Engineering Tripos Part IIB, 4F12: Computer Vision, 2018-19

Module Leader

Prof R Cipolla

Lecturers

Prof R Cipolla and Dr R Turner

Timing and Structure

Michaelmas term. 16 lectures (including 3 examples classes). Assessment: 100% exam

Aims

The aims of the course are to:

- introduce the principles, models and applications of computer vision.
- cover image structure, projection, stereo vision, structure from motion and object detection and recognition.
- give case studies of industrial (robotic) applications of computer vision, including visual navigation for autonomous robots, robot hand-eye coordination and novel man-machine interfaces.

Objectives

As specific objectives, by the end of the course students should be able to:

- design feature detectors to detect, localise and track image features.
- model perspective image formation and calibrate single and multiple camera systems.
- recover 3D position and shape information from arbitrary viewpoints;
- appreciate the problems in finding corresponding features in different viewpoints.
- analyse visual motion to recover scene structure and viewer motion, and understand how this information can be used in navigation;
- understand how simple object recognition systems can be designed so that they are independent of lighting and camera viewpoint.
- appreciate the industrial potential of computer vision but understand the limitations of current methods.

Content

- **Introduction** (1L)
  Computer vision: what is it, why study it and how ? The eye and the camera, vision as an information processing task. A geometrical framework for vision. 3D interpretation of 2D images. Applications.

- **Image structure** (3L)

- **Projection** (3L)
  Orthographic projection. Planar perspective projection. Vanishing points and lines. Projection matrix,

- **Stereo vision and Structure from Motion (3L)**

- **Object detection and recognition (3L)**

- **Example classes (3L)**
  Discussion of examples papers and past examination papers.

**Booklists**

Please see the [Booklist for Group F Courses](https://www.vle.cam.ac.uk/mod/book/view.php?id=364101&chapterid=55941) for references for this module.

**Examination Guidelines**

Please refer to [Form & conduct of the examinations](http://teaching.eng.cam.ac.uk/content/form-conduct-examinations).

**UK-SPEC**

The [UK Standard for Professional Engineering Competence (UK-SPEC)](http://www.engc.org.uk/ukspec.aspx) describes the requirements that have to be met in order to become a Chartered Engineer, and gives examples of ways of doing this.

UK-SPEC is published by the Engineering Council on behalf of the UK engineering profession. The standard has been developed, and is regularly updated, by panels representing professional engineering institutions, employers and engineering educators. Of particular relevance here is the '[Accreditation of Higher Education Programmes' (AHEP) document](http://www.engc.org.uk/standards-guidance/standards/accreditation-of-higher-education-programmes-ahep/) which sets out the standard for degree accreditation.

The [Output Standards Matrices](http://teaching.eng.cam.ac.uk/content/output-standards-matrices) indicate where each of the Output Criteria as specified in the AHEP 3rd edition document is addressed within the Engineering and Manufacturing Engineering Triposes.

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**Links**

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