CIMET Fundamentals of Spectral Science 2012-2013

Course name: Fundamentals of Spectral Science **Course code:** CIMET FSC
Course level: Master **ECTS Credits:** 5.00

Course instructors: Javier Hernández-Andrés and Eva M. Valero (University of Granada)
Education period (Dates): 2nd semester (Dates to be determined)
Exam period: -- **Language of instruction:** English

Prerequisite(s): Module "Fundamentals" (1st semester)
Expected prior-knowledge: Matlab knowledge

Aim and learning outcomes:
The main aim of this course is to provide the basis of the multispectral approach of color imaging, i.e., imaging systems that use more than three acquisition channels. The contents include image capture procedures, spectral characterization of image capture devices, estimation of spectral functions from conventional image capture systems, evaluation of the accuracy or performance of multispectral images, and a basic description of some of the most relevant applications of multispectral images.

On completion of this course the students will be able to:
• Demonstrate an understanding of basic multispectral color science.
• Analyze, compare, develop and implement algorithms for spectral estimation from camera responses.
• Describe, analyze and reason about how multispectral acquisition devices work and how can they be optimized for a particular application.
• To know the state of the art of spectral color science and some of its most relevant fields of application.

Topics to be taught (may be modified):

- Overview of color imaging: light and surfaces, color vision, colorimetry, physics of image capture.
  Spectral measurements: theory and instruments.
- Spectral characterization of image acquisition systems: experimental determination of spectral response curves, influence of noise.
- Mathematical modelization of spectral functions: reflectances, illumination, color signals, etc. Linear and non-lineal models: principal and independent component analysis.
- Spectral estimation from camera responses: models, algorithms, a priori necessary information, selection of data sets, use of color filters, filter selection, quality evaluation of the spectral signals obtained, influence of noise.
- Spectral accuracy performance: theoretical and experimental evaluation.
- Experimental spectral image acquisition systems.
- Applications of spectral imaging.

Practical Laboratory Sessions:
Matlab laboratory topics in order to implement and master basic issues explained in the lectures.

Teaching methods: Lectures and lab classes, and homework exercises.

Form(s) of Assessment: Written exam (60%), Practical work (40%)

External/internal examiner: --

Examination support: None

Literature and study materials: Lessons outlines (presentations), description and guides for exercises' sessions. Handouts of the material covered in the lectures will be distributed.

Basic textbook:
Acquisition and Reproduction of color images: colorimetric and multispectral approaches. J.Y. Hardeberg, 2001 (Universal Publishers)?

Additional books:
Color image science: Exploiting Digital Media. MacDonald, Luo, 2002 (John Wiley and Sons)
http://books.google.es/books?id=IbexPr9IcjoC&dq=Multispectral+images+book&lr=&source=gbs_summary_s&cad=0

Spectral Imaging: Eighth International Symposium on Multispectral Color Science. Mitchell Rosen, Francisco H. Imai, Shoji Tominaga, 2006, SPIE. Este sería para algunas aplicaciones…

Remote sensing digital image analysis: an introduction. Richards, Xia,, 2006 (Springer).
http://books.google.es/books?id=4PB5vhPBdJ4C&dq=remote+sensing+digital+image+analysis+an+introduction&pg=PP1&ots=AdMv5QdNUS&sig=UsezCWV1efMkDU4MWuKUFrtIYUc&hl=es&prev=http://www.google.es/search?hl=es&q=Remote+Sensing+Digital+Image+Analysis:+An+Introduction&btnG=Buscar+con+Google&sa=X&oi=print&ct=title&cad=one-book-with-thumbnail

Additional information:
Javier Hernández-Andrés
E-mail: javierha@ugr.es
Web page: http://www.ugr.es/local/javierha
Office hours: By appointment

Eva M. Valero
E-mail: valerob@ugr.es
Web page: http://www.ugr.es/local/valerob
Office hours: By appointment

Home page: *http://www.master-erasmusmundus-color.eu/*