Type d'offre : Laboratory offer

Post date : 14.11.25

Laboratoire IBISC (Université Evry Paris-Saclay)

Internship Offer "High-Resolution Generation of Multi-Sensor Signals"

Informations générales

Contract type : Stage

Contract length : 6 months

Contact :

Thomas Sendra / **Vincent Vigneron**

Starting date : Sun 01/02/2026 - 12:00

Trade : Technicien

Topic : Analyse et traitement d'images

Laboratoire IBISC (Université Evry Paris-Saclay) :

Research conducted at the IBISC laboratory focuses on the modeling, design, simulation, and validation of complex systems, whether living or artificial. The laboratory is organized into four teams (AROBAS, COSMO, IRA2, SIMOB), enabling two cross-disciplinary research areas to be defined: ICT & Life Sciences (computational biology, bioinformatics, personal assistance, signals and images for biomedicine) and ICT & Smart Systems (autonomous and intelligent systems, open and secure systems). IBISC not only has platforms referenced and supported by Genopole: EVR@ (Virtual and Augmented Reality Environments) and the EvryRNA bioinformatics software platform, but also various platforms related to intelligent systems: two-wheeled vehicles, drones, robots.

Détail de l'offre (poste, mission, profil) :

Theme / Domain / Context

- **Keywords:** deep learning, multimodal imaging, generative models, non-destructive testing, multi-sensor signals
- **Partner Laboratory:** IBISC (University of Évry – Paris-Saclay)
- **Duration:** 6 months
- **Period:** from February 2026 onwards (flexible depending on candidate profile)

Scientific and Industrial Context

Non-destructive testing (NDT) encompasses a set of techniques used to assess the integrity of industrial components without altering their structure. Among these methods, ultrasonic imaging plays a central role: acoustic waves are transmitted through the material, and the reflected signals (echoes) are analyzed to detect and

characterize possible internal defects (cracks, inclusions, delaminations, etc.). These signals are then converted into 2D/3D images, enabling detailed inspection of the components.

However, a major challenge persists: the scarcity of real-world data, particularly for critical or rare defects. This class imbalance significantly limits the performance of supervised learning models, which require large quantities of diverse and representative data.

To address this limitation, the scientific community is increasingly exploring the generation of realistic synthetic data using deep generative models (GANs, VAEs, diffusion models, etc.). In the NDT field, this approach remains largely unexplored, especially for the conditional generation of multi-sensor signals (ultrasound, eddy currents, thermography, etc.), where inter-modal correlations are complex.

Internship Objectives

The overall objective of this internship is to develop a generative model capable of producing realistic, high-resolution multi-sensor signals, thereby artificially augmenting training datasets and improving the performance of defect detection models.

More specifically, the work will involve several components:

1. State-of-the-Art Review

- Survey of existing approaches for data generation in NDT and multi-sensor signals
- Analysis of modern generative methods (GANs, VAEs, diffusion models, conditional generative models, etc.)
- Exploration of evaluation strategies for assessing the realism of synthetic data (FID, Inception Score, perceptual metrics, physical measurements, etc.)

2. Design and Improvement of a Generative Model

- Implementation or adaptation of a conditional generative model to produce signals from physical or contextual parameters (defect type, material, geometry, frequency, etc.)
- Investigation of high-resolution upscaling and inter-sensor consistency (coherence across various types of simulated measurements)
- Comparison of different architectures (GAN, diffusion models, etc.) and conditioning strategies

3. Experimental Evaluation and Validation

- Definition of quantitative and qualitative metrics to assess the realism and relevance of generated signals
- Evaluation of the impact of synthetic data on the performance of detection or classification models

Proposed Methodology

The approach will rely on state-of-the-art generative models, particularly diffusion models, which have recently become the reference standard for generating complex signals and images.

A preprocessing phase for real data (filtering, normalization, temporal/spatial segmentation) will be required prior to training. Controlled experiments will be conducted to compare synthetic signals with real data on internal or public datasets, in collaboration with laboratory partners.

Candidate Profile

Educational Background: Master’s 2 student or final-year engineering school student specializing in artificial intelligence, signal processing, computer vision, or industrial computing.

Required Technical Skills:

- Strong foundation in machine learning and deep learning
- Proficiency in Python programming
- Practical experience with PyTorch or TensorFlow
- Knowledge of signal processing or scientific imaging
- Technical English (reading and writing scientific papers)

Personal Qualities:

- Scientific curiosity and autonomy
- Strong analytical and synthesis skills
- Proactive mindset and enthusiasm for experimental research

Work Environment

The internship will take place at the IBISC laboratory (University of Évry, Paris-Saclay University), within the team dedicated to artificial intelligence applied to signal and image processing. The environment is multidisciplinary, at the intersection of machine learning, sensor physics, and the processing of complex data from

industrial environments.disciplinaire, à l’interface entre apprentissage automatique, physique des capteurs et traitement de données complexes issues d’environnements industriels.

URL de l'offre :

https://www.dataia.eu/sites/default/files/stage_stage_Thomas.pdf

Lien vers l'offre sur le site dataia.eu :https://da-cor-dev.peppercube.org/node/1458