Handling Disocclusions in Cinematic Virtual Reality

Ryan Burke

Recent years have seen enormous development in virtual reality and enhanced reality. At Stanford University in particular Haricharan Lakshman and his group of researchers have been making developments in Cinematic Virtual Reality. Cinematic Virtual Reality involves the use prerecorded images and video, which are then developed into fully-immersive virtual experiences. A small issue in this development is the creation and handling of disocclusions, this proposal will give a general description of disocclusions, how they are currently being handled, and how the disocclusions being handled and our methods for handling them differ from those that already exist.

Occlusion is a term used to refer to an object blocking the line of sight of an individual. In our case an occlusion could be any object in the foreground of a virtual environment. Disocclusion refers to the lack thereof, more specifically, disocclusion refers to the void left where an occlusion was once present. Imagine you are viewing a virtual environment that was rendered from a set of images. If you were to move inside your environment, the images could be processed to reflect the movements of objects relative to their distance from the viewpoint (this phenomena is also referred to as parallax). The processing of these objects creates voids in the environment. These voids are the areas that were occluded in the original set of images. The goal of this project is to fill in these voids while maintaining the stereoscopic nature of the virtual environment.

There are a few algorithms currently available that are similar to this goal. For instance, the Criminisi algorithm is used to remove objects from an image and extrapolate from neighboring pixels what the object had been occluding (an example of the Criminisi algorithm is shown below). This algorithm has two issues, however. The first is that there are commonly errors present after processing, and more importantly these errors are easily identifiable to a viewer. The second problem is that the Criminisi algorithm makes no considerations on depth. Our goal is to maintain the experience of the viewer in our virtual environment, so less detectable inpainting and depth maintenance are high priorities. Further developments have been made on the Criminisi algorithm that reduce the detectability of the reconstructions made to the image, but no considerations have yet been made concerning depth-sensitive, texture-based inpainting. This project seeks to rectify that and integrate our developments into Haricharan's Cinematic Virtual Reality efforts.

Figure 1) An example of the Criminisi algorithm. Notice the properly reconstructed building and the improperly reconstructed lakeside.

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