MATHEMATICAL TOOLS FOR DATING AND DOCUMENTATION IN ARCHAEOLOGICAL SCIENCE: SERIATION AND PHOTOMETRIC STEREO SHAPE RECONSTRUCTION

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Résumé

Two important aims of the archaeological investigation are to date excavation sites on the basis of found objects for determining their relative chronology, and to construct virtual reconstructions of rock art engravings or bas-reliefs.
A mathematical approach to the first issue is the seriation problem, formalized for the first time by Petrie in 1899. A modern formulation for the problem consists of associating a bipartite graph to a set of types and units, e.g., found artifacts and excavation sites. The graph is then analyzed to determine a chronological ordering of the locations under the assumption that the types were produced, or "fashionable", only for a limited period of time. We will outline a spectral method for solving the seriation problem and present some results obtained by a software implementation of the algorithm.

Photometric stereo is a Computer Vision technique that allows recovering the 3D shape of a bas-relief surface from a set of digital pictures taken under different lighting conditions. This technique reconstructs both the shape and the so-called albedo of the surface, that is, its color and texture, and allows the observer to separate one from the other. Data acquisition can be performed by standard photographic equipment, and real-time data processing only requires a laptop computer, thanks to an optimized algorithm. Reconstructions deriving from synthetic and experimental data sets will be displayed.

Mots-Clés: Seriation, Photometric stereo, Dating, Virtual Shape Reconstruction.

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