In this paper we describe the devices and the methods for imaging analysis and 3D survey of artworks developed at INOA, in collaboration with OPD, and the results obtained on Pisanello’s “Portrait of Lionello d’Este”.

The portrait of Lionello d’Este is one of the most famous paintings of the Italian Renaissance because of its dynastic and profane imagery. It was painted in a very particular and rich technique, using many glazes and metal leaves and probably an oil medium for the flesh tones (which is very unusual in Italy in the period). Recently some concerns arose about its state of conservation. At a closer look the painting surface displays a great deal of problems, due mainly to the conditions of the wooden support. In fact, in the past the panel was severely damaged by an attack of woodworms. At present the main damages seem to be concentrated on the lower edge of the support, but the fact that the upper edge was removed (and substituted by a modern addition of composite wood) gives a clue of the massive attack suffered. The addition of the above mentioned strip of modern wood on the top, caused other problems to the original support because of the interaction between the two materials and their different reactions to the humidity/temperature levels.

All these problems affect at a great extent the ground layers and the paint film: woodworms galleries are very close to the paint film and cause a very dangerous instability of the painting as a whole. In addition to those very serious problems, the painting has been widely restored in the past, disregarding its very fragile technique. The flesh tones are abraded, many of the final glazes were removed during past hard cleaning processes and part of the background was thinned as far as resulting in a very removal of the layers, determining a lower level of the surface in such areas. All the background was then repainted in black, changing dramatically the aesthetic impact of the portrait.

In order to focus on the main problems of the painting and to plan the restoration treatment, several investigations have been carried out on it. We present hereafter the 2D and 3D optical diagnostic methods developed at INOA and applied in this case.

2D imaging techniques are generally considered well suited for the analysis of easel paintings, which mostly are nearly-flat objects. Such techniques generally consist in exposing the object to a given electromagnetic radiation, collecting the radiation either reflected or emitted by it, and processing the data so returned. Depending on both the spectral characteristics of the source used and the spectral sensitivity range of the detector, such 2D representations may provide information, e.g., on the underdrawing, on the techniques and the materials used, whether original or not, on the state of conservation or the conservation history of the artwork.
The imaging techniques developed at INOA and presented in the paper are IR reflectography\(^1\), UV fluorescence\(^2\), false colour\(^3\), RGB\(^4\) and multispectral\(^5\) colour imaging. 3D techniques have been applied till now chiefly to the analysis of statues, buildings, archaeological findings etc, while they have been only rarely applied to paintings, whose “flatness” deserved, until recently, little attention. However, thanks to the recent development of highly accurate devices, the 3D scan of painting surfaces is currently able to resolve even very fine details, providing important information on the surface condition, which is impossible to obtain and quantify otherwise. The INOA 3D devices for painting diagnostics hereafter presented are: laser scanning profilometry\(^6\) and conoscopic micro-profilometry\(^7\).

![Figure 1. (a) RGB colour image, (b) IR reflectogram, (c) 3D surface model.](image)


