A100 Mapping Surface Scatter of Scavenged Human Remains Using Drone Aerial Photography

Krystle Lewis, BS, 1350 N LBJ Drive, 1531, San Marcos, TX 78666; Daniel J. Wescott, PhD, Texas State University, Dept of Anthropology, 601 University Drive, San Marcos, TX 78666-4684; Eugene J. Robinson, RPFlight Systems, Inc, 209 Brunson Lane, Wimberley, TX 78676; John Buell, Drone Pilot, LLC, 715 E 8th Street, Austin, TX 78701; and Michael Josephs, Drone Pilot, LLC, 715 E 8th Street, Austin, TX 78701*

After attending this presentation, attendees will better appreciate the suitability of mapping the spatial distribution of major elements in outdoor surface remains using images collected by an Unmanned Aerial Vehicle (UAV).

This presentation will impact the forensic science community by demonstrating the accuracy, benefits, and drawbacks of aerial photography via UAV for mapping major skeletal elements present in outdoor crime scenes without disturbing the scene.

High-resolution aerial images collected from UAVs are more commonly being used by law enforcement to map crime scenes and to search for clandestine human remains.[1] Small UAVs can be rapidly deployed and photograph a scene in a fraction of the time required when using traditional methods. Computer software can stitch the multiple photographs to render a 3D map of the scene that can be viewed and measured from multiple positions; however, in outdoor scenes containing skeletonized human remains, scavengers often distribute the small bones over a relatively large area, making them difficult to identify in aerial photographs.

The purpose of this pilot study was to compare maps of outdoor human remains sites based on UAV-collected photographs to traditional baseline maps. Two scattered remains sites at the Forensic Anthropology Research Facility at Texas State University were used in the study. Both sites were more than two years old, in an open grassy area, and the bones had been scattered over an approximately 50-meter area by scavengers.

Prior to deployment of the UAV, each scatter was mapped utilizing traditional baseline mapping techniques used in archaeology. A 2'x2' black/white aerial target was then placed near the scattered remains for reference during the UAV flight. In addition, the baseline points were marked with pink flags to provide easier visibility in the photographs. A multi-rotor UAV was then deployed and a series of aerial photographs were taken at approximately 40 feet above ground surface for each site. Two images were also imported into the open-source software, ImageJ. The baseline was drawn and the scale was set using known distances. The measure tool was then used to measure the distance from the baseline to the bone that could be observed. Additionally, an ellipse was fitted around the areas of the scatters to measure the total distribution of the scatters.

Baseline measurements using traditional techniques were compared to baseline measurements acquired from the photographs. An analysis of the two methods exhibits an average percent error of less than 2% (1.5%) for major skeletal elements. The comparison of maps demonstrates that the major skeletal elements can be accurately mapped using aerial photographs collected from an UAV equipped with a high-resolution camera; however, mapping smaller elements is difficult. Though small elements can be seen in the photographs, they are not discernible enough to accurately measure. The advantage of the aerial photograph maps is that they can be rapidly produced without disturbing the scene, and the stitched map can be viewed three-dimensionally from any position.

As drones equipped with high-resolution cameras become more readily available, they have the potential to be used to develop accurate 3D maps of outdoor crime scenes. While aerial photographs collected from UAVs cannot replace the more detailed mapping necessary in forensic anthropological cases, they do provide a valuable additional tool. Furthermore, initial mapping can be conducted prior to any disturbance of the scene.

Reference(s):

1. Katz E., Halámek J. (2016). *Forensic science: A multidisciplinary approach*. Weinheim, Germany: Wiley-VCH.

Surface Scatter, Drone Mapping, Spatial Distribution