

Digital Signal Processing and Machine Learning: Fundamentals and Applications

1. 课堂讲授学时 **Lecture Hours:**
32
2. 课堂实验学时 **Laboratory Hours**
None
3. 课下研讨学时 **Colloquia Hours**
None
4. 学生课下投入学时 **Individual Study Hours**
8-10 hours per week
5. 学分 **Credits**
2
6. 开课学年学期（如果有强制性的要求则必须填，否则可以不填） **Occurrence**
Summer 2026
7. 先修课程 **Prerequisite(s):** 必须先修的课程直接写课程编号和课程名称，建议先修的课程在课程名称后用*号标注，并在下一行注明：***Recommended, not required as prerequisite**
Linear Algebra
8. 课程概要 **Course Description:** 100 字以内，学习内容以学术关键词出现。
This course explores the fundamentals and applications of digital signal processing and machine learning, focusing on key concepts such as sampling theorem, Fourier transform, filtering, wavelet transform, dimensionality reduction, singular value decomposition, principal component analysis, convolutional neural networks, and deep learning, and their applications in communication and control systems.
9. 课程预期学习成果 **Course Outcomes:** 用数字 1 到 9 列出每一项主要学习成果
 1. **Understand the relationship between signal processing and machine learning**
 2. **Master the basics of signal processing and machine learning**
 3. **Grasp the development overview of signal processing and machine learning**
 4. **Be aware of the hotspots in the application fields of signal processing and machine learning**

10. 教学内容与学时分配 **Course Content, Laboratories and Laboratory Hours**（有则填，没有则不填），**Colloquia Hours**（有则填，没有则不填）：各章节目录与学时，实验内容与学时，研讨内容与学时

Chapter	Content	Class Hours
1	Foundations and Applications of Signal Processing	3
2	Fast Fourier Transform of Discrete Signals	3
3	Filtering and Convolution	3
4	Frequency Domain Processing	3
5	Discrete Wavelet Transform	3
6	DSP Applications to Communications and Controls	2
7	Dimensionality Reduction	3
8	Singular Value Decomposition	3
9	Principal Component Analysis	2
10	Convolutional Neural Networks	2
11	Deep Learning	2
12	Machine Learning's Applications to Communications and Controls	3

11. 考核与成绩评定 **Grading:**

Report: 50%

Oral Presentation: 50%

12. 教材，参考书 **Text & Reference Book:** 作者，书名，版本，年份，国际标准书号 ISBN

Textbook: Class Notes

Reference Books:

R. G. Lyons, Understanding Digital Signal Processing, 3rd Edition, Pearson, 2010, ISBN-13: 9780137027415

K. Steiglitz, A Digital Signal Processing Primer: With Applications to Digital Audio and Computer Music, Dover Publications, 2020, ISBN-13: 978-0486845838

M. Levene and M. Harris, Just Enough Data Science and Machine Learning: Essential Tools and Techniques, 1st edition, Addison-Wesley Professional, 2024, ISBN: 978-0138340742

D. Esposito and F. Esposito, Introducing Machine Learning, 1st edition, Microsoft Press, 2020, ISBN: 978-0135565667

M. Ekman, Learning Deep Learning: Theory and Practice of Neural Networks, Computer Vision, Natural Language Processing, and Transformers Using TensorFlow, 1st edition, Addison-Wesley Professional, 2022, ISBN: 978-0137470358

S. L. Brunton and J. N. Kutz, Data-Driven Science and Engineering: Machine Learning,
Dynamical Systems and Control, Cambridge U. Press, 2nd Ed. 2022, ISBN:
9781009089517

13. 编写教师 **Course Lecturer**:

Professor HEN-GEUL YEH

编写教师 **Course Lecturer** (签字):


