**计算机图形技术（双语）**

SJQU-QR-JW-033（A0）

**Computer Graphics Technology (Bilingual)**

**一、Basic Information**

**Course Code：【**2140021**】**

**Course Credits：【**2**】**

**Major：【**Bachelor in Digital Media Technology**】**

**Characteristic of the Course：【**Department-level required courses**】**

**Department：【**College of International Education**】**

**Teaching and Reference Materials：**

Textbook

【视觉计算基础：计算机视觉、图形学和图像处理的核心概念，阿娣提·玛珠德，机械工业出版社，2019.4】

【Majumder A ,  Gopi M . Techniques: Core Concepts in Computer Vision, Graphics, and Image Processing[M].  2018.】

Bibliography

1、【Fundamentals Of Computer Graphics，Steve Marschner，Apple Academic Press，2020.1】

2、【计算机图形学基础教程(第2版)，孙家广等，清华大学出版社，2009.8】

【Basic course of computer graphics (2nd Edition), sun Jiaguang et al., Tsinghua University Press, August 2009】

二、**Course Description**

As a newly designed overview course, this course aims to provide students with basic knowledge in different fields such as computer graphics, computer vision and image processing. Teachers can use this course to teach the common basic knowledge in these fields, so that students have the opportunity to learn more widely before entering the specific fields of computer graphics, computer vision and image processing. Mastering a wide range of knowledge in the general field of visual computing is now considered to be a strength, which can help students easily devote themselves to the cross fields of computer science and other fields, which use a lot of general knowledge of visual computing.

三、**Suggestion for Selection of Course**

This course is suitable for digital media technology students in the sophomore year and junior year.

四、**The Correlation between Curriculum and Graduation Requirements**

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| --- | --- |
| **Graduation Requirements** | Relation |
| LO1：Expressing communication  Understand the views of others, respect their values, and communicate effectively in writing or orally on different occasions. |  |
| LO2：Self-learning  Identify learning goals as needed and achieve them by gathering and analyzing information, discussing, practicing, questioning. | ● |
| LO3: Professional ability  L031: Engineering literacy: master mathematics and natural science knowledge, have engineering awareness, and be able to combine computer Professional knowledge of digital media technology to solve complex engineering problems. |  |
| LO32: Software development: master the mainstream design technology, programming thinking and related database technology, and have the ability to build a variety of terminal websites. |  |
| LO33：System maintenance: systematically master the basic theory and knowledge of computer hardware and software, and have the basic skills to ensure system operation and maintenance. |  |
| LO34：Material collection and processing: master the basic theory of digital media and the use technology of mainstream digital media application software, and have the ability of material collection, storage, processing and transmission. |  |
| LO35：Virtual reality design and production: be familiar with the basic principles of virtual reality, master the design and production process of virtual reality products and the mainstream design and integration platform, and have the ability to realize the content production and application development of virtual reality products combined with relevant hardware. | ● |
| LO4：Due diligence and pressure resistance  Discipline, abide by the rules, with resistance to setbacks, the ability to resist pressure |  |
| LO5：Collaborative innovation  Keep good cooperation with the team, be an active member of the group, be brave to think from different perspectives and put forward new ideas. | ● |
| LO6：Information application  Can apply information technology tOsolve problems in study and work, and have the ability tOuse computers tOprocess information and technology exchanges in the field of work. |  |
| LO7：Service care  Willing to serve others, enterprises and society; being enthusiastic, loving and grateful (gratitude, return, love is one of the contents of our school motto) |  |
| LO8：International Perspective  With basic foreign language communication skills and cross-cultural understanding ability, able to read professional foreign language materials, with international competition and cooperation awareness. |  |

五、**Course Objectives / Course Expected Learning Outcomes**

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| --- | --- | --- | --- | --- |
| **No.** | **Course Expected Learning Outcomes** | **Course Objectives（Detailed Expected Learning Outcomes）** | **Teaching and Learning Methods** | **Assessment Methods** |
| 1 | LO212: Be able to collect and obtain the learning resources needed to achieve the goals, implement the learning plan, reflect on the learning plan, and continuously improve to achieve the learning goals | Master the concepts and technologies related to computer vision, so that students can have an in-depth understanding of image filtering, edge detection, spectral analysis, geometric transformation, etc. | Experiment  Classroom practice | Experimental report  Assignment |
| 2 | LO353: master the whole process of 3D design and production, select reasonable tools (platforms), and be able to complete the design and production of 3D products. | Complete the transformation, projection, texture and other effects of 3D graphics, and understand the rendering pipeline of computer graphics. | Experiment  Classroom practice | Experimental report  Assignment |
| 3 | LO514： Understand industry cutting-edge knowledge and technology | Understanding of rendering pipeline in computer graphics | Autonomous Learning | Experimental summary |

六、**Course Contents**

Part 1 Preliminary Knowledge

Through the study of this part, we will introduce various visual data (such as two-dimensional image, video and three-dimensional geometric data), as well as the core mathematical technologies required in the fields of computer graphics, computer vision and image processing (such as interpolation and vector multiplication).

Theoretical class hours 4, experiment hours 0.

Part 2 image based visual computing

Through the study of this part, some basic technologies for processing two-dimensional images (such as convolution, spectral analysis and feature detection) are introduced, which correspond to the processing of low-level retinal images in human visual system.

This chapter focuses on the use of various linear and nonlinear filters, discrete Fourier transform and various feature detection.

Theoretical class hours 2, experiment hours 8.

Part 3 geometric based visual computing

Through the study of this part, we will introduce the basic technologies (such as linear transformation and projection transformation) used to synthesize the geometric information of multiple perspectives to form the three-dimensional information of the objects and the world around us. This is equivalent to the high-level processing technology in our brain, which can integrate the information seen by our eyes to help us move in the three-dimensional world.

This part focuses on understanding and mastering the virtual camera model, model transformation (translation, rotation, scaling and cutting) and projection transformation (perspective projection and orthogonal projection) in computer graphics, understanding the local coordinate system and world coordinate system, and knowing the homogeneous coordinates.

Theoretical class hours 4, experiment hours 2.

Part 4 visual calculation based on radiance

Through the study of this part, we will introduce the basic technologies required to process the information generated during the interaction between light and objects around us, involving the reflectivity, light intensity, color and other attributes related to light in the human visual system, and know the commonly used color models.

Theoretical class hours 2, experiment hours 0.

Part 5 visual content synthesis

This part introduces the basic technology of creating a computer virtual world, which can simulate all the processing technologies described above, including interactive graphics flow, realism and performance. Understand graphics pipeline; Understand Blinn Phong lighting model, shading model and how to use texture to enhance realism.

This lecture focuses on lighting, material and texture.

Theoretical class hours 4, experiment hours 6.

七、**In-Class Experiment and Basic Requirements**

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| --- | --- | --- | --- | --- | --- |
| No. | Name of Experiment | Main Content of the Experiment | Experiment  Hours | Experiment  Type | Notes |
| 1 | Introduction to computer vision | Help students master the concepts and technologies related to computer vision, and have an in-depth understanding of image filtering, edge detection, spectral analysis, geometric transformation, etc. | 8 | Verification |  |
| 2 | Introduction to computer graphics | In the tutors software, by adjusting the parameters, the transformation, projection, texture and other effects of 3D graphics are completed, and the rendering pipeline of computer graphics is understood. | 8 | Verification |  |

八、**Assessment Index & Weightage**

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| **Grading Computation** （1+X） | **Assessment Index** | **Weightage（%）** |
| X1 | Introduction to computer vision | 40% |
| X2 | Introduction to computer graphics | 40% |
| X3 | Class performance | 20% |

Tutor Signature：余莉 Program Leader Signature：张贝贝

Date：2022.2.20