Interactive Tree Illustration Generation System

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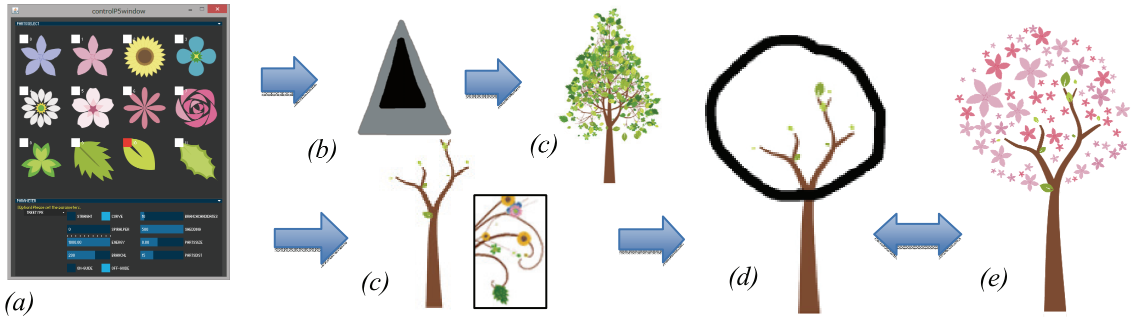

Figure 1: *System overview. (a) Parameter setting of the degree of branch growth, and the leaves/flowers to grow. (b) Energy attenuation field to control branch growth (optional). (c) Automatic generation of an illustration of tree (Branches can have decorative curves). (d) Specification of the area to fill with leaves and/or flowers. (e) Filling without any overlaps ((d) and (e) are optional and repeatable).*

1 Introduction

Modeling 3D trees is a major theme in the field of computer graphics [Steven et al. 2012]. However, there has been little research on generating illustrations of trees [Yu-Sheng et al. 2012]. One of the ways to generate them is to render their 3D models. However, it is difficult to obtain the characteristic flat representation of illustrations because of the concentration of foliage in the central part of the tree. We present a system to generate a wide variety of tree illustrations by controlling the density of branches, the shape of canopy, and the overlap of flowers and leaves (Fig. 1).

2 Energy-based branch growth control

In our system, trees are generated by an iterative growing process, where child branch nodes are randomly allocated ahead of their parent node. The child and parent nodes are interpolated with curves for illustrative expression (Fig. 1(c)). The user defines an amount of energy that is used as a stopping condition. The energy is reduced at each end point of branch, and recursion stops when the energy drops below a threshold. Pre-designated flowers and leaves are arranged around the end points.

3 Controlling the density of foliage

We have a density grid to hold the sum of the branch width of nodes that have been put in each grid. The allocation of child branch node is done by choosing the one in the lowest density grid among some randomly generated candidate locations. In addition, user can strongly control the branch growth by specifying energy attenuation field, which is drawn as black- and gray-colored regions (Fig. 1(b)). The user only needs to write a closed contour for each region on our user interface. In the black region, the energy of branches does not attenuate and each branch can be either shorter or longer than its parent branch. In the gray regions, the energy of the branches attenuates slightly, with branches becoming gradually shorter as the tree grows. Finally, outside of them, the growth of branches is prohibited.

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4 Filling with Flowers and Leaves

After constructing a tree, user can optionally specify an arbitrary region to fill with reselected flowers and leaves (Fig. 1(d,e)). Collision detection is performed to avoid any overlaps and to generate 2D-like flat representation. The region is also specified by the user as a closed contour on our user interface. This filling step is repeatable.

5 Results & Conclusion

As shown in Fig. 2, our energy-based branch control and energy attenuation field are effective to control the shapes of foliage and canopy. Coupled with the filling capability, users can easily generate a wide variety of tree illustrations by our system.

Figure 2: *Our results.*

References

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Yu-Sheng, C., Jie, S., Lieu-Hen, C. 2012. A npr system for generating floral patterns based on L-system. Bulletin of Networking, Computing, Systems, and Software Vol.1, No.1.