Cellular Modeling of Dye Stain on Cloth

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1. Introduction

In this paper, we present computer generated dyeing. Dyeing involves producing inherent patterns by different dyeing techniques, for witch, the kind of surface and the dye type used are considerations. Staining on cloth, a type of dyeing, has differnt considerations from dyeing a paper surface.

Research has been done on simulating liquid color diffusion in the paper fiber, for example simulating water colors[Curtis et al. 1997], Chinese ink paintings and black ink paintings. However, there has been no research performed for cloth. In this paper we first construct a model for the representation of dye on cloth. We then use the model to generate a more complicated image with a 2D image input.

2. Dye stain modeling

We define a "dye stain" as a drop of colored water that soaks in a cloth and diffuses inside it. String cloth is represented by a two-layerd cellular model, shown in Figure 1. The weft and warp define the positional relationship of the strings, based on the structure of real cloth.

Each cell has a transportability and a maxmum dye capacity.

Dye transport through the fiber of the cloth occurs by capillary flow. We have improved on the simulation of capillary flow inside paper described in [Curtis et al. 1997]. Because the cloth has weft and warp, we identify 3 cases of dye transport, represented in Figure 1 by the orange, green and blue cells. In each case, we set the minimum amount of dye that creates the transport. By setting the amount of fye for each of the four colors of cell, shading is given to the cloth, as shown in Figure 2.

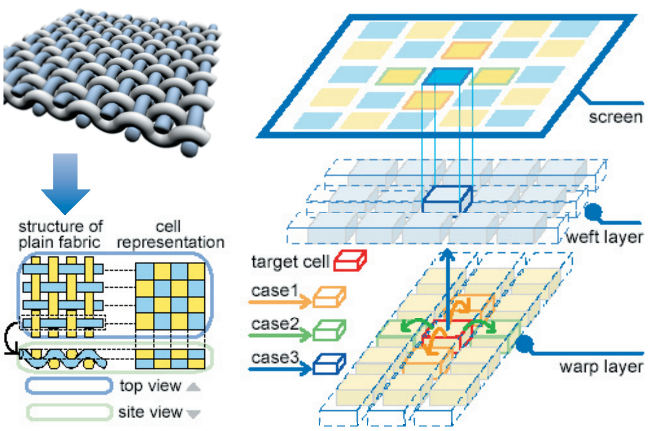

Figure 1: Fabric structure. In the red cell represents the target cell, orange cells represent the neighbor cells of the target cell, the green cells represent cells in the neihboring strings of the target cell and the blue cell represent the cell above the target cell.

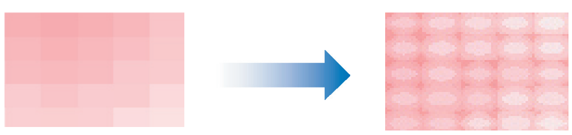

Figure 2: Shading.

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3.Result and Conclusion

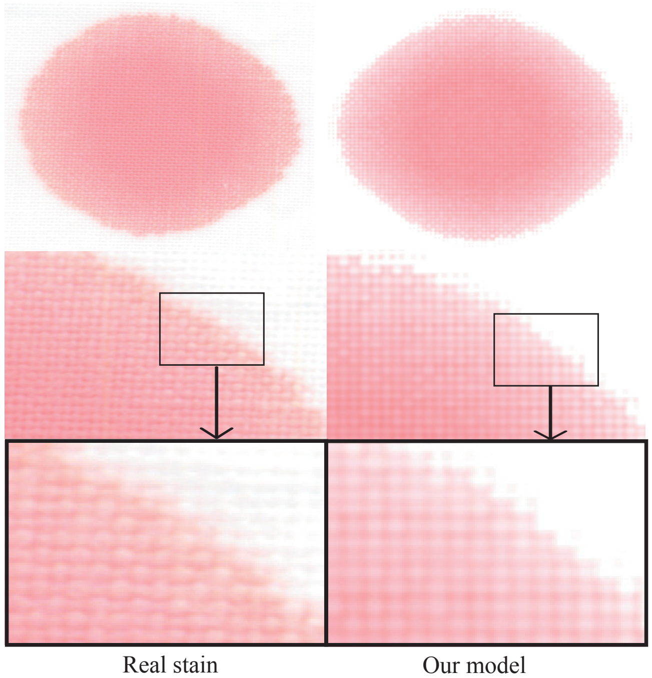

Figure 3: Comparison of real (left) and computer-generated (right) stain. The color distribution is similar for both stains and both have a mottled appearance at the fringe.

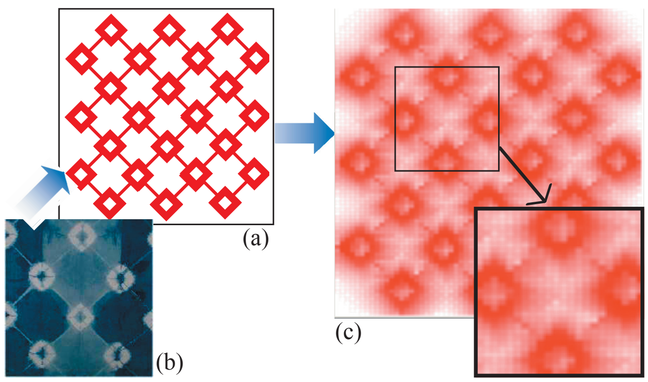

Figure 4: Application of 2D image. We make a pattern (a) from a real tie-dye image (b). Our dye stain system diffuses a pattern and produces the correct image (c).

We would like to apply this technique to multicolored dying with a 3D cloth model. Improvement to the representation of the cloth are needed for realistic dying. In the future, we would like to develop a system for simulating tie-dyeing (a dyeing technique using bound or folded cloth) and other dyeing techniques.

Reference

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