Non-photorealistic Rendering of Yangzhou School Painting for Koi Animation

Rina Savista Halim
National Taiwan University of Science and Technology

Phillip Pan
National Taiwan University of Science and Technology

Kuo-Wei Chen
National Taiwan University of Science and Technology

Chih-Yuan Yao
Taiwan Building Technology Center, National Taiwan University of Science and Technology

Tong-Yee Lee
National Cheng-Kung University

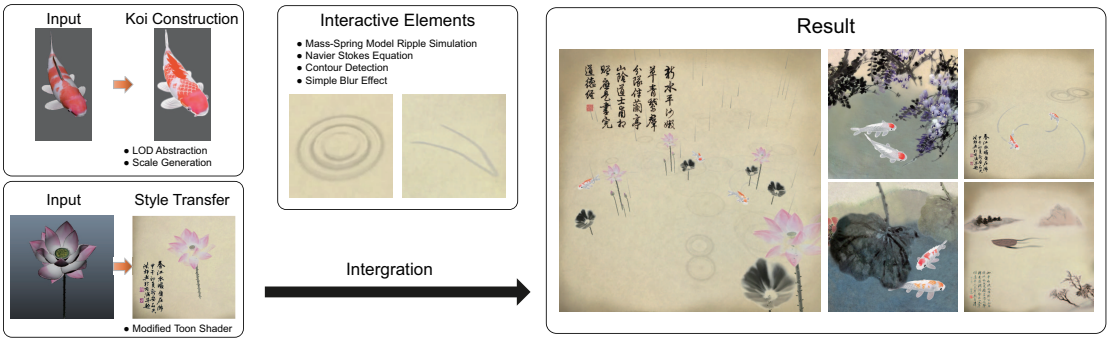

Figure 1: Our system generates koi (decorative carp) animation in the style of Chinese painting based on 3D models input. The system can also generates dynamic Chinese Painting elements according to the user inputs. Through our approaches, the Chinese painting animated scenes of koi can be easily produced and recreated.

CCS CONCEPTS

• **Computing methodologies** → **Non-photorealistic rendering**;

KEYWORDS

Non-photorealistic rendering, Chinese painting, Level of detail abstraction, Suggestive contour, Navier-Stokes, Mass-spring model

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1 INTRODUCTION

Dynamic Chinese Painting is a rendering style for animations. However, the production method today which relies on the artists to generate suitable textures and sceneries is time-consuming. In this paper, we propose a system to generate a realistic appearance of Yangzhou School Chinese Painting koi (decorative carp) animation in 3D space. Our system includes repainting the original texture, enhancing the contour of the 3D input models, and adding fin-stripes to fit the target style. For the interactive part, our system not only allows users to add ripples to the scene as the user-scene interaction but also generates water streamline as the koi-scene interaction. Through our system, a new Dynamic Chinese Painting scene can be automatically generated based on the 3D input models and user-inputs.

2 INTERACTIVE ANIMATION OF KOI CHINESE PAINTING

New Yangzhou School painting, originated from Yangzhou School painting, is a popular and well-known style for modern Chinese Painting. Our system uses the paintings of artist Zheng-Ming Wang as the reference for our koi. In order to create the desired koi result, our system needs to generate the texture, contours, and stripes of the koi to fit the style. First, our system applies a Level of Detail abstraction and color transfer algorithm [Wang et al. 2014]on the input texture to achieve the Watercolorized Chinese Painting texture style, shown in Figure 2(b). Second, stroke texture remapping and repeat pattern, as shown in Figure 3, are used to create the texture of koi's scales, result shown in Figure 2(c). Third, the system adds stripes to the fins and tail by Region-based Line Field Design Using Harmonic Functions [Yao et al. 2012], details can be seen

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on Figure 4. Forth, for the contours of the koi, our system applies the Suggestive Contours algorithm [DeCarlo et al. 2003][Proenca et al. 2008] to find both outlines and inner contours. Fifth, we apply our preprocessed stroke pattern, generated by the Navier-Stokes equation, [Stam 2003] on the outlines, inner contours, and stripes of the koi. The result can be seen in Figure 2(d).

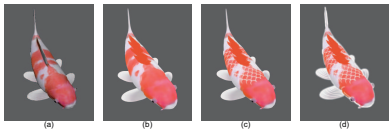

Figure 2: (a)Input Koi. (b)Watercolorized koi texture. (c)Added scale texture. (d)Added contours and fin stripes.

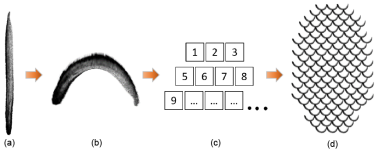

Figure 3: (a)Input stroke texture. (b)Texture remapping. (c)Repeat pattern duplication. (d)Scale texture result.

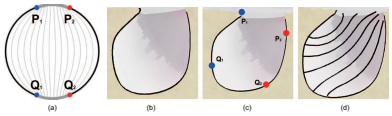

Figure 4: (a)We use the algorithm proposed by [Yao et al. 2012] to design our fin stripes. (b)We use Suggestive Contour [DeCarlo et al. 2003] [Proenca et al. 2008] to determine the boundaries of the line field. (c)We assign P_1, Q_1, P_2, Q_2 as the terminal points needed for the algorithm. In order to design the line field, the harmonic values from P_1 to Q_1 are set to 0, and from P_2 to Q_2 are set to 1. (d)After the computation, we connect the vertices with the same harmonic value and generate our fin stripes result.

Objects in Chinese paintings which commonly seen together with a koi are lotus leaves and flowers. We apply a modified toon shading algorithm on the objects to achieve a Chinese-painting style results. In addition to modifying the texture, our system can also generate dynamic elements such as ripples and water streamlines. For the user-interactive ripples, the ripples are generated by Mass-Spring Model Ripple Simulation [Zhang and Yang 2010] upon user-inputs, as shown in Figure 5(a). In order to achieve the Chinese painting look, the Navier-Stokes equation [Stam 2003] is applied to the ripples. The final appearance of the ripples can be seen on Figure 5(b). Our system also has water streamline as the koi-scene interaction. We also use the Mass-Spring Model Ripple Simulation [Zhang and Yang 2010] to generate multiple continuous ripples as the base shape, as shown in Figure 5(c). After that, the system loops through the pixels and eliminate the unnecessary ripple amplitudes. Finally, the simple blur effect is applied to imitate the Chinese Painting stroke, shown in Figure 5(d).

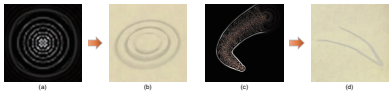

Figure 5: (a)Mass-spring model ripple simulation with a single input result.(b)Navier-Stokes equation applied to result (a). (c)Mass-spring model ripple simulation with multiple input result. (d)Boundary detection and blur effect applied to result (c).

3 RESULT AND CONCLUSION

Through our approaches, the Chinese painting style koi animation in 3D space can be automatically created by inputting the 3D koi model. The comparison between our result and our target reference can be seen in Figure 6. All methods that we use are rendered in real-time. Through our system, artists can easily generate certain Chinese Painting animation which contains dynamic elements such as koi, interactive ripples, and streamlines.

Figure 6: Animated result created by our system (upper) and target reference (lower).

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REFERENCES

Doug DeCarlo, Adam Finkelstein, Szymon Rusinkiewicz, and Anthony Santella1. 2003. Suggestive Contours for Conveying Shape. *ACM SIGGRAPH* (2003).

Joao Proenca, Joaquim Jorge, and Mario Costa Sousa. 2008. Suggestive Contours Over Point-Set Implicits. *GRAPP, Computer Graphics Theory and Applications* (2008), 171–180.

Jos Stam. 2003. Real-Time Fluid Dynamics for Games. (2003).

Miaoyi Wang, Bin Wang, Yun Fei, Kangglai Qian, Wenping Wang, Jiating Chen, and Jun-Hai Yong. 2014. Towards Photo Watercolorization with Artistic Verisimilitude. *IEEE Transactions on Visualization and Graphics* 20, 10 (2014), 1451–1460.

Chih-Yuan Yao, Ming-Te Chi, Tong-Yee Lee, and Tao Ju. 2012. Region-Based Line Field Design Using Harmonic Functions. *IEEE Transactions on Visualization and Graphics* 18, 6 (2012), 902–913.

Xinghua Zhang and Gang Yang. 2010. Ripple Simulation Based on Mass-Spring Model and Image Space Computation. *IEEE, 3rd International Congress on Image and Signal Processing* 2 (2010), 553–557.