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The Dataset of Paintings from the Pompeii Archive: a task of the RePAIR Project

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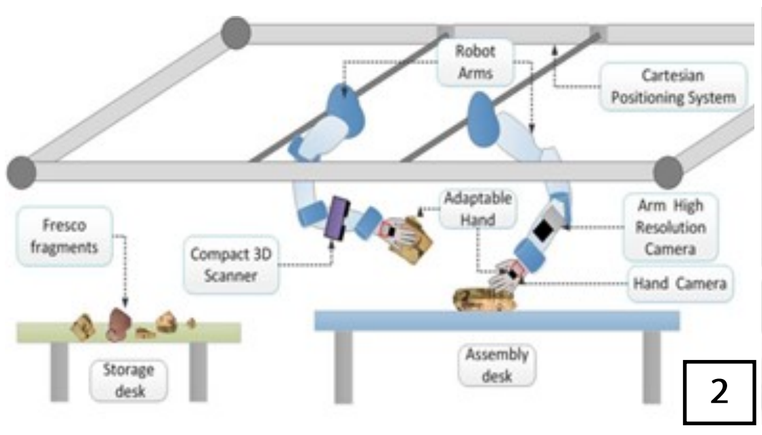

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RePAIR

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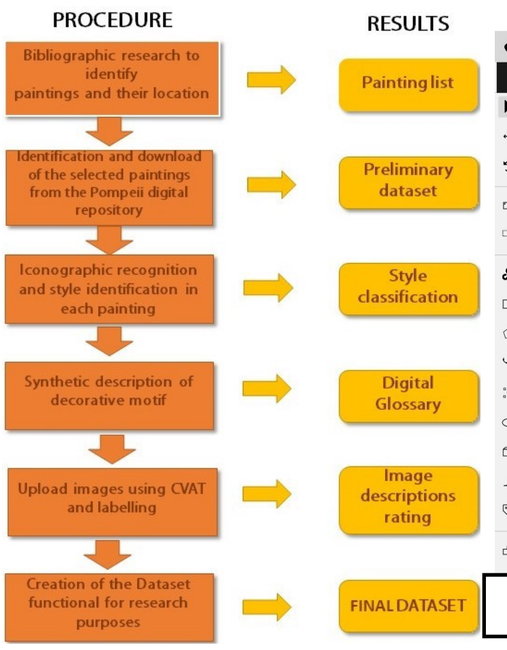
The RePAIR project aims to develop an intelligent robotic system (**Fig. 1-2**) that will autonomously process, match and physically assemble large fractured artefacts in a fraction of the time it takes humans. The level of ambition of the RePAIR project poses several challenges that cannot be satisfactorily addressed with off-the-shelf technologies, and hence brand-new solutions will be developed to push the boundaries of research in the fields of robotics and computer vision. The system will be tested using fragments of the ceiling frescoes found in the House of the Painters at Work in Pompeii (**Fig. 3**). The processing and preparation of frescoes from images in the Pompeii archive involved annotating whole frescoes according to the traditional conventions of the four styles of Pompeian painting, as well as the identification and annotation of separate motifs within each of them (**Fig. 4**). References from bibliographical sources are used as a first step in the methodology to select the wall painting. Then, the selected paintings are searched for within the digital archive of the Archaeological Park of Pompeii: a repository of high-resolution orthophotos of the wall paintings from Pompeii. The aim of the work is to describe recognisable decorative elements present in 400 photos of Pompeian paintings that will comprise the dataset used by the artificial intelligence. The selected images are then divided into groups following the four styles.



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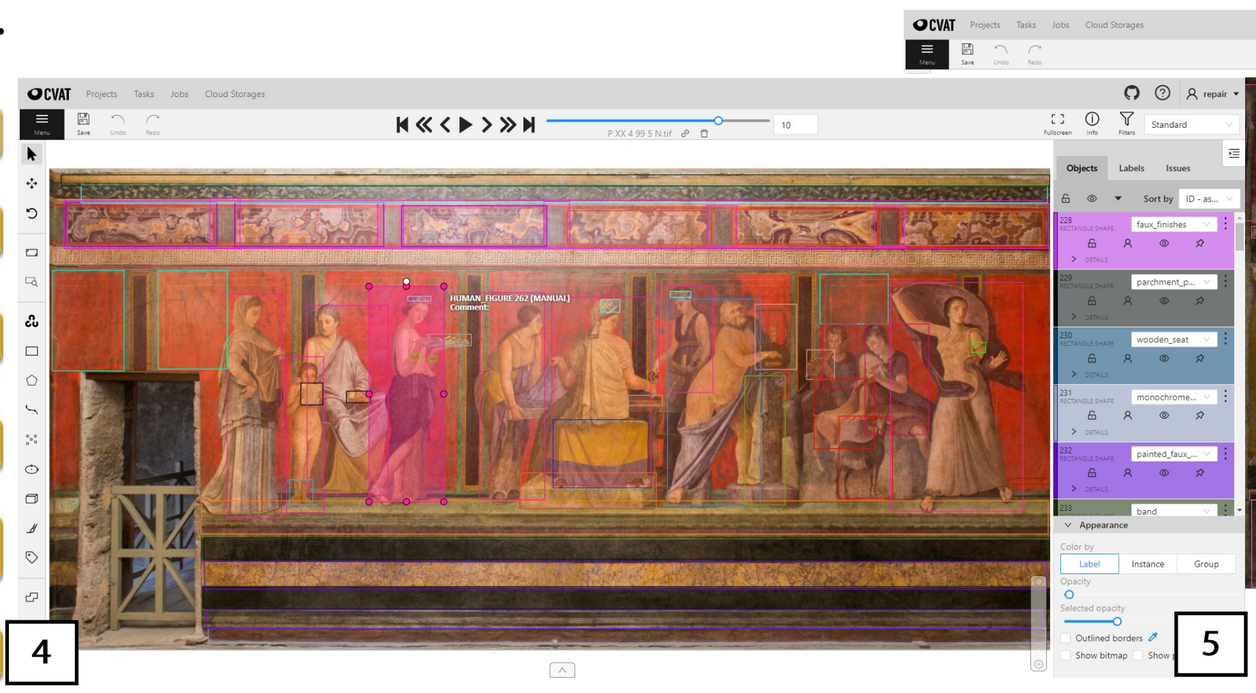

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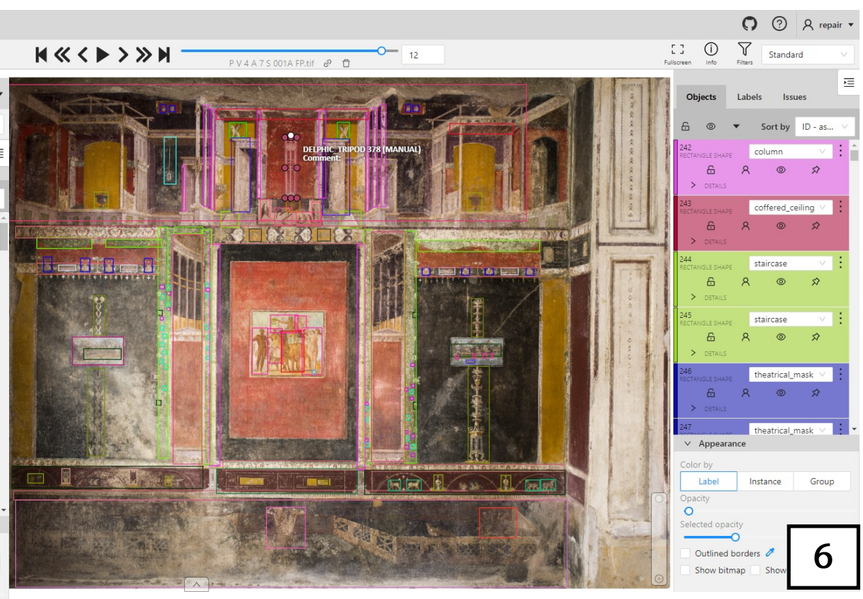

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This subdivision is followed by the first description of the paintings. To perform this task, we used Computer Vision Annotation Tool (CVAT) (**Fig. 5-6**), an open-source web-based tool designed for annotating digital images and videos. CVAT is particularly useful for its user-friendly interface, collaborative features, and ability to handle large datasets. We mark motifs interactively with a bounding box and then select one of the designated descriptive labels associated with this box. The list of iconographic motifs used in the inventory corresponds with the labels of CVAT which define each decorative element in the image. The labels were chosen on the basis of the form of the motif and the nomenclature used is an open, modifiable and constantly expandable vocabulary. By seamlessly combining digitisation, robotics, and artificial intelligence, this project showcases their vast potential in enhancing archaeological research and restoration efforts. Additionally, a comprehensive glossary is being developed, enriching our understanding of fresco-related concepts and terminology. The dataset's versatility and adaptability are key aspects, allowing it to be replicated and customised for a diverse range of scientific research. This outcome establishes a robust basis for future research projects that harness the power of artificial intelligence.