Multimedia
Module No: CM3106
Laboratory Worksheet Lab 8 (Week 9):
MATLAB Video Coding: Motion Compensation and I, B, P-frames

Dr. Kirill Sidorov

Aims and Objectives

This is a short exercise since you will be finishing or demonstrating your assessed coursework in this lab and probably will be too nervous to care about this exercise. After working through this worksheet you should be familiar with:

- Block-based motion compensation.
- Encoding videos using I, B, P-frames.
- The basic use of MATLAB to investigate the above.

None of the work here is part of the assessed coursework for this module

MATLAB Motion Estimation and I, B, P-frames

1. **Preliminaries**.

   (a) For this exercise we will be using the MPEG demos kindly provided by International Hellenic University. (But do not download these yet, see below.)
   Their website: http://rad.ihu.edu.gr/55/. These demos are free and open-source so feel free to explore the other ones.

   (b) I have patched the above MPEG demo to correctly work on Macs/Unices, so please download the patched version:
   http://www.cs.cf.ac.uk/Dave/Multimedia/Lecture_Examples/mpeg.zip. Uncompress and install in an appropriate MATLAB accessible directory.

   (c) You will also need some example videos. You can download some classic test clips from our website:
   foreman.avi, football.avi, garden.avi, tennis.avi, suzie.avi.
   (It may be prudent to start downloading immediately, as the videos are uncompressed and large.) Place these videos in the `videos` folder on the same level as the `MPEG` folder.

2. **Motion Estimation**.

   (a) Go to the `MPEG/MotionEstimation` folder and run `MPEG.m`. This demo does motion compensation and shows: the target and reference frames, the computed motion vectors, the reconstructed (predicted) frame, and the difference between the actual and the predicted frames.

   - Open a video file, say `foreman.avi`.
   - Using the ◄ and ► buttons you can navigate through the frames of the video.
   - Observe the results of motion estimation.
   - On the right, experiment with the motion estimation parameters: try different block sizes, half-pixel precision, various search ranges. How does changing these affect the results of motion compensation?
   - Try other video files.

3. **I, B, P-frames**.

   (a) Go to the `MPEG/MPEG_IPB` folder and run `MPEG.m`. This demo encodes a group of pictures (GOP) using the following pattern of frames: `IBBPBBPBBI...`

   - In the bottom left corner, you can use the ◄ and ► buttons to advance the frames within the current GOP. Using the buttons in the bottom right you can navigate between different GOPs.
   - As the program encodes frames, observe the intra-coding results with DCT, and the motion vectors for inter-coding. At the bottom of the frame the program tells you what it is currently doing.

- Note the encoding/decoding order. Why is it so?
- Observe the cost of encoding (displayed above each frame in bits/pixel). Which frames (I, B, P) are cheaper and which are more expensive to encode. Why?
- Try other video files.