Editorial

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Theory and Applications of Computer Vision and Robotics for Cultural Heritage.

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INTRODUCTION

Cultural heritage is becoming more and more entwined with robotics and computer vision. The diverse responsibilities of the latter broad range, from data collection to heritage interpretation, must deal with the unique characteristics of both tangible and intangible heritages. As an illustration, certain historic Materials have changed over time and may be extremely unique, making them distinct from the structures and artwork of today. Another illustration would be the rarity of artifacts or cultural practices, such as certain dances or ceremonies that are practiced by a small number of people in a special location on Earth but are nevertheless a part of human history.

The reality is far more widespread than a few isolated cases, which motivates researchers in computer vision and robotics to work with historians, doctors, and other experts to develop new sensors, robots, techniques, and interfaces.

educators and curators to enable hitherto unheard-of methods of archiving, deconstructing, and understanding cultural material. These days, the amalgamation of so many different skills is recognized as digital legacy. The purpose of this Special Issue is to discuss the latest findings in research on novel imaging techniques, some of which involve robotics, for the purpose of capturing unique information about heritage artifacts. Additionally, data processing is included to automatically detect and analyze textual, visual, and building structure characteristics.

Cultural heritage artifacts are difficult to image and process because of their rarity and occasionally because of their distinctiveness. As a result, specialized imaging sensors and technologies are created to more accurately record historical artifacts like paintings. In light of this, the Special Issue's essay "Documenting Paintings with Gigapixel Photography" [1] presents a technique for capturing color photographs of historical paintings with very high definition and correct chromaticity. The technique is applied to masterpieces from Valencia, Spain's Museo de Bellas Artes and can be accessed online at https://gpix.webs.upv.es (accessed on December 20, 2022).

Reflectance Transformation Imaging (RTI) is then utilized to highlight these non-flat properties because paintings can have surface fissures or varying thicknesses. The RTI method involves lighting the artwork in succession from different positions in order to capture photographs from a single position.

The shading makes even the smallest changes in thickness easier to see. The article "LightBot: A multi-light position robotic acquisition system for adaptive capturing of Cultural Heritage surfaces" [2] uses a robot arm to precisely position the light source at different positions so that the system is adaptive to the size of the artifact and other constraints, in contrast to existing techniques that take into account light domes or free-form manual lighting. But in order to convey aspects of paintings that transcend its paintings The processing of heritage artefact data enables the analysis of ancient texts, including handwritten texts in ancient Greek. This is addressed in the article "HTR (Handwritten Text Recognition) for Greek Historical Handwritten Documents," where the authors train recurrent neural networks to transcribe from new datasets.

Creating datasets for neural network training presents a problem when working with heritage artifacts because, for example, medieval musical instruments may have uncommon representations with a wide range of shapes, making them difficult to spot in photos. This is the aim of the the paper "Few-Shot Object Detection: Application to Medieval Musicological studies" [5], which assesses object detection using a number of neural network topologies. The article "Historic timber roof structure reconstruction through automated analysis of point clouds" [6] addresses the issue of multiple object detection in 3D point clouds and offers a precise method for identifying wooden structural elements that are highly repetitive within the same roof environment.

The latter effort uses a Terrestrial Laser Scanner (TLS) to acquire 3D point clouds; however, a technique known as photogrammetry may produce 3D point clouds from sets of

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photographs taken in the same location, even when there is a significant amount of overlap between them. The latter The introduction of new, affordable spherical cameras, such as those examined in the tutorial article "Use of low-cost spherical cameras for the digitization of Cultural Heritage structures into 3D point clouds" [7] of this Special Issue, has somewhat eased the constraint that was previously necessary to enable photogrammetry. The second article is a good example of how professional software that cultural interpreters can use in the field in conjunction with newly developed photographic technology and customized processing can make the archiving task of historical documenters easier.

Finally, because the authors of the papers in this Special Issue are affiliated with research institutions in Austria, Greece, Italy, Spain, France, and Switzerland, it provides a glimpse of the global scope of the digital heritage issue. Of course, a large number of other nations own a thriving digital heritage sector. In fact, committees of French, Japanese, Brazilian, Israeli, and Italian researchers, among others, organized the "E-Heritage and Robotics" international workshop in conjunction with the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) on October 20, 2021, in Prague, Czech Republic (see https://www.cvl.iis.u-tokyo.ac.jp/EHR2021, accessed on December 20, 2022). There, the article about Lightbot [2] in this Special Issue was presented, in addition to presentations of a panel discussion.

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