AI as a means to assess ISIS campaign of destruction at the World Heritage Site of Ashur

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General issues

Just over a century ago, the ancient city of Ashur (modern Qal'at Sherqat) served as an important focal point for the revival of modern Iraq. It was here that Walther Andrae trained the first professional corps of local archaeologists, known as Sherqatis, who could excavate as well, if not better, than any foreign archaeologist. It was also here that ancient Assyria came to light, when the extensive excavation of the inner city (*libbi alim* or heart of the city) helped reveal a history long gone. As a result of this research, Ashur is fully registered on the World Heritage list (UNESCO 2018; Lamprichs 1996).

Yet past research into the long dead cities of Mesopotamia still maintain political significance. Ashur is only one of several important cultural sites in northern Iraq that were damaged or destroyed by ISIS because of what it represents but it is an important site for post-conflict Iraq that is often overlooked. As a cultural asset, Ashur can make a significant contribution to the regional economy. Yet, ISIS targeted the ancient ruins with physical destruction because of its cultural heritage value (Dante et al. 2015). ISIS literally smashed the protective cover of the royal tombs, bulldozed the museum that was housed in the Ottoman palace, looted the excavation house, and used explosives in an attempt to demolish the reconstructed Tabira Gate.

Date:	Destructive Event:
March 8, 2015	Looting at Dur Šarrukin.
April 3, 2015	ISIS explodes the major monuments on the Nimrud Citadel
May 28, 2015	The first attack on Ashur including the attempt on the Tabira Gate
May 29, 2015	Bulldozing of several monuments in the inner city, mostly near the Temple of Ashur
December 2015	ISIS excavates several trenches at Ashur and nearby mounds, seemingly in preparation for an attack by Iraqi Security Forces (ISF), Sunni tribes, and coalition forces.
November 13, 2016	Ashur is liberated.
May 2019	Recent UN reports document continued casualties from IEDs in the Shirqat district. The nature and extent of the contamination is currently unknown.

Table 1. Timeline of ISIS destructive activities at Ashur.

Collecting a deeper understanding of these acts of destruction is important for understanding ISIS' broader attempt to destroy national memories (Jones 2018). As a first step, this project tested a new means of visualizing ISIS' destruction of ancient cities through the application of Artificial Intelligence (hereafter AI). The first stage of the project combines Google's Tensorflow library and a Python API together with our cultural heritage experience to train the algorithm. A supervised learning algorithm is currently being trained with an archive of approximately 500 low-resolution (72 dpi) aerial photographs of looted sites and 500 low-resolution aerial photos of excavated sites. These archival photographs derive from leading research institutions in Europe and America, such as the Oriental Institute at the University of Chicago. The algorithm is being edited in PyCharm.

In the next phase, the supervised learning algorithm's assessments will be independently evaluated by human oversight. At the end of this training period, the supervised learning algorithm should report a greater-than 90% confidence rate in its identification of looted as opposed to excavated sites. Early trials suggest that the accuracy is partly a function of the properties of the image, so any image that lacks this 90%

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confidence rate will be reviewed in order to identify what elements of the imagery may hinder accurate identification.

After the supervised learning algorithm has been trained, the project will apply the same algorithm to 2000+ high-resolution images taken at the site of Ashur. The project used a small unmanned aerial vehicle (sUAV) flying at low-altitude (50 ft, 15 m) in order to collect photos of the site with a relatively high resolution (1 cm pixels) when compared to commercially available satellite imagery (50 cm pixels from Digital Globe or 72 cm pixels from Planet Labs; Figure 1). The sUAV flew transects 10m apart for 60% overlap in order to ensure that two photos would cover any given point and thus provide a stereo pair for 3D modelling.

Figure 1. The planned routes for the sUAV flights over Ashur (© Adam Azad Tawfeeq).

This project is intended to demonstrate how archaeologists can train the computer to automatically identify types of destruction. Ultimately, the automatic curation of several thousand high-resolution images can serve as a test case for visualizing destruction at other sites of cultural significance in the region.

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