Programming on Block Based Motion Compensation *(80 points)*

This programming assignment will help you gain an understanding of issues that relate to block-based motion compensation. *Note – use of any external libraries is not allowed, you are expected to explicity implement the details as instructed below.*

Given two consecutive image frames – $frame_n$ and $frame_{n+1}$, write a function that creates and display two images as follows

- a *predicted or reconstructed frame* for $frame_{n+1}$ built using motion compensation techniques from $frame_n$ and,
- error difference frame.

You will be using the full brute force method, by dividing $frame_{n+1}$ into 16x16 blocks and performing motion compensation within an input search area k. The details of the algorithm have been explained in the class lecture and in the textbook. Here is how your program will be invoked

MyMotionPredictor.exe $frame_n$.rgb $frame_{n+1}$.rgb k

Input to your program will be three parameters - two consecutive rgb image frames of size 640x320 (**first parameter is previous frame, second parameter is frame to predict**) and search parameter *k*, which will define the search area to search into, *k* can have values from 1 to 32. Speed is important, but more important is the accuracy of your output.

Although your inputs are .rgb frames, you will need to compute motion vectors only on the Y channel – so your process will produce and display two gray level images.

Conversion of RGB to YUV

Given R, G and B values the conversion from RGB to YUV is given by

$$\begin{bmatrix} Y \\ U \\ V \end{bmatrix} = \begin{bmatrix} 0.299 & 0.587 & 0.114 \\ 0.596 & -0.274 & -0.322 \\ 0.211 & -0.523 & 0.312 \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$

Remember that if RGB channels are represented by n bits each, then the YUV channels are also represented by the same number of bits. In this assignment you are asked to use just the Y value for doing motion prediction.

Example output is shown below

predicted Y channel for $frame_{n+1}$

error difference for Y channel