Highlighting rock types of blocks using surface roughness and colour : the case study of the ancient theatre of Orange (France)

Sophie Viseur*[1], Jeff Allard[2], Marc Panneau[3], Gilles Conesa[1], Alain Badie[4], and Sandrine Borel-Dubourg[5]

[1]Aix Marseille Univ, CNRS, IRD, INRAE, Coll France, CEREGE, Aix-en-Provence, France – Centre Européen de Recherche et d'Enseignement de Géosciences de l'Environnement – France
[2]Institut d'archéologie méditerranéenne ARKAIA – Aix-Marseille Université - AMU – France
[3]Univ Lyon 2, IRAA, A-BIME Aix-en-Provence, France – Institut de recherche sur l'architecture antique – France
[4]CNRS, Aix Marseille Univ, IRAA, Aix-en-Provence, France. – Aix-Marseille Université - AMU – France
[5]CNRS, Aix Marseille Univ, IRAA, Aix-en-Provence, France. – Aix Marseille Université – France

Résumé

The ancient theatre of Orange is one of the best preserved ancient theatres in the world. It was built at the end of the first century BC. Geological analyses showed that different rock types, hence quarries, were used for its construction and archaeologists are interested to map the quarry origin of rock blocks to understand the construction history. Interpreting rock types on all the walls and architectural elements of the ancient theatre of Orange is a daunting task. Moreover, in some places, it might be hard to distinguish facies with naked eye. Thus, we propose an approach for detecting block origin using roughness and texture descriptors. As input data, we used lasergrammetric acquisitions performed from different theatre facades and corresponding to point clouds with RGB attributes. Beyond the chemical differences, facies may visually differentiate by their colour, but also by their contents (e.g., fossils, grains) considering their size (e.g., coarse or fine grains) and their organization (e.g., lamination), which leads to differences in surface roughness. Roughness analysis of natural rocks is not a novel issue and approaches were proposed to classify rock surfaces using roughness descriptors. The proposed approach relies on one of this roughness descriptor. Indeed, an omnidirectional variogram is computed from the local surface variabilities. It is shown that this variogram should follow a power law and using a curve fitting approach of this experimental variogram, it is possible to determine the power value α linked with the fractal dimension d of the surface. These two values α and d represent the roughness descriptors. Second, the well-known Local Binary Pattern (LBP) descriptor is calculated to decipher texture changes using different colour components (e.g., RGB, Lab, HSV) in order to minimize effects of shadows, for instance. By combining these descriptors with a segmentation algorithm, it could be possible to map blocks sharing similar characteristics. The proposed approach was applied on different parts of the point cloud data and the results will be shown.

*Intervenant

Mots-Clés: geoarcheology, surface roughness, Local Binary Pattern, Pattern recognition