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M3DEA - A new diagnostic imaging model (DIM) for Measuring 3d surface recession as a tool for the quantification of heritage damage & for the Development of custom rEmediation strAtegies: The Trajan's Column in Rome, Italy

We are aware that global climate change and its consequences are a pressing concern, and that heritage monuments are particularly sensitive and increasingly vulnerable. The comparison between photographic reports on monuments and historical copies reveals at a glance the surface transformations over short periods, with severe impact on details readability. M3DEA offers an overarching strategy for the development of a new Diagnostic Imaging Model (DIM) which aims to quantify the stone recession rate in carbonate rocks by comparing high-resolution 3D reconstructions obtained from the Trajan's Column in Rome (113 A.D., Italy) and those obtained from its historical replicas (1667-1670, 1861-1862, 1939-1943) and photographic reports realized during a major last century restoration work (1980-1990). M3DEA proposes a risk assessment approach that i) combines laboratory tests, on-site surveys, and 3D modelling to provide quantitative indicators highly representative of potential climate change effects on long-time scale, based on multi-scale phenomena from the current state of decay and historical climate data; ii) identifies the main environmental stressors and refine the dose-response functions (DRFs) in order to foresee future deterioration patterns with reliable simulations according to the Intergovernmental Panel on Climate Change (IPCC) scenarios (e.g., to years 2050, 2100); iii) considers the loss of surface material in relation to a hierarchical classification of geometrical features and converts stone recession in terms of Loss of Details (LoD), which will be further elaborated as to decline of Future Cultural Value (FCV) with 3D visual projections; iv) develops a DIM suitable to be implemented on a larger scale. M3DEA aspires to raise awareness on cultural heritage vulnerability and to support custom remediation strategies for specific stone surface features and climate conditions providing a useful tool to be used in preservation plans of historical areas.