Developing Tools for 2D/3D Conversion of Japanese Animations

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1 Japanese Animation to Stereoscopy

2D/3D conversion is a process where 3D information is added to an originally 2D flat content. The content may be of three kinds: live-action movies, 3DCG movies, and animated cartoon. In this talk we will describe a set of in-house tools to efficiently convert from Japanese hand-drawn animation to stereoscopic animation.

Typical conversion process usually involves depth map or 3D model generation. Depth map can be use to apply some displace effects on pixel while 3D model can be used to project original art work and re-render it with two cameras. As for 3DCG movies and live-action movies, we can retrieve 3D information using motion continuity and time coherency (lights, shadows, shape retrieval, tracking...). On the other hand, animated cartoon conversion is not straightforward. In animated cartoon, a piece of a fantastic and unreal world has been drawn in 2D, on a piece of paper by an artist. The colors are usually flat, the shapes are exaggerated, and the motion is not continuous. Color information (like color saturation), time coherency may not be used easily to convert from 2D to 3D.

Moreover, in the case of Japanese animation, for budget reasons, every single drawing is repeated 2-3 times (or more) in a 24 frame per second movie. Animation is usually minimal, colors are almost always flat, and the drawings have really few details. Even though, those restrictions give to Japanese animation a specific style, they make it really difficult to apply common automatic 2D/3D conversion. That’s why we developed a set of tools to help designers in this mostly non-automatic conversion process. The first movie created using those tools was screened in theater: “Inazuma Eleven the Movie”(2010).

2 The Tools

In the case of Inazuma Eleven the Movie, we used only 3D background, which halved the problem of rotoscoping and the problem of painting holes after displacement. For all CG elements that we rendered, we decided to output depth instead of pair of pictures. It unifies the workflow and makes it simpler to adjust stereoscopic feeling. We then needed to develop tools for three major tasks: rotoscoping, depth generation and depth.

2.1 Rotoscopy

One color is usually associated to one part of a character or an object. Then flat colors of Japanese animation can be used to extract parts information. In most compositing package, color keying feature is available, but to isolate one color, it means keying all other colors! That’s why we developed a simple tool to ‘keep’ a set of colors. We also added the possibility of analyzing connection between colors to automatically retrieve shadow colors too. If the color is used in different part of one character, we may get a set of separated parts. To separate it in various layers, we use some region recognition and tracking method.

2.2 Depth Generation

To make it easier to give depth to the various objects, we developed a point gradation and path gradation tool. Given a set of points/paths and corresponding colors, gray levels for depth, we generate a depth map using scattered data interpolation. We added some tracking features to avoid manual tracking of points/paths during animation.

2.3 Depth Adjustment

Once each object depth has been created, we need to assemble everything to create the depth for the whole scene. The assembly can be a tedious task, so we enable the designer to set each layer depth range with distance number, and we then rescale the depth automatically to meet those distance constraints. We then can set a global depth range for the scene, but we cannot ensure precise character position relative to the background. We then added a color constraint tool where the user can enforce seamless and continuous depth appearance.

3 Conclusion and Future Works

We developed a whole set of general tools to make it easier to convert animation to stereoscopic animation. The tools are general and may be used even in non-stereoscopic context. We thought about developing some medial axis generation tools like seen recently [Goldberg 2009]. The speed and the parameter tuning of our implementation were not satisfying production needs. Still, designers felt that it would be a great tool if we improve it. We also thought about adding some magic selection tool to make rotoscope easier. The user would ideally place some point, and according to some adjacency condition, a whole part of the character (like head, or arm) would be selected. The current implementation of our tools has speed issues, but we hope to alleviate those limitations in the near future.

References