Guest Editors' Introduction

Art and Cultural Heritage

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COMPUTER GRAPHICS HAS application in virtually every area of human activity. In this Special Issue, we focus on applications in art and cultural heritage. For decades now graphics has played a role in the digitization, restoration, conservation, presentation, and communication of our cultural heritage as well as providing new mediums for reflecting on our culture. There continues to be a productive two-way channel between computer graphics and heritage—new graphics techniques continue to have a positive impact on the understanding and communication of heritage, and heritage applications continue to inspire new innovations in computer graphics. In this issue, we present four papers that illustrate the broad range of productive interactions between these fields.

The first paper "High-Fidelity Point-Based Rendering of Large-Scale 3-D Scan Datasets" by P. Schmitz, T. Blut, C. Mattes, and L. Kobbelt presents innovations in the use of three-dimensional (3-D) geometric and appearance data for objects and spaces of significance in heritage. Current capture techniques produce tens of millions of points aligned with hundreds of high-resolution color images. One way to make use of this data is to put it in a form that allows the user to tour and inspect the captured artifact or space in real time in an immersive environment. Schmitz *et al.* present a technique using splatting of 3-D oriented ellipsoids and dynamic loading of image data to achieve real-time rates with high visual fidelity. Their approach has been proven in practice, having already been used in a museum exhibition that attracted more than 30 000 visitors.

In addition to presenting data in a natural form interpretation, computer graphics can also provide tools for analysis to help experts gain insight into the past. The second paper "A Classification Method of Oracle Materials Based on Local Convolutional Neural Network Framework" by S. Chen, H. Xu, G. Weizhe, L. Xuxin, and M. Bofeng, presents a new method for analysis of the materials used for oracle inscriptions in the Shang Dynasty. In addition to the inscriptions themselves, scholars are interested in the production of the inscription artifacts. Current practice requires professionals to observe and discuss a large number of artifacts over time to develop the expertise to classify the materials used. Chen *et al.* present a method using modern machine learning techniques to classify materials based on rubbings made from the artifacts. They demonstrate success in classifications that approaches that of seasoned experts. However, full analysis of oracle materials is a complex problem, and this work is just the beginning of opening a new line of inquiry in the analysis of artifacts.

The third paper in the issue considers the broader problem of the use of data visualization

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in the digital humanities. Many researchers are interested in data visualization in this domain, but it is difficult to understand the state of the art in this interdisciplinary domain. "A Data-Driven Introduction to Authors, Readings, and Techniques in Visualization for the Digital Humanities" the authors A. Benito-Santos and R. T. Sanchez present a computational method for deriving insight into this area by analyzing publications from a recent workshop series Vis4DH co-located event with the IEEE VIS.

The final paper, "Many Views Are Not Enough: Designing for Synoptic Insights in Cultural Collections" by F. Windhager, S. Salisu, R.A. Leite, V. Filipov, S. Miksch, G. Schreder, and E. Mayr approaches the problem of forming a coherent mental model of diverse collections of cultural artifacts and their associated meta-data. Individual views of artifacts and data visualizations often provide just a "mashup of information." Windhager *et al.* present the "PolyCube" project that uses visual coherence techniques to provide insights beyond those obtained in previous multi-view visualizations.

These papers present methods for visualizing, analyzing, and understanding cultural heritage. While each is motivated by a particular application, they have in common that they present methods that can be applied in many other problems.

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