Study program: Information Technology

Type and level of studies: Undergraduate studies

Course unit: Computer Graphics

Teacher in charge: Veljko Aleksić

Language of instruction: English

ECTS: 6

Prerequisites: -

Semester: Winter

Course unit objective

A comprehensive introduction to computer graphics with a focus on fundamental concepts and techniques, as well as their interrelationships in a variety of domains such as rendering, animation, geometry, image processing. Enabling students to develop and manipulate computer graphic elements. Encouraging creative and critical use of appropriate digital tools and interfaces.

Learning outcomes of Course unit

At the end of the course, the student is expected to know the basic concepts of computer graphics and functionally use development environments and tools for creating and manipulating elements of computer graphics in various fields of application: 2D and 3D graphics; interpolation; rasterization; image composition, processing and compression; geometric curves, surfaces, transformations and data structures; spatial hierarchy; temporal integration, animation and kinematics. The student is trained to use available software and devices to manipulate computer graphics, including HMD.

Course unit contents

Theoretical classes

Basic terms. Triangles, Fourier transform, AA. Coordinate spaces and transformations. Homogeneous coordinates. Perspective. Texture mapping. Bilinear/trilinear interpolation. Rasterization. Z-buffer algorithm. Properties and representation of surfaces - triangular networks and Bezier curves. Network representations and geometry processing. Ray tracing - materials, light, shading. Introduction to animation. Kinematics and dynamics. Color theory, brightness, gamma correction. Image processing and compression. Modern GPU rendering techniques. Efficient rendering on mobile devices.

Practical classes

Introduction to computer drawing - points, lines and triangles. Linear transformation, basic geometric transformations. Sampling texture. AA techniques. Introduction to geometry. 3D modeling. Mesh operations - tessellation and simplification. Properties and characteristics of GPU and HMD. Kinematics optimization, inverse kinematics, motion graphics. Real-world tracking. Image filters (convolution - sharpening/blurring and nonlinear filters). GPU rendering - shadow mapping, reflection, ambient occlusion, precomputed lighting, parallel rasterization. Mobile rendering techniques: early Z cull, MSAA and tile-based deferred.

Literature

[1] Hughes, J. F., Van Dam, A., McGuire, M., Sklar, D. F., Foley, J. D., Feiner, S. K., & Akeley, K. (2013). *Computer graphics: Principles and Practice (3rd Edition)*. Addison-Wesley Professional.

[2] Marschner, S., & Shirley, P. (2015). *Fundamentals of Computer Graphics (4th Edition)*. CRC Press.

[3] Barkley, E. (2010), Student Engagement Techniques: A Handbook for College Faculty. USA, SF: Jossey-Bass.

Number of active teaching hours				**Other classes**
Lectures: 2	Practice: 2	Other forms of classes: /	Independent work: /	

Teaching methods

Interactive lectures; Case studies and discussions; Practical work in computer laboratory.

Examination methods (maximum 100 points)

Exam prerequisites	**No. of points:**	**Final exam**	**No. of points:**
Student's activity during lectures	10	oral examination	10
Practical classes/tests	20	written examination	20
Seminars/homework	40		

Grading system

Grade	**No. of points**	**Description**
10	**91-100**	Excellent
9	**81-90**	Exceptionally good
8	**71-80**	Very good
7	**61-70**	Good
6	**51-60**	Passing
5	**less than 51**	Failing