Hair Motion Capturing from Multiple View Videos

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1. Introduction

To create a realistic virtual human, hair animation is an indispensable factor. Many hair simulation methods have been proposed so far, but simulating realistic hair motion such as considering an effect of turbulent flow and friction among enormous amount of hairs is still one of the challenging phenomena. Thus, to reproduce hair motion which includes these desirable features, capturing real hair motion has advantages compared with simulated one. Ishikawa et al. [2007] used a motion capture system and tracked some reflective makers placed on some strands. They successfully reproduce hair motions including an effect of turbulent flow, but since they put on some markers which have weight and only captured sparse strands which mean friction among others is ignored, it is still far from real hair motion.

So our goal is to overcome those defects and capture more realistic hair motion. To achieve the goal, we assume that hair is a model of several hair-bundles and so we decided to use some hair extensions which are dyed in horizontal strips. We capture the center of gravity of colored areas and then estimate those 3D coordinates. We also applied them to existing hair model. By our results, more realistic hair animation reflecting hair-to-hair friction is achieved than previous technique.

2. Hair Extension and Acquisition

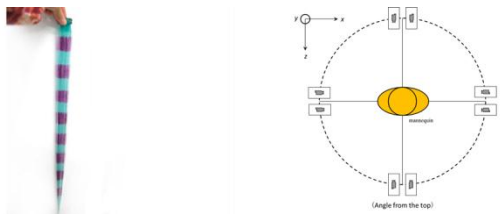
To escape overlapping of colored hair extensions, each strand has to be located as sparse as possible. And also to identify each strand easily and accurately, color combination of each strand has to be different. So we choose eleven positions and colors of hair strands to represent overall hair motion to be captured by eight cameras located in four directions around head. An example of hair bundle is shown in Figure 1(a). Figure 1 (b) shows the acquisition setup. Note that external and internal camera parameters are calibrated using Zhang method.

3. Color detection and Parallel Stereo

We captured hair motion when wind is given. First of all, image coordinates of center of colored areas are detected and then 3D coordinates are estimated.

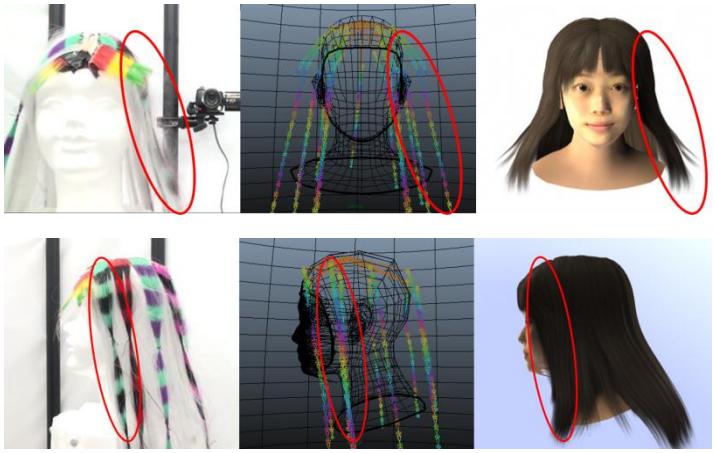
We first process color detection every video sequences and define a center of colored areas. To make correspondence automatically, colored areas in initial frame are labeled by hand.

After second frame, they are labeled based on nearest colored areas of the previous frame and so all of the areas in all video frames are able to capture automatically.



(a) Hair Extension (b) Acquisition Setup

Figure 1. *hair extension and acquisition set-up*



(a):Reference motion (b): Result of our hair motion capture (c): Applying hair model

Figure 2. *hair motion result based on camera capture*

Next, the 3D coordinates of colored areas are estimated by parallel stereo vision which is based on detected 2D coordinates.

4. Hair Model

We design hair model for a reed-shaped hair strand. This reed-shaped polygon structure is generally used hair mapping textures onto this kind of structure. This model actually has been used to design a realistic human character's hair in movies or games. Hair motion we captured is applied to the chosen the hair strand.

5. Results

In this section, we demonstrate an animation obtained by applying our approach. The reference motion is showed in Figure 2(a). The result of computing hair motion is achieved in Figure 2(b). Figure 1(d) represents the result of applying hair motion to a hair model. This method shows that our hair motion capture consist with the reference motion.

6. Conclusions and Future Work

In this paper, we have proposed a method of capturing hair motion using hair extensions instead of markers. Consequently, we successfully capture and reconstruct more natural hair motion, since no weight is put on the hair and also friction among hairs is considered.

As future work, we need to capture hair motion in a more natural situation, for example, when human walk. Furthermore, if we position more hair extensions and capture motion inside of hair, we could create richer hair animation.

Reference

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