3D Urban Modeling of Historic Black Neighborhoods Using GIS and Machine Learning: Poindexter Village, Columbus, in 1940

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ABSTRACT:

Located in Columbus, Ohio, Poindexter Village is one of the first public housing projects in the United States. This neighborhood used to be a dynamic hub of African American culture and community life on the near east side of the city. However, this once-vibrant community progressively started to decline due to the combination of disinvestment, racially biased policies, and systemic inequities. Despite considerable efforts to preserve its historical significance, most of the project's structures were demolished in 2013, leaving just two residential buildings intact. A museum and visitor center are planned for those buildings. To support this new initiative, we are creating a 3D model of Poindexter Village as it was built in 1940, using historical maps, machine learning, GIS, and 3D urban modeling techniques. The foundation for our research is historical Sanborn Fire Insurance Maps, available in digital form from the Library of Congress. We developed machine learning techniques to extract building footprints and associated details such as building use, construction material, and the number of stories. The extraction process involved two primary stages: identification of building footprints and construction materials and determination of building utilization and story counts. To guarantee spatial accuracy, we utilized georeferencing techniques on the extracted footprints. The geocoding service by the Center for Urban and Regional Analysis (CURA) at Ohio State University was used to match control points to street addresses or road intersections manually. With this service, the scanned Sanborn maps were georeferenced to the WGS 84 datum. This method created georeferenced shapefiles seamlessly integrated into CityEngine for the subsequent 3D modeling phase. A thorough examination of architectural drawings dating back to the 1940s was carried out to achieve a realistic representation of building heights. Additionally, to model the intricate facades of the buildings, we used a diverse collection of archival images gathered from the Columbus Metropolitan Library, the Ohio History Connection, and Google Street View Maps. The combination of these approaches led to the creation of a 3D model of Poindexter Village as it used to be in the 1940s. The Poindexter Village model is part of a broader Ghost Neighborhoods of Columbus project that is creating 3D models of Black neighborhoods that were damaged by urban highway construction and urban renewal in the 20th century.

KEYWORDS: *3D modeling, ArcGIS, machine learning, historical maps*

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