

ECE 160: Multimedia Systems Project

Section 1. Video Codec

For this project, you will be creating your own video encoder and decoder, also known as a codec, that additionally supports closed caption text. You can work in teams of up to 4 people within the class.

Your codec must follow specifications described below. Any design decisions not described are open for each team to make a decision on.

1. You will be submitting the following items:
 - (a) A long form report on the design decisions of your codec and performance results
 - (b) Source code
 - (c) Presentation slides and notes for the class presentation
 - (d) Encoded and decoded files and images based on test data that we provide.
2. The source code should include at least these four components:
 - (a) An encoder function that takes a specified directory of images (frames of a video) and converts it into a binary file (bit stream).
 - (b) A decoder function that reads the binary outputted file of the encoder, and outputs images (video frames) into a specified directory. **The decoder should also have an input to enable or disable the display of close caption text.**
 - (c) A script named main (for MATLAB users, a file, main.m) that runs both the decoder and encoder with easily set input and output directories.
 - (d) Comments in source code that make the code easy to navigate by a 3rd party developer (or TA)
3. The I- frames should be compressed using (lossy) JPEG. You are free to use off-the-shelf libraries for accomplishing this task. However, you should understand how the code works. A description of the overall important implementation details of the JPEG compression should be included in the final project report. (You will learn more about I and P frames when we discuss video compression in the next few lectures.)
4. Motion compensation should be used to help encode nearby frames. Specifically, at a minimum, you must have a group of pictures structure of IBPB, i.e. one I-frame that predicts a P-frame two frames later, which both are used to predict the first B-frame. The P and next I-frame are used to predict the final B-frame. The difference should be encoded using JPEG. (This topic will be covered in class the week of May 11.)
5. Text data should be encoded in the binary separately from the video. The decoder must have an option to display the text or not. Text should be displayed like subtitles in a movie, i.e. a specified line is overlaid over a number of specified frames. It is centered and in the lower part of each of the relevant frames.
6. You may use 3rd party libraries in order to implement large components of your video codec. Each library that you use must be documented in your report. For example, you may use a JPEG encoder and decoder function call, and any existing motion compensation implementations. You still need to put together an end-to-end system whose components are fully documented.
7. You will be graded based on three components:
 - (a) The execution of your implementation. The degree to which your implementation is functional and follows the guidelines.

- (b) The quality of your presentation and report, and its ability to convey your work clearly and concisely. Communication is an important skill even in engineering, and especially when working in larger organizations.
8. We will provide you with the following separate from this document:
- A list of suggested software libraries that you may find useful
 - Test data consisting of uncompressed frames and corresponding text subtitles.