +358 13 251 5610
Fax +358 13 251 7955
info@ifc.joensuu.fi
www.ifc.joensuu.fi



Photography: 247 Images Oy and Tanja Tikka Layout design: Tanja Tikka



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Applications for Various Branches and Wavelength Ranges

The color of an object is determined by three basic factors: illumination, reflectance or transmittance, and the observer. The traditional way of modeling a color signal is to create a mathematical 3-dimensional representation using, e.g., the RGB or CIE-LAB color spaces. However, the most accurate way of creating a color representation is to measure the spectrum of the electromagnetic radiation sent by the object.

Because humans observe the electromagnetic radiation in the wavelength range of visible light as different colors, we often talk about the color spectrum. Spectral methods at the InFotonics Center Joensuu are also used to research the phenomena of electromagnetic radiation beyond visible light, i.e. in the ultraviolet and infrared regions.

Depending on the application needs, spectral measurements can be carried out either as dot measure-

ments or area measurements. The latter comprises an image matrix whose each pixel contains the spectral information of the object.

The use of spectral information enables the total control of the illumination changes in the measurement environment and makes it possible to reproduce real colors on various display equipment. Moreover, the data obtained by spectral measurements can be converted into any desired color space values.

Spectral data often cannot be processed by commercial software, which requires the InFotonics Center Joensuu to build its own tailor-made measurement and analysis software to meet the various application needs. The InFotonics Center Joensuu continuously develops new spectral software solutions that cater for scientific basic research and the center's corporate clients.

Spectral Color Research at the InFotonics Center Joensuu

- Spectral measurement techniques and spectral software
- Computational processing and analysis of spectral images
- Spectral research of color vision models
- Search methods for spectral image databases
- Research of fluorescent materials

Applications

- Color management and quality assurance systems for industrial products
- Spectral analysis methods for medicine
- Digital reproduction and archiving of cultural-historical artifacts
- Accurate color reproduction methods for display equipment
- Product development of future materials, light sources and color measurement equipment