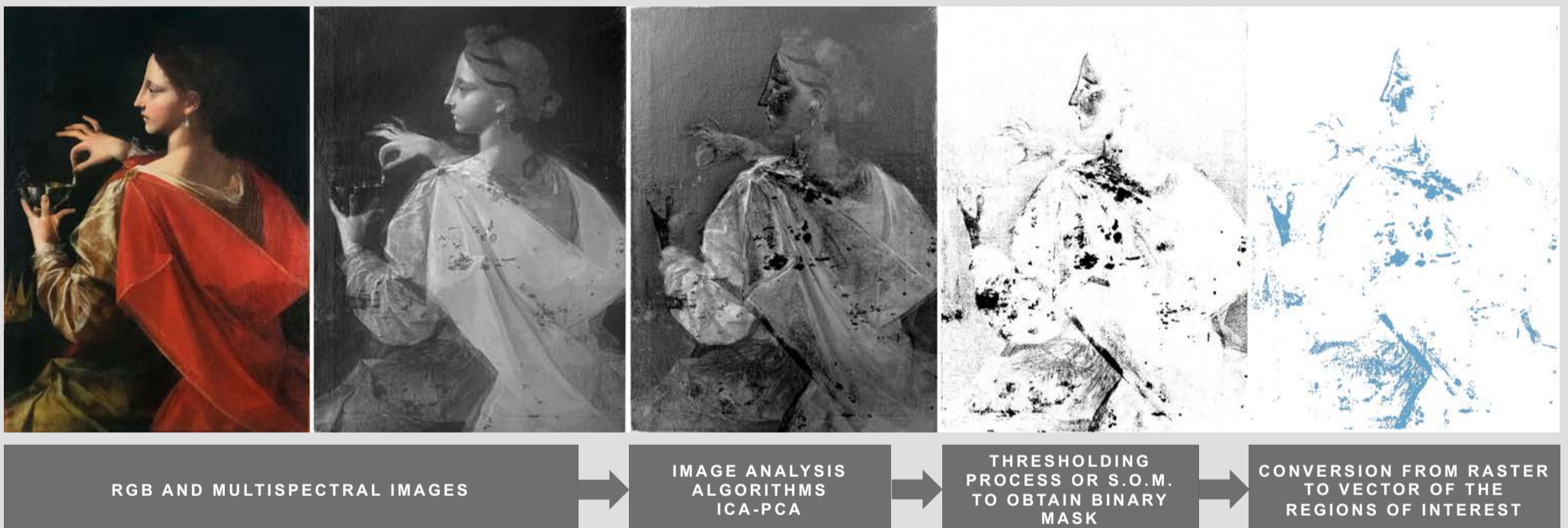


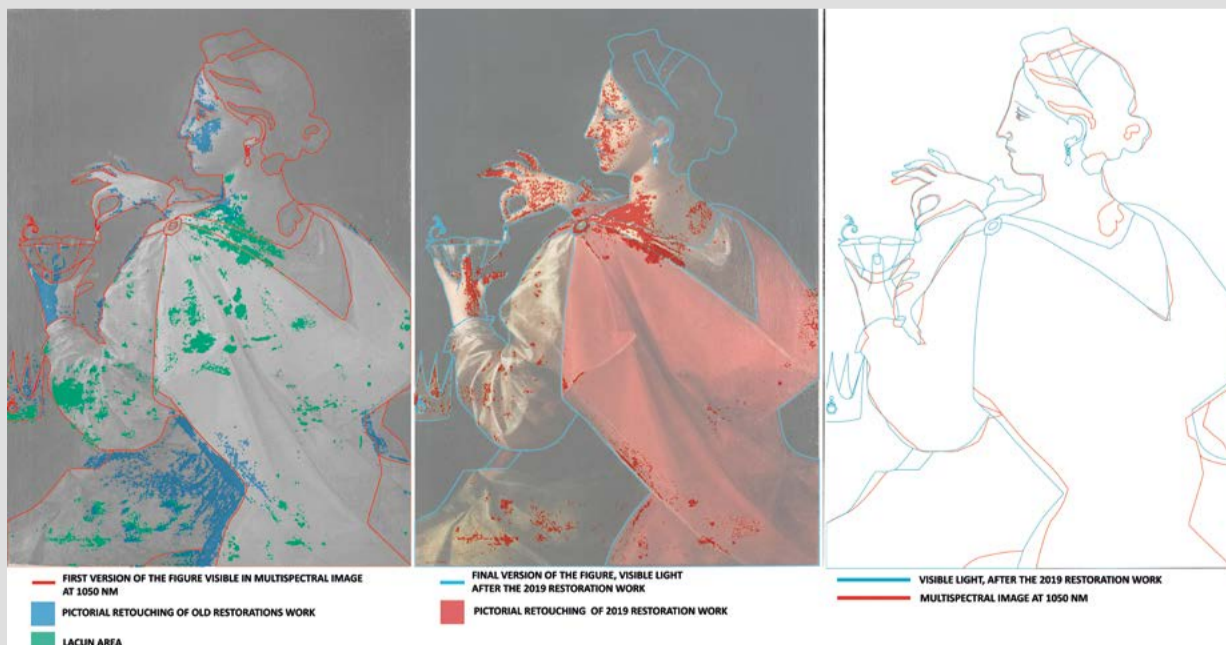
COLOR SEGMENTATION ALGORITHMS TO SUPPORT AUTOMATISM OF GRAPHIC DOCUMENTATION IN RESTORATION.

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All the disciplines connected to restoration have always shown a deep need to achieve a wide understanding of the object of interest, in order to develop a greater awareness of the actions needed and to perform in the full respect of its features. Diagnostic investigation and graphic design are the main tools the restorer operator uses to turn this dialogue into a process of representation where the design acts like a precise language responsible for synthesizing and plainly describing all the information. Our methodology starts with multispectral imaging coupled with segmentation algorithms for the automatic extraction of regions of interest (ROI) from raster images. Thanks to their different optical behavior, we can isolate different areas of the painting that are attributable to its executive and restoration history. These areas, each corresponding to specific information, are then used for the representation and description of the edge and the area of the regions, producing outputs with vector attributes derived from the raster images. The methodology described above has been applied on a canvas depicting queen Cleopatra, attributed to Donato Creti. The last restoring intervention executed on the artwork is from 2019, during which the restorers have discovered several pictorial remakes, some executed by the artist himself and others executed after his death by unknown artists or restorers.



In our case study, we assume the 9 channels representative set of multispectral image as input data, and apply three processing strategies: Independent Component Analysis (ICA), Symmetric Whitening (SW) and Principal Component Analysis (PCA), thus obtaining 27 output images in which we try to locate the regions of interest. The final result is to obtain binary masks to eliminate excessive noise and keep the edges of regions of interest clean, therefore we have applied the neural networks self-organizing map (SOM), a thresholding process and finally raster to vector conversion.



THEMATICS MAPS, are the main tool for communication and synthesis of the data collected, are formed by two graphically distinct models using different textures and colors and associated with a legend

- ARTWORK MODEL** is the graphic representation of the shape of the artwork and its figurative symbology.
- INFORMATION MODEL** is the graphically describes the information regarding historical conservative data identified by spatially and dividing them into categories and classes.

THE EXTREME PRECISION OF THIS TRANSCRIBED IS A FEATURE MADE POSSIBLE BY THE AUTOMATIC METHODOLOGY WE PROPOSE HERE

With this methodology, we have identified three distinct moments in the history of the opera in question and we have been able to map and document much more quickly and accurately than those of the current manual graphic documentation methodology. We are also studying to implement this methodology in open source software, in order to combine all operations into an easy to use toll for restorers.