Keyframe Animation Using an Artist's Doll (sap_0467)

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1. Introduction

Keyframe animation of an articulated human figure is a difficult task due to the large number of degrees of freedom inherent in the model's 3D joints, the complex range of motion and the vast amount of possible interpolations between keyframes. Existing software solutions, such as Maya and Poser, try to solve these problems by providing extensive user control over positioning and orientation of joints, etc. However, due to the sheer number of adjustable parameters and settings in these interfaces, skills of a master animator are required to create satisfactory results.

We propose a method for generating high quality animations that can easily be used by anyone. The process starts with the user specifying the keyframes by simply posing an artist's doll, which has distinctly painted joints for ease of detection, in front of a stereo camera rig. The stereo correspondence from the captured images is then used to determine the 3D joint position for each joint. These positions are then used to extract the 3D pose of the doll, which can then be used as keyframes for creating an extended 3D character animation by directly using interpolation techniques found in software such as Maya. We also hope to take this a step further by matching the keyframes with existing motion capture data to generate more natural motion. Our main contribution is an intuitive interface that can be used to generate poses for keyframe based 3D animation.

2. Method

From the applications perspective, our method closely corresponds to the work done by Esposito and Paley [Esposito et al. 1995], they created an intuitive and specialized interface called the Monkey – a 25" tall robot with human-like structure with potentiometers attached to each joint for measuring the joint angles. Users specify keyframes by directly manipulating the body parts of the Monkey. The downside of it is its price; it costs $14,500 USD. Unlike their approach, our interface makes use of an artist's doll and a stereo camera rig, which is available and affordable to almost everybody, for keyframe generation.

We use a calibrated stereo camera rig to capture a pair of images of the doll in each pose. The doll's joints are painted in distinct colors (figure 1a) to facilitate simpler detection and be robust under changing lighting conditions. We then search for the largest connected components of each color in each image (figure 1b), and we find the centers of these joints as basis for calculating the 3D positions for these joints (figure 1c) using stereo triangulation (figure 2). The process is repeated for all joints and all poses of the doll. Given the hierarchy of the joints on the articulated figure, we can extract the 3D poses. We have used these 3D poses as sequential keyframes to generate animation using Maya, the results of which are shown in figure 3.

3. Discussion

Looking at previous work done on reanimating using motion capture data; Kovar, Gleicher and Pighin [Kovar et al. 2002] have developed a method which extracts and combines segments of motion from different clips. The resulting motion is then presented along a path set by the user. Although this technique works well in path synthesizing using existing motion capture data, it does not provide a simple interface for doing keyframe animation. We are currently working on incorporating database keyframe matching with a technique similar to theirs for generating life-like motion using the keyframe poses specified by users. Finally, the goal of our system is to provide a unique interface which greatly simplifies the process of creating realistic human motion.

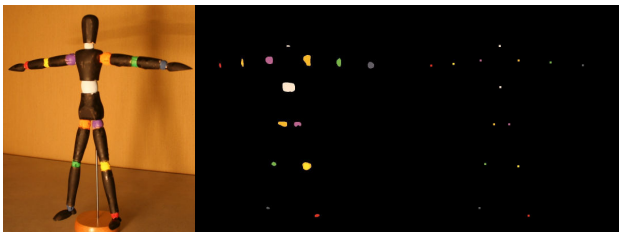

Figure 1: (a) A doll in the natural position with its joints painted (b) Joints of different colors are extracted (c) Centers of the joints are calculated for finding 3D joint positions.

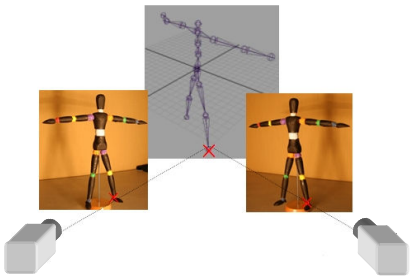

Figure 2: For both left and right images, rays are projected from camera centers through a joint center to find its 3D position.

Figure 3: Animation sequence generated using Maya, with the keyframes highlighted.

4. References

ESPOSITO, C., PALEY, W. B., ONG, J. C.: Of mice and monkeys: a specialized input device for virtual body animation. In: Proc. of the Symposium on Interactive 3D Graphics, 1995, pp. 109-114.

KOVAR, L., GLEICHER, M., PIGHIN, F. 2002: Motion graphs. In Proceedings of SIGGRAPH 2002.