E9 208 Digital Video: Perception and Algorithms
Assignment 1
(Due Nov 16, 2020)

Note: The assignment needs to be uploaded on Teams. Late submissions will be penalized.

Video Interpolation using Optical Flow
In the given video sequences, you are required to interpolate a video frame in between two alternate frames using optical flow. In particular, you are required to estimate the forward optical flow (flow from Frame n to Frame $n+2$) and the backward flow (flow from Frame $n+2$ to n) and use both of them to estimate the intermediate Frame n. Compare the performance of the following optical flow algorithms in terms of the quality of the estimated intermediate frame (the reference intermediate frame is already available for this comparison):

1. Lucas-Kanade optical flow algorithm: Assuming that the optical flow is constant for a block of pixels of size $N \times N$. Experiment with different values of N including $N = 11$. Indicate difficulties in computing the optical flow for certain patches and provide simple heuristics to resolve such issues.

2. Multiscale Lucas-Kanade algorithm: Formulate optical flow estimation as a refinement of the flow estimate from the previous scale. Keep in mind that when you propagate optical flow from one scale to the next,, the values need to be scaled. For example, upsampling by 2 requires a scaling of optical flow estimates by 2. You also need to warp this estimate to refine your estimate at each level. Does the multiscale approach improve over the single scale estimates? When does this happen?

3. Discrete Horn-Schunck optical flow

While estimating the interpolated frame, there could be pixels which do not map to any location to either the forward or the backward frame. Present simple heuristics to resolve such situations. Upload the code and a brief report on the observations on questions raised above. Please also show the interpolated frames and comment on the visual performance.