Syllabus for EECS258: Multimedia Systems

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Textbook

Ze-Nian Li, Mark S. Drew, and Jiangchuan Liu. 2021. Fundamentals of Multimedia (3rd edition). Springer Publishing Company, Incorporated. The 2nd edition was published in 2014. You may use the 2nd edition if you could not find the 3rd one.

For extended reading, you may read this book. Vidal, Ivan, Ignacio Soto, Albert Banchs, Jaime Garcia-Reinoso, Ivan Lozano, and Gonzalo Camarillo. Multimedia Networking Technologies, Protocols, and Architectures. Artech House, 2019.

Course Description:

Introduction to the fundamentals and emerging technologies of multimedia systems. Topics include multimedia data representation, multimedia data compression, bit rate adaptation of video streaming, and new Internet infrastructure innovations for video streaming.

Topics:

Topics include 2/3 from textbooks (e.g., data representation, data compression, etc.) and 1/3 from state-of-the-art research papers. Broadly the topics are:

- Multimedia data representation, including audio, image, and video
- Lossless and lossy video compression algorithms
- Image and video compression standard
- Video coding standard
- Network Protocols for Multimedia Communication, such as TCP/IP and UDP
- Content Distribution Network for video streaming
- Multimedia over Wireless and Mobile Networks
- Bit rate adaptation for Video on Demand
- WebRTC, DASH, and HTTP
- QUIC, Video streaming over multi-path TCP or multi-path QUIC
- Live streaming

Schedule:

EECS258 is a 4-credit course, which includes 3hours of lecture, 3 hours of lab each week. You should plan on spending at least 6 hours outside of lecture and lab on reading, studying, and project assignments. One semester of this course is tentatively scheduled as follows.

Lecture 0	Overview
Lecture 1	Representation – Audio
Lecture 2	Representation – Image
Lecture 3	Representation – Video
Lecture 4	Compression – Overview
Lecture 5	Compression - Lossless Compression Algorithms
Lecture 6	Compression - Lossy Compression Algorithms
Lecture 7	Compression - Image Compression Standard
Lecture 8	Compression - Video Compression Standard

Lecture 9	Compression - Video Coding Standard
Lecture 10	Communication - Network Protocols for Multimedia Communication
Lecture 11	Communication - Internet Multimedia Content Distribution
Lecture 12	Communication - Multimedia over Wireless and Mobile Networks
Lecture 13	Communication - Bit Rate Adaptation for Video on Demand
Lecture 14	Communication - Bit Rate Adaptation for Video on Demand II
Lecture 15	Communication - WebRTC, DASH and HTTP
Lecture 16	Emerging Technologies - QUIC
Lecture 17	Emerging Technologies - VoD over Multi-Path TCP or QUIC
Lecture 18	Emerging Technologies - Live Streaming
Lecture 19	Paper Presentation
Lecture 20	Paper Presentation
Lecture 21	Paper Presentation
Lecture 22	Paper Presentation
Lecture 23	Paper Presentation
Lecture 24	Paper Presentation
Lecture 25	Paper Presentation
Lecture 26	Project presentation
Lecture 27	Review

The instructor will give lectures in most of the classes according to the primary textbook. Students will also work on a project. The instruction of two projects, e.g., video compression and video streaming over the Internet, will be given. Students may choose one as their final project.

The lab session will be used for students to implement their code for accomplishing the project, better understand the content of the lecture slides and the textbooks, work on their homework, and prepare for their exam.

At the beginning of the semester, the instructor will recommend 10 recent top-conference papers in the research domain of Multimedia Systems. Each student needs to choose one or two papers from the list. The student can also find one or two papers from top conferences (ACM Multimedia, ACM SIGCOMM, and USENIX NSDI). She/he will orally present the selected papers in the class. The other students need to read the paper before the class and write a summary of the paper. Regarding paper reading, students are expected to understand the papers and further criticize the papers for possible research opportunities.

Assessment/ Grading Policy:

Grading will be based on written tests, projects, and in-class presentations. All tests will be closed book. Your final grade will be calculated based on the following (Note that the final grade components may change):
2 homework: 30%
1 or 2 in-class presentations: 20%
1 project: 20% (10% project report and 10% project presentation.)
1 final exam: 30%

Program Learning Outcomes:

Based on the training described in the above items, including course description, course objectives, and course learning outcomes, students will obtain the ability to

1. Apply their knowledge of computing, mathematics, science, and engineering to the analysis of technological problems, as well as to the design and implementation of viable solutions to those problems.
2. Design and conduct experiments and computational simulations for the purpose of evaluating and comparing proposed solutions on the basis of empirical evidence.
3. Are able to conduct experiments and computational simulations for the purpose of evaluating and comparing proposed solutions on the basis of empirical evidence.

4. Possess the characteristics of lifelong learners; they are able to acquire and use new techniques, skills, and engineering and scientific tools for research and development in electrical engineering and computer science, as well as to develop new methods and make new discoveries.
5. Practice a high standard of professional ethics, including integrity in the conducting and writing of research.
6. Communicate effectively through oral, visual, and written means, effectively addressing a broad range of technical audiences.

Prerequisite by Topic: N/A

Course Policies:

STUDENT RESPONSIBILITIES:

Please be sensitive to the learning environment. It is assumed that every student is attending class to learn; therefore, anything which distracts any student from learning is not appropriate classroom behavior (for example, cell phones, conversing during lecture, checking E-mail or Facebook, Internet use not related to current class topic).

In attempting to keep with a business-like, professional atmosphere, any behavior which would be considered inappropriate in a business setting will be addressed in class (talking during lecture, sitting on the floor, feet on chairs, etc.)

DEVICE AND FACILITY POLICIES:

Computers are NOT needed for exams or for any in-lecture activities. Please do not bring laptops or mobile gaming devices to lecture. It is not necessary for you to have your own computer for this course, as all computing resources necessary will be provided in the lab. Projects can be completed within the designated weekly lab sessions and with use of any Open Access lab. Even though our labs will use the Linux operating system, the Eclipse programming environment we will use is identical for Linux, Windows and macOS.

COLLABORATION POLICIES:

The project assignments will be done in groups of 3 to 4 students. You may help each other understand the assignment, and are encouraged to approach other students to ask about concepts, algorithms, or general approaches to solve problems. However, each group must write their OWN CODE, and submitted work MUST be of the students turning them in. Allowing students from other groups to see your code, asking to see another group's code, or copying code/solutions from any other sources IS STRICTLY PROHIBITED.

You may, of course, seek assistance from the course TAs and the course instructor for all the assignments.

USE OF STUDENT WORK:

Work submitted by students may be used as examples for future students for educational or academic purposes. Names will be removed as possible. You may specifically request to not participate.

DEADLINE AND LATE POLICIES:

The posted deadline on CatCourses will be the official deadline for each assignment. The instructor has the discretion to change the deadline on a per-assignment basis. The penalty will be 10% for each day you are late with the submission unless stated otherwise.

CLASS/LAB ATTENDANCE POLICIES:

You are expected to attend the lab sessions for which you are enrolled, unless you

make explicit arrangements with the instructor. Lab sessions are where you will get most of the information and learn so it is important to be there physically every week.

If you will be missing class lectures or labs due to participation in sports or academic activities (e.g., seminar), you should provide the professor with documentation at the start of the semester, and then provide confirmation before missing each such date. This is particularly important in the case of exams and program deadlines; as mentioned earlier, make-up exams and extensions of deadlines will NOT be provided unless arrangements are made beforehand.

Academic Dishonesty Statement:

a. Each student in this course is expected to abide by the University of California, Merced's Academic Honesty Policy. Any work submitted by a student in this course for academic credit will be the student's own work.
b. You are encouraged to study together and to discuss information and concepts covered in the lecture and the sections with other students. You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else, in the form of an e-mail, an email attachment file, a diskette, or a hard copy. Should copying occur, both the student who copied work from another student and the student who gave material to be copied will automatically receive a zero for the assignment. Penalty for violation of the University of California, Merced's Academic Honesty Policy can also be extended to include failure of the course and University disciplinary action.
c. During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, copy from others, or collaborate in any way. Any collaborative behavior during the examinations will result in failure of the exam and may lead to failure of the course and University disciplinary action.

Disability Statement:

Accommodations for Students with Disabilities: The University of California Merced is committed to ensuring equal academic opportunities and inclusion for students with disabilities based on the principles of independent living, accessible universal design and diversity. I am available to discuss appropriate academic accommodations that may be required for student with disabilities. Requests for academic accommodations are to be made during the first three weeks of the semester, except for unusual circumstances. Students are encouraged to register with Disability Services Center to verify their eligibility for appropriate accommodations.