A118 A Mixed-Method Approach to Predicting Deceased Migrant Attributes in the Southern Arizona Desert

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Learning Overview: After attending this presentation, attendees will better understand methods developed in several disciplines as they are applied to the predictive modeling of attributes of Unidentified Border Crossers (UBCs) recovered in the southern Arizona desert.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by highlighting the utility of employing traditional methods of ancestry prediction using skeletal traits in a geospatial framework to aid in the identification of UBCs. These methods could be applied to similar situations in which the identification process may be supplemented by an individual's physical location on the landscape.

The ongoing humanitarian crisis along the southern United States border demands the expansion of methods used to identify unknown individuals found in this region. The correlation between the ancestral background of an individual and their skeletal morphology has been well established and now the implications of combining these data with other indicators of geographic origin must be investigated. Research into the spatial relationships of identified UBCs recovered in the southern Arizona desert has shown positive spatial autocorrelation between attributes such as a person's sex and country of origin.[1] These findings demonstrate that where an individual is from influences where they are found after dying while crossing the United States-Mexico border. This has been documented in the sociological and ethnographic literature and can now be seen in the forensic anthropological data as well. This research applies these spatial patterns to the identification process to predict the country of origin of an unknown individual.

Geographically Weighted Regression (GWR) analyses using the R package spgwr were employed to create a predictive model for an individual's country of origin using skeletal indicators of ancestry and the recovery location of remains.[2] Rather than creating a single equation like traditional regression methods, GWR calculates the model at each data point relative to both its physical location in space and to the other points around it. The global model applied to the GWR analyses used factor analysis of craniometric and macromorphoscopic data from 25 identified individuals originating in Mexico and Guatemala who were previously analyzed at the Pima County Office of the Medical Examiner (PCOME). For each case, accurate Global Positioning System (GPS) coordinates of their recovery location in the southern Arizona desert were known. The GWR model (R^2=0.540) was developed using this known dataset and accounted for just over half of the variation in the sample. This is an increase from the global model (R^2=0.432), which did not incorporate the recovery location and attributes of other individuals found nearby. The GWR model also had lower residual squares values compared to the global model, which indicates a smaller difference between the observed values and the predicted values calculated using the GWR. Other indicators of model goodness-of-fit, including low Root Mean Squared Prediction Error (RMSPE) and Mean Absolute Prediction Error (MAPE) rates show that more accurate country of origin predictions also were created using the GWR method.

The model was then tested on a set of individuals (*n*=8) with presumptive identifications of Mexican origin. The test correctly predicted the country of origin of two individuals and provided promising results for future predictive modeling. Although sample sizes were small, the potential for successfully applying this method was shown. Furthermore, the application of these techniques to other situations in which the physical location of an individual might correspond with their personal characteristics is demonstrated.

Reference(s):

1. 1. Caitlin C.M. Vogelsberg, MS. Assessing the Spatial Patterns of Undocumented Border Crosser (UBC) Deaths in the Southern Arizona Desert. *Proceedings of the American Academy of Forensic Sciences*, 70th Annual Scientific Meeting, Seattle, WA. 2018.
2. 2. Williams, G. *Data Mining with Rattle and R: The Art of Excavating Data for Knowledge Discovery.* New York: Springer. 2011.

Undocumented Border Crossers, Geospatial, Migration