Title: Spectrum Preserving Random Extension of Multidimensional Signals and Economical Optical Flow

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Abstract: The idea of a live image was first introduced in the iPhone 6s. Basically, one wishes to replace a completely static image with an image where some parts move subtly. The straightforward way of achieving this is of course to record a brief video of a few frames and then play it repeatedly to give the sensation of motion. The limitation of this straight forward approach, is that the 'live image' gets predictably repetitive and hence fails to impress. However, there are many other situations where one needs to create non trivial random infinite extensions of finitely supported signals which are characterized by a similar magnitude spectrum as the original signal. This thesis explores and offers a method to precisely achieve this kind of an infinite extension. Initially we attempt a random infinite extension of a signal in one dimension of the domain only, namely, time. This approach covers all possible cases from simple waveforms that are functions of time to video clips which are again extended only in the time axis. Subsequently, we address the challenging and interesting problem of extending a signal in two dimensions of the domain. In order to do such an extension, one needs to first understand what it really means in two dimensions. We decide to proceed in a manner that logically extends the approach used for one dimensional extension. It is easy to show that having solved the problem for two dimensions, spectrum preserving random infinite extension in n dimensions is a straight forward generalisation. \par As a final additional piece of work, we propose a pyramidal approach for obtaining dense optical flow. It can be shown that this approach achieves considerable computational savings while simultaneously reducing noise in the computed flow field.

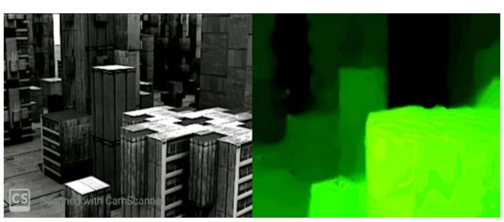

Figure 5.3: Left side is the original image and right side shows magnitude of dense optical flow

(a)

(b)

Figure 2.2: Girl dancing with a ribbon

Figure 6.1: Example:1- Patterns are found to be repeating when we take a closer look to bricks.
[This image is one frame taken from cartoon video available on youtube named "Make joke of"]

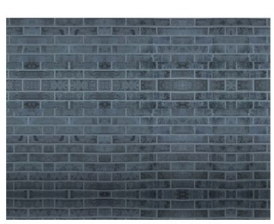

Figure 6.2: Obtained after performing multiple reflections on bricks.

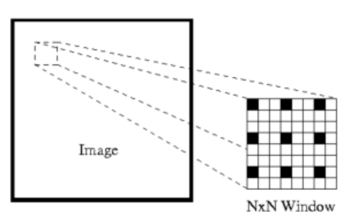

Figure 5.2: Lucas-Kanade optical flow is calculated for the black pixels