

< For the most updated syllabus, please visit <http://tigpsnhcc.iis.sinica.edu.tw/course.html#s1>>

Human-Centered Computing (HCC)

Place: Room 107, New Building, IIS, AS

Time: Wed, 09:00-12:00

Chair: Dr. Jun-Cheng Chen (Chair)

Dr. Hen-Hsen Huang

Dr. Wen-Hung Liao

Dr. Yan-Tsung Peng

Dr. Li Su

1. Introduction to Multimedia

1.1. What is Multimedia and its connection with Generative AI?

1.2. Overview of Multimedia Applications

1.3. Multimedia Research Resources

2. Multimedia Basics

2.1. Graphics and Image Data Representations

2.2. Color in Image and Video

2.3. Fundamental Concepts in Video

2.4. Basics of Digital Audio

3. Machine Learning and Deep Learning in Social Multimedia Analytics

3.1. Machine learning Basics

3.2. Deep Learning Basics

3.3. Unsupervised/Semi-supervised/Supervised Learning, etc.

4. Multimedia Processing & Coding

4.1. Video coding fundamentals

4.2. Lossless Compression & Lossy Compression

4.3. Transform Coding

4.4. Motion Compensated Predictive Coding

4.5. Multimedia Coding Standards

4.5.1. JPEG, JPEG-2000

4.5.2. H.261, H.263, MPEG-1, MPEG-2, MPEG-4, H.264, and H.265

5. Audio Information Analysis

5.1. Audio Signal Processing fundamentals

5.2. Deep Learning for Audio Multimedia Analysis

6. Social Network Basics with Deep Learning

6.1. An Introduction to Social Networks

6.2. Properties and Models of Social Networks

6.3. Social Multimedia Analytics with Deep Learning

6.3.1. Sentiment, Opinion, Locations, and Multimedia

6.3.2 Search and Recommendation in Social Media

7. Advanced Multimedia and Image Processing with Generative AI

7.1. Image Manipulation Techniques

7.2. Interactive Multimedia Editing

8. Natural Language Processing

8.1 Natural Language Processing Basics

8.2 Advanced Topics in Natural Language Processing (e.g., LLM)

Textbook/Reference:

1. Ze-Nian Li, Mark S. Drew, and Jiangchuan Liu, *Fundamentals of Multimedia*, 2nd edition, Springer, 2014.
2. Gonzalez and Woods, *Digital Image Processing*, 3rd edition, Prentice Hall, 2008.
3. Christopher M. Bishop, *Pattern Recognition and Machine Learning*, Springer, 2007.
4. Richard Szeliski, *Computer Vision: Algorithms and Applications*, Springer, 2010.
5. Richard J. Radke, *Computer Vision for Visual Effects*, Cambridge University Press, 2012.
6. S. Wasserman and K. Faust, *Social Network Analysis: Methods and Applications*, Cambridge University Press, 1994.
7. R. A. Hanneman and M. Riddle, *Introduction to Social Network Methods*, University of California, 2005.
http://faculty.ucr.edu/~hanneman/nettext/Introduction_to_Social_Network_Methods.pdf
8. R. Zafarani, M. A. Abbasi, and H. Liu, *Social Media Mining: An Introduction*, Cambridge University Press, 2014.
9. Charu C. Aggarwal, *Social Network Data Analytics*, Springer, 2011.
10. W. Chen, L. V.S. Lakshmanan, and C. Castillo, *Information and Influence Propagation in Social Networks*, Morgan &

Claypool Publishers, 2013.

11. Selected research papers.

12. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, "Deep Learning" (<https://www.deeplearningbook.org/>), 2016
Mehryar Mohri, Afshin Rostamizadeh, and Ameet Talwalkar, "Foundation of Machine Learning 2nd edition" (<https://cs.nyu.edu/~mohri/mlbook/>), 2018

13. Aston Zhang, Zachary C. Lipton, Mu Lin, and Alexander J. Smola, "Dive into Deep Learning", <https://d2l.ai/> (free, with code examples)

14. Deep Learning, Foundations and Concepts, Christopher M. Bishop and Hugh Bishop, 2024 (<https://link.springer.com/book/10.1007/978-3-031-45468-4>)

15. Computer Vision: Algorithms and Applications 2nd edition, Richard Szeliski, 2022. (<https://szeliski.org/Book/>)

Office hours: by appointment

Grades:

- Exam 50%
- Final Project 50%

Prerequisite

Basic math part:

https://drive.google.com/file/d/1SecJqkww8RXzliUWO_kiAKl1mWLyLLGN/view
<https://www.youtube.com/playlist?list=PL05umP7R6ij0bo4UtMdzEJ6TiLOqj4ZCm>

A short tutorial for python:

<https://cs231n.github.io/python-numpy-tutorial/>

The following can be a toolbox book for reference. (Dive into deep learning)

<https://d2l.ai/>

Courses you should have learned and gained enough knowledge and experiences. Make sure you go through the syllabus and course content, not just the title of the course.

CS Basic

1. Intro to python programming
2. linear algebra

CS Advanced

1. Introduction to Image Processing
2. Introduction to Intelligent Computing
3. Introduction to machine learning
4. numerical optimization
5. Deep Learning
6. Data mining
7. Computer vision

EE basic

1. linear algebra
2. probability

Week	Date	Topics/Brief Description	Lecturers
1	2024/09/04	Introduction to Multimedia	Jun-Cheng Chen
2	2024/09/11	Multimedia Basics (I)	Wen-Hung Liao
3	2024/09/18	Multimedia Basics (II)	Wen-Hung Liao
4	2024/09/25	Audio Analysis in Multimedia (I)	Li Su
5	2024/10/02	Audio Analysis in Multimedia (II)	Li Su

6	2024/10/09	Fundamental of Deep Learning (I)	Jun-Cheng Chen
7	2024/10/16	Fundamental of Deep Learning (II) Final-Project Proposal Explanation (Milestone I)	Jun-Cheng Chen
8	2024/10/23	Multimedia Processing & Coding 【Webex Only】	Yan-Tsung Peng
9	2024/10/30	Deep Learning for Image Processing Applications (I) 【Webex Only】	Yan-Tsung Peng
10	2024/11/06	Midterm Exam	
11	2024/11/13	Deep Learning for Image Processing Applications (II) 【Webex Only】	Yan-Tsung Peng
12	2024/11/20	Final-Project Proposal Presentation (Milestone II)	Jun-Cheng Chen
13	2024/11/27	Natural Language Processing in Multimedia (I)	Hen-Hsen Huang
14	2024/12/03	Natural Language Processing in Multimedia (II)	Hen-Hsen Huang
15	2024/12/10	Social Multimedia and Related Applications Final-Project Clinic (Milestone III)	Jun-Cheng Chen
16	2024/12/17	Polishing Up your Demo No Class	
17	2024/12/24	Final	MM Faculty