Study programmes: Bachelor studies – Informatics

Course name: M133 – Application of projective geometry in computer science

Lecturers: Srđan Vukmirović and other lecturers from the Department of geometry

Status: Optional

ECTS: 5

Attendance prerequisites: M131

Course aims: Acquisition of general and specific knowledge in projective geometry and its applications in computing.

Course outcome: Upon completion of the course, the student has basic knowledge about homogeneous coordinates, projective mappings, projections and applications of projective geometry such as: binocular (three-dimensional) vision, elimination of projective distortion, reconstruction of spatial object from its projections.

Course content:

1. Basics of projective geometry: Homogeneous coordinates in the plane and space. Lines, planes and conies. Affine and projective mappings in homogeneous coordinates. Absolute conic. Numerical determination of the plane projective transformation (SVD-singular decomposition of matrix, DLT algorithm). Normalization and error estimation. Application: elimination of projective distortion.
2. Geometry of the projective camera: Basics of optics. Notion of projective camera. Action of a projective camera on planes, lines, and conies. Application: "gluing" panoramic photographs. Camera calibration and the image of the absolute conic.
3. Reconstruction of spatial object from two projections on the plane: Binocular vision. Direct problem – determining two projections of a spatial object. Application: determining the projections of an object for watching by 3D glasses. Epipolar geometry. Notion of fundamental matrix and its computation. Inverse problem – algorithm for reconstruction of spatial object from two projections on the plane. Application: implementation of algorithm for reconstruction.

Literature:

1. R. Hartley, A. Zisserman, Multiple View Geometry in Computer Vision, Cambridge University Press, 2003.

(The lecturer can choose any other appropriate literature)

Number of hours: 5	**Lectures: 2**	**Tutorials: 3**	**Laboratory: -**	**Research: -**

Teaching and learning methods: Frontal / Lectures / Tutorials

Assessment (maximal 100 points)

Course assignments	**points**	**Final exam**	**points**
Lectures	-	Written exam	-
Exercises / Tutorials	30	Oral exam	-
Colloquia	-	Written-oral exam	40
Essay / Project	30		