

## 数字图像处理（EE326）课程大纲

- 1、2017 春季学期——2023 春季学期 (2-5)
- 2、2024 春季学期起 (6-9)



## 课程详述

### COURSE SPECIFICATION

以下课程信息可能根据实际授课需要或在课程检讨之后产生变动。如对课程有任何疑问，请联系授课教师。

The course information as follows may be subject to change, either during the session because of unforeseen circumstances, or following review of the course at the end of the session. Queries about the course should be directed to the course instructor.

|     |   |  |
|-----|---|--|
| 1.  | <b>课程名称 Course Title</b>  | 数字图像处理 / Digital Image Processing  |
| 2.  | <b>授课院系<br/>Originating Department</b>  | 电子与电气工程系 Department of Electrical and Electronic Engineering   |
| 3.  | <b>课程编号<br/>Course Code</b>   | EE326  |
| 4.  | <b>课程学分 Credit Value</b>  | 3  |
| 5.  | <b>课程类别<br/>Course Type</b>   | 专业核心课 Major Core Courses<br>专业选修课 Major Elective Courses   |
| 6.  | <b>授课学期<br/>Semester</b>  | 2017 春季学期——2023 春季学期 2017 Spring – 2023 Spring   |
| 7.  | <b>授课语言<br/>Teaching Language</b>   | 英文 English   |
| 8.  | <b>授课教师、所属学系、联系方式<br/>(如属团队授课, 请列明其他授课教师)<br/>Instructor(s), Affiliation &amp; Contact<br/>(For team teaching, please list all instructors)</b> | 虞亚军, 副教授, 电子与电气工程系<br>Associate Professor YU Yajun, Department of Electrical & Electronic Engineering<br>Email: <a href="mailto:yuyj@sustech.edu.cn">yuyj@sustech.edu.cn</a><br>Tel: 0755-88018557 |
| 9.  | <b>实验员/助教、所属学系、联系方式<br/>Tutor/TA(s), Contact</b>  | 待公布 To be announced  |
| 10. | <b>选课人数限额(可不填)<br/>Maximum Enrolment (Optional)</b>   | 50   |

| 11. 授课方式<br>Delivery Method   | 讲授<br>Lectures                  | 习题/辅导/讨论<br>Tutorials | 实验/实习<br>Lab/Practical | 其它(请具体注明)<br>Other (Please specify) | 总学时<br>Total |
|---|---------------------------------|-----------------------|------------------------|-------------------------------------|--------------|
| 学时数<br>Credit Hours   | 32                              |                       | 32                     |                                     | 64           |
| 12. 先修课程、其它学习要求<br>Pre-requisites or Other Academic Requirements    | EE205 信号与系统 Signals and Systems |                       |                        |                                     |              |
| 13. 后续课程、其它学习规划<br>Courses for which this course is a pre-requisite |                                 |                       |                        |                                     |              |
| 14. 其它要求修读本课程的学系<br>Cross-listing Dept.                             |                                 |                       |                        |                                     |              |

### 教学大纲及教学日历 SYLLABUS

#### 15. 教学目标 Course Objectives

本课程的教学目标是介绍图像处理的总体领域，理解图像处理在空域和频域的基本算法和实现方式，图像增强，图像的恢复，彩色图像处理，以及图像分割。

This course develops an overview of the field of image processing, introduces the fundamental spatial domain and frequency domain image processing techniques and their implements, image enhancement, image restoration, processing of color images, and image segmentation.

#### 16. 预达学习成果 Learning Outcomes

通过学习这门课程，学生能够

1. 了解图像处理的总体领域，
2. 通过运用数学知识，如概率与统计，理解图像处理在空域和时域的基本处理方法和技  
术。
3. 用计算机语言实现图像处理算法。
4. 积累经验并且运用图像处理算法解决实际图像问题。
5. 查阅最新图像处理文献，对图像处理领域做进一步的研究。

After completing this course, students are able to

1. Have an overview of the field of digital image processing;
2. Understand the fundamental spatial domain and frequency domain image processing techniques, by applying mathematic knowledge, such as probability and statistics;
3. Implement image processing algorithms using a computer language;
4. Gain experience and apply the image processing algorithms to solve practical problems in images;

5. Read the current image processing research literature and conduct further investigation in the area of image processing.

17. 课程内容及教学日历（如授课语言以英文为主，则课程内容介绍可以用英文；如团队教学或模块教学，教学日历须注明主讲人）

**Course Contents (in Parts/Chapters/Sections/Weeks. Please notify name of instructor for course section(s), if this is a team teaching or module course.)**

1. Introduction of digital image processing, including the principle of imaging, imaging sensing, acquisition, sampling and quantization. 2hr
2. Digital image fundamentals: Basic relationship between pixels, and mathematical tools used in digital image processing. 2hr
3. Intensity Transformation and spatial filtering. 5hr
4. Filtering in the frequency domain. 5hr
5. Image restoration and reconstruction. 5hr
6. Color image processing. 4hr
7. Image segmentation. 9hr

The lab session includes:

Lab 1: Nearest neighbor & bilinear interpolation

Lab 2: Spatial domain transform and filtering

Lab 3: Frequency domain filtering

Lab quiz: Image enhancement

Lab 4: Image restoration

Self-proposed project

18. 教材及其它参考资料 **Textbook and Supplementary Readings**

Digital Image Processing (3rd Edition) by Rafael C. Gonzalez and Richard E. Woods, Publishing house of Electronics Industry

**课程评估 ASSESSMENT**

| 19. 评估形式<br>Type of<br>Assessment | 评估时间<br>Time | 占考试总成绩百分比<br>% of final<br>score | 违纪处罚<br>Penalty | 备注<br>Notes                      |
|-----------------------------------|--------------|----------------------------------|-----------------|----------------------------------|
| 出勤 Attendance                     |              |                                  |                 |                                  |
| 课堂表现<br>Class<br>Performance      |              |                                  |                 |                                  |
| 小测验                               | 2 hours      | 10                               |                 | To enhance an poor quality image |

|  |         |    |  |
|--|---------|----|--|
| Quiz   |         |    | with multiple noise sources                                      |
| 课程项目 Projects  | 15      |    | Technical quality, significance, and originality of the project. |
| 平时作业 Assignments   | 20      |    | 4 Lab sessions   |
| 期中考试 Mid-Term Test   |         |    |  |
| 期末考试 Final Exam  | 2 hours | 40 |  |
| 期末报告 Final Presentation  | 15      |    | 10% Written report<br>5% Poster or PPT presentation              |
| 其它（可根据需要改写以上评估方式）<br>Others (The above may be modified as necessary) |         |    |  |

20. 记分方式 GRADING SYSTEM

- A. 十三级等级制 Letter Grading  
 B. 二级记分制（通过/不通过） Pass/Fail Grading

课程审批 REVIEW AND APPROVAL

21. 本课程设置已经过以下责任人/委员会审议通过  
This Course has been approved by the following person or committee of authority



## 课程详述

### COURSE SPECIFICATION

以下课程信息可能根据实际授课需要或在课程检讨之后产生变动。如对课程有任何疑问，请联系授课教师。

The course information as follows may be subject to change, either during the session because of unforeseen circumstances, or following review of the course at the end of the session. Queries about the course should be directed to the course instructor.

|     |  |  |
|-----|--|--|
| 1.  | 课程名称 <b>Course Title</b>   | 数字图像处理 / Digital Image Processing  |
| 2.  | 授课院系<br><b>Originating Department</b>  | 电子与电气工程系 Department of Electrical and Electronic Engineering   |
| 3.  | 课程编号<br><b>Course Code</b>   | EE326  |
| 4.  | 课程学分 <b>Credit Value</b>   | 3  |
| 5.  | 课程类别<br><b>Course Type</b>   | 专业选修课 Major Elective Courses   |
| 6.  | 授课学期<br><b>Semester</b>  | 2024 春季学期起 From 2024 Spring  |
| 7.  | 授课语言<br><b>Teaching Language</b>   | 英文 English   |
| 8.  | 授课教师、所属学系、联系方式<br>(如属团队授课, 请列明其他授课教师)<br><b>Instructor(s), Affiliation &amp; Contact</b><br>(For team teaching, please list all instructors) | 虞亚军, 副教授, 电子与电气工程系<br>Associate Professor YU Yajun, Department of Electrical & Electronic Engineering<br>Email: <a href="mailto:yuyj@sustech.edu.cn">yuyj@sustech.edu.cn</a><br>Tel: 0755-88018557 |
| 9.  | 实验员/助教、所属学系、联系方式<br><b>Tutor/TA(s), Contact</b>  | 待公布 To be announced  |
| 10. | 选课人数限额(可不填)<br><b>Maximum Enrolment (Optional)</b>   | 50   |

| 11. 授课方式<br>Delivery Method   | 讲授<br>Lectures                  | 习题/辅导/讨论<br>Tutorials | 实验/实习<br>Lab/Practical | 其它(请具体注明)<br>Other (Please specify) | 总学时<br>Total |
|---|---------------------------------|-----------------------|------------------------|-------------------------------------|--------------|
| 学时数<br>Credit Hours   | 32                              |                       | 32                     |                                     | 64           |
| 12. 先修课程、其它学习要求<br>Pre-requisites or Other Academic Requirements    | EE205 信号与系统 Signals and Systems |                       |                        |                                     |              |
| 13. 后续课程、其它学习规划<br>Courses for which this course is a pre-requisite |                                 |                       |                        |                                     |              |
| 14. 其它要求修读本课程的学系<br>Cross-listing Dept.                             |                                 |                       |                        |                                     |              |

### 教学大纲及教学日历 SYLLABUS

#### 15. 教学目标 Course Objectives

本课程的教学目标是介绍图像处理的总体领域，理解图像处理在空域和频域的基本算法和实现方式，图像增强，图像的恢复，彩色图像处理，以及图像分割。

This course develops an overview of the field of image processing, introduces the fundamental spatial domain and frequency domain image processing techniques and their implements, image enhancement, image restoration, processing of color images, and image segmentation.

#### 16. 预达学习成果 Learning Outcomes

通过学习这门课程，学生能够

1. 了解图像处理的总体领域，
2. 通过运用数学知识，如概率与统计，理解图像处理在空域和时域的基本处理方法和技  
术。
3. 用计算机语言实现图像处理算法。
4. 积累经验并且运用图像处理算法解决实际图像问题。
5. 查阅最新图像处理文献，对图像处理领域做进一步的研究。

After completing this course, students are able to

1. Have an overview of the field of digital image processing;
2. Understand the fundamental spatial domain and frequency domain image processing techniques, by applying mathematic knowledge, such as probability and statistics;
3. Implement image processing algorithms using a computer language;
4. Gain experience and apply the image processing algorithms to solve practical problems in images;

5. Read the current image processing research literature and conduct further investigation in the area of image processing.

17. 课程内容及教学日历（如授课语言以英文为主，则课程内容介绍可以用英文；如团队教学或模块教学，教学日历须注明主讲人）

**Course Contents (in Parts/Chapters/Sections/Weeks. Please notify name of instructor for course section(s), if this is a team teaching or module course.)**

1. Introduction of digital image processing, including the principle of imaging, imaging sensing, acquisition, sampling and quantization. 2hr
2. Digital image fundamentals: Basic relationship between pixels, and mathematical tools used in digital image processing. 2hr
3. Intensity Transformation and spatial filtering. 5hr
4. Filtering in the frequency domain. 5hr
5. Image restoration and reconstruction. 5hr
6. Color image processing. 4hr
7. Image segmentation. 9hr

The lab session includes:

Lab 1: Python introduction

Lab 2: Nearest neighbor & bilinear interpolation

Lab 3: Spatial domain transform and filtering

Lab 4: Sharpening image

Lab 5: Frequency domain filtering

Lab quiz: Image enhancement

Lab 6: Image restoration

Self-proposed project

18. 教材及其它参考资料 **Textbook and Supplementary Readings**

Digital Image Processing (3rd Edition) by Rafael C. Gonzalez and Richard E. Woods, Publishing house of Electronics Industry

**课程评估 ASSESSMENT**

| 19. 评估形式<br>Type of<br>Assessment | 评估时间<br>Time | 占考试总成绩百分比<br>% of final<br>score | 违纪处罚<br>Penalty | 备注<br>Notes |
|-----------------------------------|--------------|----------------------------------|-----------------|-------------|
| 出勤 Attendance                     |              | 15                               |                 |             |
| 课堂表现                              |              |                                  |                 |             |



|   |         |    |  |  |
|---|---------|----|--|--|
| <b>Class Performance</b>  |         |    |  |  |
| 小测验<br><b>Quiz</b>  | 2 hours | 10 |  |  |
| 课程项目<br><b>Projects</b>   |         | 15 |  | Technical quality, significance, and originality of the project. |
| 平时作业<br><b>Assignments</b>  |         | 40 |  | 5 Lab sessions   |
| 期中考试<br><b>Mid-Term Test</b>  |         |    |  |  |
| 期末考试<br><b>Final Exam</b>   |         |    |  |  |
| 期末报告<br><b>Final Presentation</b>   |         | 20 |  | 10% Written report<br>10% Poster or PPT presentation             |
| 其它（可根据需要<br>改写以上评估方式）<br><b>Others (The above may be modified as necessary)</b> |         |    |  |  |

20. 记分方式 **GRADING SYSTEM**

- A. 十三级等级制 **Letter Grading**  
 B. 二级记分制（通过/不通过） **Pass/Fail Grading**

课程审批 **REVIEW AND APPROVAL**

21. 本课程设置已经过以下责任人/委员会审议通过  
**This Course has been approved by the following person or committee of authority**