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Exploiting MPEG-4 Motion Estimation mechanism to produce 2-D video 3-D video

Abstract

During the last decade, interest in 3D visualization and 3D content has been constantly growing as the technology ripens. Nowadays processors can make real-time 3D video thus - enhancing the viewer experience by adding 3D visualization. True 3D is rapidly becoming an integral part of computer graphics, visualization, virtual-reality systems, and video movies. Numerous 3D systems are granted patents each year, but very few systems move beyond the prototype stage and become commercially viable. Still, it seems to be that more and more systems will adopt 3D techniques in the nearest future.

One of the methods of synthesizing 3D video is by using depth maps to recreate a stereo pair stream from a single video stream. This process, however, is extremely intense in terms of computational complexity. In order to reduce this complexity we propose a method that relies on compression based motion compensation.

By modifying a standard 2D video sequence encoder, it is possible to extract this motion estimation, as well as, the compressed 2D video bit stream sequence. By corresponding modifying the decoder, it is possible to utilize the depth maps to synthesize a 3D video stream.

An example for such a compression method is MPEG-4 part 10, baseline profile, known as the H.264 AVC of the JVT, which is used in this project.

The reasons of preferring this standard are:

1. This standard allows 4x4 pixel blocks motion vectors. This ensures that the depth maps will have at lest 4x4 pixels resolution.
2. The motion estimation has quarter pixel accuracy.
3. Motion vectors are computed per block prior to block type decision.

As a result, we were able to synthesize a 3D video stream using MPEG-4 encoder with some modification and still preserve very good compression rate. We were also able to decode the bit stream, generate a 3D sequence with the speed of up to 15 frames per second for QVGA resolution.