Geographical Scene Reconstruction and Application of Ancient Site with Fused Multi-source Data

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Abstract:

As important places and cultural relics retained by the ancients in production and activities, ancient sites have internal geographical feature and differentiation laws under the interaction of long-term human-environment relationship. Thereof, aiming to the current relative research shortage of geographical background and space-time frame, the research goal of multi-level geographical parsing for archaeological site was proposed in this paper. By summarizing the characteristics of multi-source spatio-temporal data, we studied on the data fusion method and building the whole archaeological site considering total scene factors and knowledge rules, as well as the related application research. The Lingjiatan Site was adopted as the study area in this paper, and we reconstructed its 3D geographical scene with the surveying and excavation data in the past 30 years. Furthermore, we attempted to study the spatial morphology, patterns and arrangement on different levels and scales about the site.

Methodology: the data fusion method proposed in this paper was as Figure1. The multi-source data included UAV images, LiDAR data, archaeological drilling and excavation data, basic geographical data and so on. On basis of the completed spatio-temporal elements information, aiming at the characteristic of these data, we put forward the methods of data pre-processing and data fusion, which involved registration, space interpolation, raster calculation, Boolean operation, 3D modelling and so on. The key research focused on the seamless integration and uniform data maintenance of these multi dimensions and multi-time data. Ultimately, we constructed the holographic geographical scene of the historical site, which provided a spatio-time platform for the subsequent geographical analysis and primary application.

Analysis and primary application: the geographical scene of Lingjiatan Site was as figure 2. Combining with the archaeological data, we could carry out some primary spatio-temporal analysis: (1) the distribution of the functional areas (three kinds of relics: sacrificial area, living areas and trenches) and the relationship with the natural environment; (2) the spatio-temporal relationship among the functional areas; (3) by simulating the optimal paths of several typical relics (the details were as following figure 3 showed), reasoning for the ancients' behaviour patterns, and providing the forecasting and verification for field archaeology.
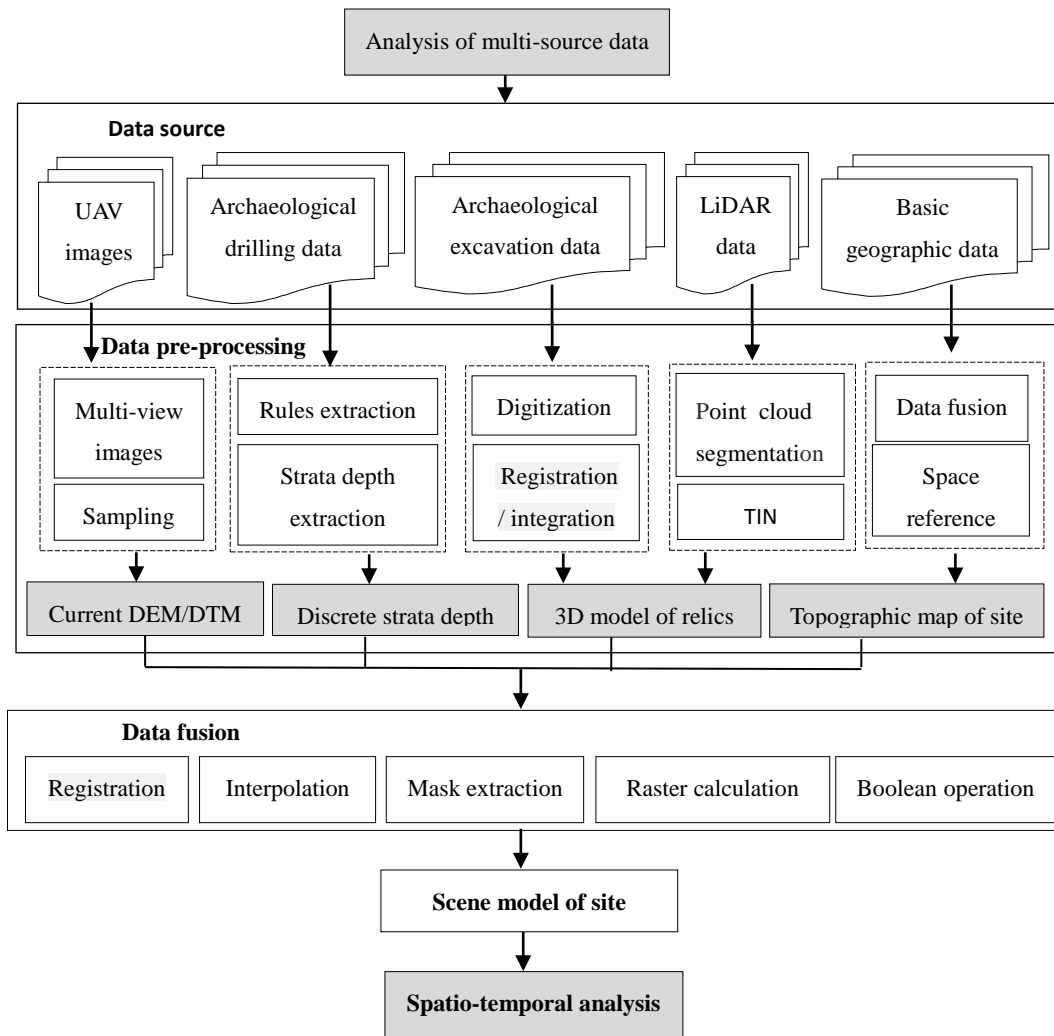
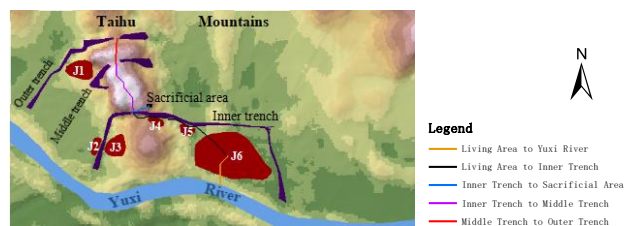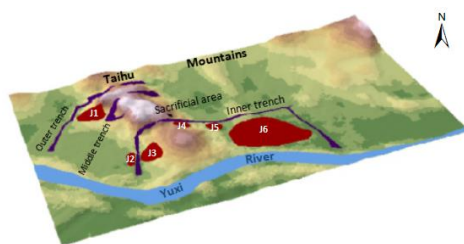Figure1. The fusion method of multi-source data

Figure 2. Geographical Scene of Lingjiatan Site   Figure 3. Optimal paths of several typical relics