

Large-scale Quantitative Analysis of Painting Arts — Big-data and Network Science —

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Abstract

Scientists have made efforts to understand the beauty of painting art in their own languages. As digital image acquisition of painting arts has made rapid progress, researchers have come to a point where it is possible to perform statistical analysis of a large-scale database of artistic paints to make a bridge between art and science. Using digital image processing techniques, we investigate three quantitative measures of images – the usage of individual colors, the variety of colors, and the roughness of the brightness. We found a difference in color usage between classical paintings and photographs, and a significantly low color variety of the medieval period. Interestingly, moreover, the increment of roughness exponent as painting techniques such as *chiaroscuro* and *sfumato* have advanced is consistent with historical circumstances.

Keyword: Big-data, Painting Arts, Complex Networks

1. Summary

We statistically analyze a large-scale database of painting arts covering almost millennium period by measuring color usage, color variety and spatial characteristics of brightness values. First, we quantitatively find that “Chiaroscuro” artistic style, invented in early Renaissance to emphasize the contrast between light and darkness, is observed in roughness measure of brightness. There is a quite clear tendency that the roughness measure increases along the art history. Furthermore, “Sfumato” style, which gives mysterious feeling by smoothing and softening boundaries in a painting, is reflected in image entropy measures. From fractal analysis, we find that the change of fractal dimension over art historical periods is related to the color palette expansion in the European painting art history caused by the introduction of oil paints and new kinds of color pigments. All these analyses are quantitative not qualitative based on

8,798 paintings. We also discuss a difference between paintings and photographs in a similar manner.

In addition, in art world it was a quite long controversy about artistic value of drip paintings created by American abstract painter, Jackson Pollock at mid-20th century. Following the analysis, we find an incisive verdict about his paintings that they are rather close to randomized images in our quantitative analysis. This is the first time a large-scale database of painting arts has been statistically studied. Our quantitative approaches will be possibly extended to provide a deeper understanding of painting arts, therefore, our study would appeal to the general public as well as the science community.

References

- [1] D. Kim, S. W. Son, and H. Jeong, “Large-scale Quantitative Analysis of Painting Arts”, Scientific Reports (accepted for publication).