AI-driven acoustic monitoring of laser cleaning interventions

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Laser-assisted selective removal of altered and unwanted crusts and coatings from heritage surfaces is a particularly delicate procedure which urges for refined and reliable monitoring protocols. This gets particularly important in the case of encrustations that show similar physicochemical properties to the underlying authentic surface. Thus, self-limiting laser ablation cannot be guaranteed, as for example the removal of aged varnish films from painted surfaces [1]. Among the different analytical methodologies to follow in real-time the ablation process, the monitoring of acoustic signals produced upon laser-assisted material removal, has been found to be remarkably straightforward and promising [1, 2, 3].

This paper reflects feasibility studies to follow online laser cleaning through the recording of the intrinsically generated acoustic waves during the process and the use of AI algorithms to predict the outcome of the next laser pulse, justifying the decisions taken on the continuation or the suspension of the ablation process. Laser cleaning was undertaken using infrared (1064nm) ns pulses emitted from a QS Nd:YAG laser on model plates. of marble covered with black graffiti films of varying thickness. Irradiation tests with various parameters related to over-, under- and optimum cleaning outcomes are studied on the basis of acoustic monitoring in order to determine the critical AI-indicated thresholds.

References:

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