- DC8 PhD subject -
MSCA ITN EU UNVEIL

https://unveil-dn.eu/

General information

PhD in information science
Location : Paris et Gif-sur-Yvette
Date of publication : 4 march 2026

Application deadline: 26 April 2026
Contract type : CDD CNRS EU ITN PhD
Duration : 36 mois
Starting date: 1 octobre 2026
Salary : between 3760 euros and 4420 depending on family situation
Section(s) CN : Sciences informatiques : signaux, images, langues, automatique, robotique, interactions, systèmes intégrés matériel-logiciel

Work informations

UNVEIL is a **Marie Skłodowska-Curie Doctoral Network** linking 21 academic, cultural, and industrial partners to develop advanced nondestructive evaluation and data-driven digital tools for paintings and 3D artworks (https://unveil-dn.eu/). The goal is to understand how objects are built and age and to support conservation, restoration, and authentication—while training 12 doctoral researchers across engineering and the humanities.

We combine terahertz, ultrasound, infrared thermography, hyperspectral/multispectral, and X-ray imaging with multimodal data fusion, interactive visualisation, and digital twins. Results are validated on mock-ups and artworks, showcased via AR exhibits at partner museums, and shared openly (data, software, DTs) through European platforms.

The Centre for Research and Restoration of the Museums of France in Paris (C2RMF), in collaboration with the SATIE (Systèmes et Applications des Technologies de l'Information et de l'Energie) and the Centro per la Conservazione ed il Restauro dei Beni Culturali “La Venaria Reale” (CCR) in the province of Turin, invites applications for 3-year full time early stage Researcher (DC8) position in pigment identification in the context of the EU-funded Marie Sklodowska-Curie Initial training network (ITN) project entitled UNVEIL.

The position will be based in France, at the C2RMF in Paris, and SATIE in Gif-sur-Yvette (near Paris). The PhD Enrollment is Université ED STIC (Sciences et

Technologies de l'Information et de la Communication, ED#580). Collaborations with the firm Profilocolore in Roma and the CCR near Turin are planned.

The C2RMF is the national research centre in France responsible for the research, conservation and restoration of the items held in the collections of the French museums (https://c2rmf.fr/). C2RMF also carries out extensive scientific studies and data recording for these collections, and is active both nationally and internationally in the field of cultural heritage conservation and analysis. The C2RMF is involved in the development of technologies and scientific procedures employed in the preservation of artworks and artefacts, both on its own and in partnership with other museums and research institutions across the globe. The recruited researchers will work in a professional environment in the domain of conservation, restoration and research on cultural heritage, the C2RMF. During their 36 month contract the researchers will be based in the imagery team and in close collaboration with the other departments of the center as well as other partners from the UNVEIL project all around Europe.

SATIE is a joint research unit (UMR CNRS 8029) bringing together researchers, engineers and doctoral students across a broad spectrum of electrical engineering topics, including electronics, electrical energy systems, signal processing, and emerging interdisciplinary fields. The laboratory maintains strong academic and industrial partnerships. Within SATIE, the SICOIA research group, located in Gif-sur-Yvette, develops both theoretical and applied methodologies in Data and Image Analysis, Computational Imaging, Statistical Learning, Uncertainty Quantification, Robust Estimation, and Deep Neural Networks. The group combines expertise in stochastic modeling, Bayesian inference, data fusion and modern machine learning. Its research activities span various application domains such as security, non-destructive testing, infrared imaging and cultural heritage analysis. SICOIA offers a stimulating scientific environment with access to high-performance computing resources within the Paris-Saclay ecosystem.

The Centro per la Conservazione ed il Restauro dei Beni Culturali "La Venaria Reale" (CCR) is a conservation centre dedicated to cultural heritage and managed by a non-profit Foundation established by the Italian Ministry for Cultural Activities, the Piemonte Region, the University of Turin, the Fondazione per l'Arte of the Compagnia di San Paolo, and the Fondazione Cassa di Risparmio di Torino. Over time, additional institutions have joined the original founders, including the Metropolitan City of Turin, the City of Turin, and the City of Venaria Reale (https://www.centrorestaurovenaria.it/eng/). The CCR has nine conservation laboratories organized into specialized workshops: wooden furniture; contemporary art; paper and photography; mural paintings, stone materials, and construction sites; panel paintings; paintings on canvas; metals, ceramics, and glass; wooden sculptures; fabrics, tapestries, leather, and carpets. Conservation activities are carried out on behalf of the founding institutions as well as other public and private

bodies. The CCR hosts scientific laboratories dedicated to photographic and 3D documentation, multiband imaging, scientific analysis, and environmental monitoring for cultural heritage. These facilities support both the study of artworks and the development of conservation and restoration strategies.

In collaboration with the University of Turin, the CCR hosts the Master's Degree Course in Conservation and Restoration of Cultural Heritage, which trains professional conservators in accordance with Italian legislation (DLgs 42/2004). It has an Advanced Training School (SAF), which organizes and manages training and professional development courses and contributes to the activities of the Master's Degree Course.

Through its integrated approach to conservation, research, and training, the CCR promotes the development of professional skills and fosters employment opportunities in the field of cultural and environmental heritage at both national and international levels.

Main supervisor(s):

- Dr Clotilde Boust (C2RMF & CNRS-SATIE)
- Prof. Sylvie Le Hégarat-Mascle (Université Paris-Saclay / CNRS-SATIE-SAC)
- Assoc. Prof. Aurélia Fraysse (Université Paris-Saclay / CNRS-SATIE-SAC)

Co-supervisor: Dr. Tiziana Cavaleri (CCR)
Referee: Gui Yun Tian (Newcastle University)

Planned secondments

- Year 2 : 3 months at the CCR (Venaria Reale, province of Turin) for training on optical and chemical analysis.
- Year 3 : 3 months in Roma with Profilocolore Firm for training on HMI and methods for classification and comparison of different techniques.

Research PhD subject

Title: Uncertainty-aware multimodal learning for pigment mapping: joint X-Ray Fluorescence & Hyperspectral data fusion

Project overview:
In the context of museum artwork conservation (2D and 3D such as paintings, photographs, sculptures…) where material identification plays a crucial role, this PhD will focus on material and pigment identification. The research aims to develop a data-efficient and uncertainty-aware framework for pigment mapping in Cultural Heritage. Heterogeneous spectral and imaging data from different sensors will be

jointly exploited, including X-ray fluorescence (XRF) and optical reflectance and fluorescence imaging (hyperspectral/multispectral).

The primary objective is multimodal unmixing, i.e., estimating pigment abundances at each location under scarce supervision and strong domain shifts across sensors and artworks. Pigment identification can then be derived from the unmixing outputs (endmember presence and abundance distributions), while optional auxiliary classification objectives may be introduced to stabilize training.

The research will explicitly account for modality-specific mixture formation laws: XRF mixtures can often be approximated by (quasi-) linear mixing in appropriate representations, while optical spectral mixtures are commonly approximately described by Kubelka–Munk theory or related radiative transfer approximations. These physical laws will guide model design, constrain the latent space, and improve interpretability.

The main research axes will be:

1. Multimodal data acquisition, preprocessing, and cross-modal alignment: Development of painted mock-ups in controlled conditions, acquisition of multimodal datasets (XRF and optical spectral imaging), and design of robust preprocessing and cross-modal registration pipelines. *This axis provides the experimental foundation and enables quantitative evaluation.*
2. Representation learning with physics-guided data augmentation and adaptation: Design of self-supervised learning strategies to learn shared and modality-specific embeddings, using physics-inspired data augmentations and mixture models (linear/quasi-linear behavior for XRF; non-linear Kubelka–Munk-inspired transformations for optical imaging) to regularize training and improve robustness under domain shifts (across artworks and sensors). *This axis aims to obtain stable, transferable representations despite scarce labels, heterogeneous sensors, and varying imaging conditions.*
3. Multimodal unmixing, uncertainty quantification, and adaptive fusion: Development of multimodal unmixing models to estimate pigment abundances, combined with uncertainty-aware mechanisms for dynamic modality weighting, open-set rejection, and calibrated confidence maps for expert interpretation. *This axis delivers physically meaningful pigment abundance maps and trustworthy fused outputs for conservation scientists*

Expected Results:
1) A multimodal dataset combining controlled mock-ups and selected artworks, with standardized acquisition and documentation protocols; 2) A set of algorithms for multimodal representation learning and data fusion tailored to Cultural Heritage imaging; 3) A robust unmixing and pigment-mapping workflow producing

interpretable abundance maps, allowing conservators and imaging scientists to apply the developed methods to new artworks.

Candidate profile

Applicants should hold a Master's degree in optics, physics, computer vision, deep learning, or a closely related discipline, obtained with a strong academic record.

Eligibility for admission will be determined based on the combination of academic qualifications and relevant professional experience. The selected candidate must be eligible for enrolment in the PhD programme at Université Paris-Saclay.

Candidates should demonstrate:

• Strong motivation for scientific research
• Interest in cultural heritage and conservation science
• Ability to work both independently and within an interdisciplinary international team
• Strong analytical and problem-solving skills
• Excellent written and oral communication skills in English
• Ability to meet deadlines and produce high-quality work
• Motivation to disseminate research results through scientific publications and international conferences

MSCA eligibility criteria (mandatory)

Applicants must fulfil the Marie Skłodowska-Curie Doctoral Network eligibility requirements :

• At the date of recruitment, the candidate must not have been awarded a doctoral degree.
• Applicants must comply with the MSCA mobility rule: they must not have resided or carried out their main activity (work, studies, etc.) in France for more than 12 months during the 36 months immediately prior to recruitment. Short stays such as holidays are not taken into account.
• Researchers of any nationality are eligible.
• The selected candidate will be recruited under a full-time employment contract as a Doctoral Candidate and must enrol in the PhD programme at Université Paris-Saclay.
• The researcher will work exclusively on the UNVEIL project during the duration of the contract.

Further information on MSCA eligibility rules:
http://ec.europa.eu/research/mariecurieactions

Salary and benefits

This position is funded by the Horizon Europe Marie Skłodowska-Curie Doctoral Networks programme. Doctoral Candidates will be recruited by CNRS under French employment regulations. The remuneration follows MSCA funding rules and includes:

• Living allowance: approximately €4,735 gross per month (before employer deductions)
• Mobility allowance: €710 per month
• Family allowance: €660 per month (if applicable)

The final net salary depends on national taxation and social security regulations in France.

What we offer

Joining UNVEIL means becoming part of a prestigious European doctoral network. The selected candidate will benefit from:

• A 36-month fully funded PhD position
• A prestigious EU fellowship (MSCA Doctoral Network)
• An international, interdisciplinary and intersectoral research environment
• Access to cutting-edge imaging technologies and computational resources
• A structured doctoral training programme, including network-wide schools and workshops
• International secondments in academic, industrial and cultural heritage institutions
• Opportunities to develop scientific, technical and transferable skills
• Participation in international conferences and training events

Equal opportunities

The recruiting institutions are committed to equal opportunities and diversity in employment. Applications from candidates of all backgrounds are welcome, and we particularly encourage applications from underrepresented groups in research.

To apply

Send an email with explicit subject (e.g Application for ITN-UNVEIL-DC8) with a transfer link to all required documents (cf. application components above) compiled in one PDF file to the email addresses :
clotilde.boust@culture.gouv.fr
sylvie.le-hegarat@universite-paris-saclay.fr
tiziana.cavaleri@ccrvenaria.it

Application components, all documents must be translated in English :

- Curriculum vitae. Include if there any relevant publications and the names and contact information of 2 references.
- Copies of academic certificates with detailed grades.
- Motivation letter.
- A brief research proposal addressing the topic of the research project (1 or 2 pages).

For additional information about the research project, contact main supervisors: clotilde.boust@culture.gouv.fr and sylvie.le-hegarat@universite-paris-saclay.fr

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