2025 internship offers @CEA List

AI – Deep Learning

Computer Vision – Scene understanding

Crédits : Adobestock

- **S01- Image Editing via Natural Language for Complex Scene Representation**
- **S02- Object detection by parametrization using elementary 3D shapes**
- **S03- Open-Set Object Detection: Can VLM understand all of the unknown world?**
- **S04- Motion Guided Object Discovery**
- **S05- Video Anomaly Detection and Understanding**
- **S06- Develop an MLOps stack**
- **S07- Label Efficient 3D Detection with Foundation Models**
- **S08- Enhancing Visual Reasoning in Vision-Language Models (VLMs) through Dynamic Visual Feature Selection**
- **S09- Multi-view re-identification of objects and individuals based on 3D representation**
- **S10- AI-Driven Data Collection and Continuous Model Improvement for Robotic Applications**

To apply, contact the Laboratory of Vision and Learning for Scene Analysis (LVA) with a CV and cover letter: lva-stages@cea.fr
More details on https://kalisteo.cea.fr/index.php/apply-for-a-job/

S01 - Image Editing via Natural Language for Complex Scene Representation

6-month internship @ CEA List

Internship context

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Missions

This internship focuses on the emerging field of **natural language-guided image editing**, specifically targeting the **generation and modification of complex scenes based on verbal descriptions**. The candidate will work on designing and implementing novel methods that can interpret natural language to manipulate or generate detailed images representing multifaceted scenarios (e.g., crowd scenes, cityscapes, interactions between multiple objects).

This project presents several key challenges, including:

- **Scene Complexity**: Managing multiple objects and their relationships in a scene adds significant complexity. The goal is to **maintain coherence and accuracy** in the edited images, even when the scenes described involve intricate interactions between various elements.
- **Multimodal Integration**: Successfully combining linguistic inputs with visual inputs to obtain visual outputs, is a complex problem requiring seamless interaction between natural language processing (NLP) and computer vision models.

The objectives of this internship are to:

- Investigate current methods for natural language-based image generation and editing of complex scenes;
- Develop an innovative approach for editing complex scenes using natural language descriptions;
- Demonstrate significant improvements in the accuracy and detail of generated images;
- Contribute to academic research through potential publications and/or patents.

Qualifications

- Students in their 5th year of studies (M2)
- Computer vision skills
- Machine learning skills (deep learning, LLM, VLM, generative AI…)
- Python proficiency in a deep learning framework (especially PyTorch or TensorFlow)

Job-related benefits

Join CEA List and LVA as an intern to:

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- Conduct research autonomously and creatively: encouragement to valorize results (scientific articles, patents, open-source codes...)
- Join a young and dynamic team
- Benefit from an internal computing infrastructure with more than 300 state-of-the-art GPUs
- Receive a stipend between €1300 and €1400 per month
- Have the opportunity to continue with a PhD or as a research engineer after the internship
- Have the possibility of remote work, receive a 75% reimbursement on public transportation costs, and benefit from the “mobili-jeune” aid to reduce rent costs…

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S02 - Object detection by parametrization using elementary 3D shapes

6-month internship @ CEA List

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Missions

Computer vision is currently at a turning point, with the convergence of visual, audio and, above all, textual modalities. This convergence is making it increasingly possible to benefit from or pool the knowledge generated by these different modalities. This knowledge is also becoming 'fundamental', meaning that it transgresses the ontologies of databases and seeks to move towards a holistic representation of their field of expertise. To interrogate these fundamental models, it is necessary to use a prompt, which is often text-based. This is the case for object detection with Open Vocabulary detection. However, it is not always simple or practical to describe an object in text only. Describing it using an image, a sketch or a CAD model may be more relevant in certain contexts, particularly in industry.

As an intern at the CEA's Vision and Learning Laboratory, you will help develop innovative technologies for using 3D CAD models as prompts for Open Vocabulary object detection, with a particular focus on object and model shape. You will be ask to :

- Develop zero-shot object detector algorithms using breakthrough neural network technology
- Analyze and summarize existing algorithms then propose realistic development plans.
- Identify and make effective use of the computing resources needed
- Keep environmental constraints in mind and integrate the development of solutions into a responsible approach.
- Collaborate and participate in the exchange of knowledge within the laboratory in order to cultivate the laboratory's scientific excellence.
- Promote the work carried out through communication media, demonstrators and/or scientific publications.

Qualifications

- Students in their 4th or 5th year of studies (M1, M2 or gap year)
- Computer vision skills
- Machine learning skills (deep learning, perception models, generative AI…)
- Python proficiency in a deep learning framework (especially TensorFlow or PyTorch)

Job-related benefits

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S03 – Open-Set Object Detection: Can VLM understand all of the unknown world?

6-month internship @ CEA List

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Missions

- Deep learning models have demonstrated significant success to detect a close set of known annotated classes seen during training. But, how will they behave when **facing up to objects of unknown classes**?
- As their behaviour is uncertain when subjected to never-before-seen classes, we aim to develop **robust Open Set Object Detectors (OSOD)**, able to localise and classify any objects, no matter their classes are **known or unknown during training**.
- It is of paramount importance to ensure safe deployment of AI models as **trustable AI** is crucial in **critical applications** such as autonomous driving. Indeed, one of the most important issues for these applications is the lack of supervisory signals on data not seen in training, which can generate erroneous yet confident predictions on out-of-distribution (OOD) data.

Your missions within this internship are to:

- Study **state-of-the-art** methods of **Open Set Object Detection (OSOD)** as well as **Visual Language Models (VLM)** in the context of Open World containing both known and unknown objects;
- **Design** an object detector aware of the existence of the unknown;
- **Evaluate** the proposed method on recent OSOD benchmarks and compare to the state of the art;
- **Challenge** these methods by applying them to **new contexts** (e.g. aerial images);
- If relevant, submit your contributions to an international conference or workshop for **publication**.

Qualifications

- Students in their 5th year of studies (M2)
- Computer vision skills
- Machine learning skills (deep learning, VLM…)
- Python proficiency in a deep learning framework (especially PyTorch or TensorFlow)

Job-related benefits

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S04 – Motion Guided Object Discovery

6-month internship @ CEA List

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Missions

In recent years, deep learning models have demonstrated outstanding advances for several computer vision applications such as object detection and semantic segmentation. However, to obtain a reliable model, a massive amount of labeled data is needed. As an alternative, several research areas have raised aiming to acquire a good perception capacities with minimal or no annotations. Specifically, **object discovery** delivers instance segmentation **without using any human annotation**.

In this internship, we propose to improve actual object discovery methods leveraging **different semantic concepts** by focusing on **temporal similarities** and using pre-trained features of **foundation models**.

Samples of results of state-of-the-art method for Object Discovery

Qualifications

- Students in their 4th or 5th year of studies (M1, M2 or gap year)
- Computer vision skills
- Machine learning skills (deep learning, perception models, generative AI…)
- Python proficiency in a deep learning framework (especially TensorFlow or PyTorch)

Job-related benefits

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S05 – Video Anomaly Detection and Understanding

6-month internship @ CEA List

Internship context

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Missions

This internship aims to develop **Video Anomaly Detection** (VAD) methods that deal with anomalies requiring **high-level semantic** information. Constraints about **data frugality** and **application-specific** anomalies are additional challenges.

Unlike One-Class approaches, we will assume some abnormal samples can be used in training (**Weakly-Supervised, Few-Shot methods**).

Beyond detecting anomalies, we will also address the challenge of **understanding and explaining** video anomaly by exploiting **Vision-Language Models (VLM)**.

Internship objectives:

- Study **state-of-the-art** of Video Anomaly Detection and Explainability.
- Identify **promising methods** as baselines and perform **experiments on public benchmarks**.
- Propose **improvements** to the baselines and **evaluate**.
- If relevant, submit your contributions to an international conference or workshop for **publication**.

Qualifications

- Students in their 5th year of studies (M2)
- Computer vision skills
- Machine learning skills (deep learning, LLM, VLM, generative AI…)
- Python proficiency in a deep learning framework (especially PyTorch or TensorFlow)

Job-related benefits

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S06 – Develop an MLOps stack

6-month internship @ CEA List

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Missions

In order to develop scene and text comprehension tools, the SIALV laboratory (including the LVA) is developing a number of algorithms for different tasks. These different building blocks have historically been developed in different projects, which has led to compartmentalization between projects and difficulty in sharing knowledge. We would like to implement tools to develop a stack from the data curing to the deployment of machine learning models that are reliable and efficient. Indeed, with the arrival of Foundation models for text and vision, it is now crucial to completely manage an MLOps stack shareable across researchers from data management to training and eventually deploy models.

During this internship, development can occur in various place of the MLOps stack to :

- Train neural networks efficiently on multiple GPUs and multiple computational nodes for different vision and text tasks such as Generative AI (text and image), object detections, Named Entity Recognition (NER)...
- Deploy models internally to make predictions and evaluate models.
- Monitor our models.
- Store our large quantity of data.
- Maintain a model registry to track our experiments and easily deploy our best performing models.
- Visualize and annotate datasets containing multiple modalities (text, image, video, etc.) assisted by AI.
- Solutions to orchestrate, maintain and scale the technical infrastructure in our laboratory

You will also perform technological watch of MLOps tools to find the best languages, libraries or frameworks to perform the missions mentioned above.

Qualifications

- Students in their 4th or 5th year of studies (M1, M2 or gap year)
- Python proficiency and preferably in a deep learning framework (especially TensorFlow or PyTorch)
- Skills in Machine learning (deep learning, perception models, generative AI…)
- Knowledge in orchestration (Kubernetes), containerization (Docker) and in Web Development is a plus

Job-related benefits

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S07 – Label Efficient 3D Detection with Foundation Models

6-month internship @ CEA List

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Missions

In this internship, you will contribute to breakthrough research in areas critical to autonomous driving, robotics, and augmented reality. We are addressing the challenge of reducing reliance on costly 3D annotations by exploring cutting-edge techniques.

As part of our team, you will:

- Leverage vision-language models (VLMs) to enhance 3D detection performance.
- Work on innovative pseudo-labeling techniques to improve model training with minimal labeled data.
- Use 2D and 3D feature integration to improve scene understanding.
- Gain hands-on experience with deep learning frameworks and 3D vision algorithms.

This internship is a fantastic opportunity to dive into the world of AI research and contribute to real-world applications. You will be working on high-impact projects with the potential for publication in top conferences. If you're passionate about machine learning, computer vision, and advanced AI techniques, we encourage you to apply!

Qualifications

- Students in their 4th or 5th year of studies (M1, M2 or gap year)
- Computer vision skills
- Machine learning skills (deep learning, perception models, generative AI…)
- Python proficiency in a deep learning framework (especially TensorFlow or PyTorch)

Job-related benefits

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S08 - Enhancing Visual Reasoning in Vision-Language Models (VLMs) through Dynamic Visual Feature Selection

6-month internship @ CEA List

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Missions

Generative Vision Language Models (VLMs) are designed to integrate text generation with visual contexts, but their performance in tasks requiring complex visual reasoning remains under scrutiny. This internship will focus on enhancing VLMs by using Chain-of-Thought (CoT) reasoning to optimize visual feature selection for text generation.

As part of this internship, your key responsibilities will include:

- Conduct a literature review on VLMs and CoT techniques
- Implement a method to iteratively link reasoning steps to visual features for text generation
- Train and evaluate the model's ability to perform structured visual reasoning
- Compare model performance with and without CoT-driven feature selection
- Develop a dataset to further train VLMs on visual reasoning tasks
- Clearly communicate results to the team, and contribute to academic research through potential publications

Qualifications

- Students in their 4th or 5th year of studies (M1, M2 or gap year)
- Computer vision or natural language processing (NLP) skills
- Machine learning skills (deep learning, generative AI, …)
- Python proficiency in a deep learning framework (especially TensorFlow or PyTorch)
- Scientific research experience will be appreciated

Job-related benefits

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S09 - Multi-view re-identification of objects and individuals based on 3D representation

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Missions

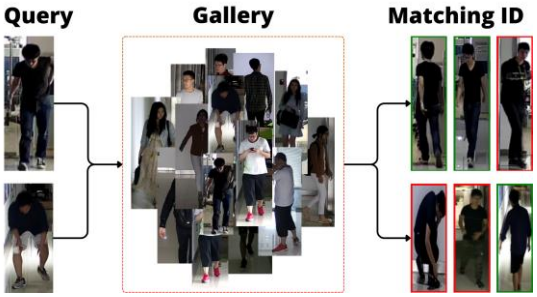
Many monitoring applications, like pedestrian video protection, farm cow monitoring, or team sports analysis, rely on accurate re-identification in camera networks. While re-identification based on appearance details like color and texture has shown good results, the task becomes more complex when recognizing individuals from different viewpoints due to changes in resolution, pose, and lighting.

Otherwise, recent advances in 3D object reconstruction offer impressive results. These new representations of individuals are valuable for re-identification based on 3D understanding.

With this internship, we would like to explore the extension of this research on 3D representations for re-identification, to the use of multiple views of the same object or individual.

Different approaches can be explored during the intership :

- Exploiting multiple images as query or gallery for re-identification during training or inference.
- Explore the concept of multiple view fusion in a unique re-identification representation enriched by each point of view.
- Explore the fusion of 2D images as an implicit multi-view re-id representation vs a more explicit 3D representation leveraging SOTA 3D reconstruction approaches from one or many images



Re-identification principle : Retrieve query individual in a gallery of multiple persons or objects

Qualifications

- Students in their 4th or 5th year of studies (M1, M2 or gap year)
- Computer vision and 3D geometry understanding skills
- Machine learning skills (deep learning, perception models, generative AI…)
- Python proficiency in a deep learning framework (especially TensorFlow or PyTorch)

Job-related benefits

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S10 – AI-Driven Data Collection and Continuous Model Improvement for Robotic Applications

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Missions

This internship will focus on tackling one of the most critical issues in robotics: the scalable collection and curation of high-quality data to train robust AI models for various robotic tasks. This research will aim to leverage advanced AI techniques such as large language models and vision models to automate the processes of task generation, data collection, and data curation.

The deployment of high-performing, robust AI models in robotics, whether for industrial manufacturing or household automation, relies on the availability of diverse and high-quality data. Collecting sufficient data to cover the wide range of tasks and systems that robots might encounter is both time-consuming and difficult to scale. The challenge of this internship will be to address this key bottleneck by exploring methods to automate and enhance data collection and curation, potentially accelerating the deployment of effective AI models in the field of robotics.

During this internship, you will:

- Study and explore techniques for automatic data collection in robotic environments.
- Leverage existing large language models (LLMs) and vision models to automate task generation for various robotic applications.
- Develop methods for data curation and data mixing to improve the quality and diversity of the data used for training robotics AI models.
- Build methods that continuously improve the AI models using the newly generated and curated data, ensuring that the models evolve and become more robust and performant over time.
- Work closely with a team of researchers and engineers to prototype, test, and iterate on solutions aimed at reducing the complexity and cost of data collection in robotics.

Qualifications

- Students in their 4th or 5th year of studies (M1, M2 or gap year)
- Computer vision skills
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