



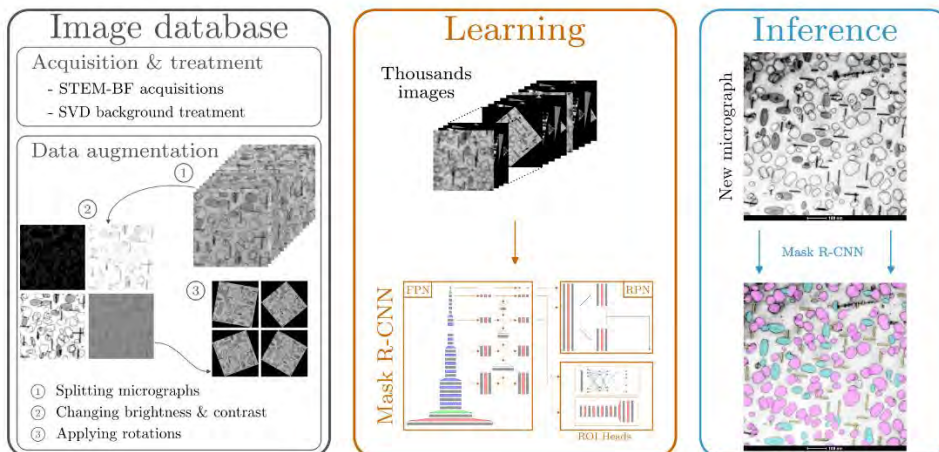
**Three years position at SRMP,
University Paris-Saclay, CEA:
Accurate identification and characterization of defects in
materials enabled by deep learning image analysis**

A three-year position is open at the *Section de Recherches de Métallurgie Physique (SRMP)* at CEA Paris-Saclay, starting in March 2024. SRMP is a part of Department of Research on Materials and Physical Chemistry (DRMP), which is responsible for understanding and advancing knowledge in physico-chemical processes related to material science and engineering in extreme environments and for low-carbon energy applications. The SRMP, Physical Metallurgy Research Section of Service of Corrosion and Material Behavior Research (S2CM), specializes in materials science, bringing together theoretical, numerical, and experimental approaches and leveraging them with AI-based methods in order to address the challenges in nuclear and renewable energy innovations.

Scientific context and goals. Transmission electron microscopy (TEM) allows detailed study of materials at the atomic scale, revealing defects and structures. Many objects such as voids, second-phase precipitates, stacking fault tetrahedra, and radiation-induced segregation on grain boundaries or dislocation loops etc can be seen in a TEM micrograph, leading to complex and numerous data. Manual analysis is error-prone and time-intensive. While semi-automatic methods have limitations, artificial intelligence offers a tailored solution for analyzing these complex images. For two years, we have been working on a workflow designed for TEM analysis using deep learning tools (figure below). The new recruit will create a workflow that incorporates previous work and new advancements. Two main areas are addressed: first, using computer vision and deep learning like Yolo and Mask R-CNN for TEM image analysis to detect, track, follow and classify objects; and second, employing TEM tomography to generate 3D visualizations from multiple angled images, a task made efficient by our novel segmentation approach using a convolutional auto-encoder. Finally, great attention will be given to the database design of the experimental information.

Required skills. We are looking for a motivated candidate with a Ph.D. in materials science, physics, or a related field, who possesses strong proficiency in Python programming. Prior experience in transmission electron microscopy (TEM) analysis is highly regarded. Notably, our department houses a variety of TEM instruments, including the double-Cs corrected Jeol Neo ARM, which will be accessible to the candidate.

How to apply. Please send your application, including a motivation letter and a complete CV with references that we may contact, to both Mihai-Cosmin Marinica (mihai-cosmin.marinica@cea.fr) and Estelle Meslin (estelle.meslin@cea.fr). The application deadline is December 30, 2023.



General workflow for dislocation loops segmentation by a Mask R-CNN [T.Bilyk, et al., 2023 (submitted)]