COURSE DATA

Data Subject	
Code	34317
Name	Vision of forms and colour
Cycle	Grade
ECTS Credits	4.5
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1207 - Degree in Optics and Optometry	Faculty of Physics	4	First term

Subject-matter

Degree	Subject-matter	Character
1207 - Degree in Optics and Optometry	16 - Optional subjects	Optional
1207 - Degree in Optics and Optometry	20 - Visual perception: mechanisms and clinical applications	Optional

Coordination

Name	Department
CAPILLA PEREA, PASCUAL	280 - Optics and Optometry and Vision Sciences
MALO LOPEZ, JESUS	280 - Optics and Optometry and Vision Sciences

SUMMARY

The phenomenon of vision is presented as a process of extracting information from the measurements acquired by an imaging system. In the case of the human visual system, the retinal images. The goal of this process is to represent the information in such a way that it can solve object identification problems. In this process, the sensors (neurons of the LGN and V1) are applied to the input signal and extract features whose behavior determines what information is retained and which one is removed. In this context, the role of characteristics such as edges, textures and colors is essential.The course consists of two major blocks: (1) texture vision, and (2) color vision. The course introduces the necessary material for the linear characterization of edge and texture sensors in V1. Its nonlinear behavior, related to adaptation to contrast, is also presented. About color, the limitations of the linear triestimulus colorimetry are presented (introduced in the subject "Vision Mechanisms and Models"), giving way to the consideration of the perceptual dimensions of chromatic stimuli and the nonlinear behavior of models that explain the appearance of color. At the end of the course students learn the basics of a simple spatichromatic observer model that can be applied to real images.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

There is no official restriction to select this course, but it is convenient to have attended "Psychophysics" (2nd year) and "Vision Mechanisms and Models" (3rd year).

OUTCOMES

1207 - Degree in Optics and Optometry

- To have and to understand the fundamentals of Optometry for its correct clinical and healthcare application.
- Knowing how to apply the knowledge acquired to professional activity, knowing how to solve problems and develop and defend arguments.
- Being able to gather and interpret relevant data to make judgments.
- Being able to transmit information, ideas, problems and solutions to both a specialized and non-specialized audience.
- Development of learning skills necessary to undertake further studies with a high degree of autonomy.
- To know the applicable legislation in professional practice, with special attention to matters of gender equality between men and women, human rights, solidarity, sustainability, protection of the environment and promotion of the culture of peace.
- To know how the visual system adapts to the lighting level and the chromaticity of light.
- To know how the visual system adapts to the frequency content (space-time) of complex scenes.
- To know the architecture and function of the areas of the extra-striated cortex with relevant participation in visual perception, as well as their interactions.
- To know the way in which the information of the various perceptual dimensions is integrated to make judgments about the scene.

LEARNING OUTCOMES

- Understanding the phenomenon of vision as a process of representation of information that allows the classification.
- Understanding the role of edges, textures and the invariant description of color for identification of objects.
- Analysis of spatially invariant linear systems in the Fourier domain.
- Understanding the role of bandpass filters for edge identification and characterization of visual textures.

- Modeling of V1 sensors as a set of bandpass filters with adaptation to contrast.
- Calculation of contrast thresholds from the set of bandpass filter responses.
- Recognition of invariants in the perceptual dimensions of color and identification of limitations of linear triestimulus colorimetry.
- Knowledge of the basic elements of color appearance models.
- Elaboration and handling of a space-chromatic observer model.

DESCRIPTION OF CONTENTS

1. First part

Brightness perception
Contrast discrimination
Perceptual contrast
Multichannel models
On the physiological mechanisms for spatial vision

2. Second part

Colour appearance. Limitations of the triestimulus colorimetry.
Colour visión models with a single opponent stage
Colour visión models with two opponent stages
On the physiological mechanisms for colour vision
Spatio-chromatic models

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	30,00	100
Tutorials	7,50	100
Laboratory practices	7,50	100
Study and independent work	35,00	0
Preparing lectures	12,50	0
Preparation of practical classes and problem	10,00	0
Resolution of case studies	10,00	0
TOTAL	**112,50**	

TEACHING METHODOLOGY

1) Face-to-face work consisting of:

a) Theory classes, which will consist of the presentation and basic explanation of the corresponding material.

b) Seminars and demonstrative practices designed to illustrate the operation of the models covered in the course using specific software developed for the subject.

2) Non-contact work consisting of:

a) Completion (voluntary, see evaluation section) of exercises proposed in theory classes and seminars, as well as in practical classes.

b) Exam preparation.

3) Individual and / or group tutorials. There are established certain hours of unscheduled tutoring per week that students can attend to clarify their doubts.

EVALUATION

Option 1: Assessment based on the completion of the proposed practical exercises (mandatory requirement to pass) and additional practical theoretical exam (voluntary) to raise grade. A- Delivery of the proposed numerical exercises (50% of the final grade).
B- Attendance to the theoretical-practical sessions and demonstrative seminars (5% of the final note).
C- Examination of theoretical and practical questions (45% of the final mark).
Compliance with sections A and B (attendance and completion of the exercises) is the necessary requirement for pass according to this Option 1. Otherwise it will be evaluated according to Option 2.
Option 2: For students who decide not to attend the sessions regularly or do not attend the exercises, an evaluation based exclusively on the examination of theoretical-practical questions is proposed.
The evaluation will conform to the Regulations of Qualifications of the University of Valencia. At the time of drafting of this teaching guide, the current regulations are those approved by the Governing Council of the UVEG of 27 January 2004, which complies with that established for this purpose by Royal Decrees 1044/2003 i 1125/2003. It basically states that grades will be numerical from 0 to 10 with expression of a decimal and to which must be added the qualitative rating corresponding to this scale: From 0 to 4.9: “Suspended” From 5 to 6.9: “Approved” From 7 to 8.9: “Notable” From 9 to 10: “Excellent” or "Excellent with Honors."

REFERENCES

Basic

- Apuntes de clase y notas proporcionadas por el profesor (disponibles en el aula virtual)
  B. Wandell. Foundations of Vision. Sinauer Assoc. 1995
  M. Fairchild. Color appearance models. Wiley. 2005
  P. Capilla et al. Introducción a la Colorimetria. Univ. Valencia 2002
  Percepción visual. Psicofísica, mecanismos y modelos, Editorial Médica panamericana (2019)

Additional

- Gaskill. Linear Systems, Fourier Transforms, and Optics (Wiley Series in Pure and Applied Optics). Wiley 1978