Research Engineer
Web Development and Computer Vision

in the IMAGINE group at Ecole des Ponts ParisTech

Call for a 1-year renewable Research Engineer position, at École des Pont ParisTech, under the supervision of [Mathieu Aubry](), in the context of the DISCOVER ERC project on "Discovering and Analyzing Visual Structures". The goal of the position is to develop web-based tools for historians to leverage computer vision algorithms developed within the project on their own data.

1. Institution presentation

École des Ponts ParisTech is an institution of higher education and research in the field of science, engineering and economics. Under the supervision of the Ministry of Ecological and Solidarity Transition (MTES) and with an EPSCP status (Public Scientific, Cultural and Professional Establishment), its missions concern research, training and continuing education, the dissemination of knowledge, and the transfer to economic sectors and support for business creation. Its activities are national and international.

The research at École des Ponts ParisTech is characterized by a balanced effort in the following scientific activities:
- Outstanding academic research, evaluated at the highest level by the HCERES (highest council for research), with 5 ERC, more than 1000 publications of rank A per year, a hundred Ph.D. theses supported per year,
- Partnership research with companies, public entities and local authorities.

École des Ponts ParisTech, in accordance with its strategic plan, develops a long-term research activity in the field of Machine Learning and Computer Vision.

The IMAGINE team is a renowned research group in computer vision and machine learning, with seminal results in 3D reconstruction from images, scene understanding, deep learning, optimization, sparsity, etc. IMAGINE is part of the Laboratoire d'informatique Gaspard-Monge (LIGM), a top-ranked computer science lab.

The Imagine team currently includes 5 permanent researchers and about 30 PhD students. It has strong ties with both academic and industrial partners.

2. ERC DISCOVER Project

DISCOVER is an ERC starting grant project (2023-2028) led by [Mathieu Aubry]().

The goal of this project is to develop approaches to assist experts in identifying and analyzing patterns. Indeed, while the success of deep learning on visual data is undeniable, applications are often limited to the supervised learning scenario where the algorithm tries to infer a label for a new image based on the annotations made by experts in a reference dataset. In contrast, we will take as input images without any annotation, automatically identify consistent patterns and model their variation and evolution, so that an expert can more easily analyze them.

The key concept it will develop is the one of *visual structures*. Their key features will be their interpretability, in terms of correspondences, deformations, or properties of the observed images, and their ability to incorporate prior knowledge about the data and expert feedback. It will explore two complementary approaches to formally define and identify visual structures: one based on analyzing correspondences, the other on learning interpretable image models.

We will develop visual structures in two domains: historical documents and Earth imagery. For example, from temporal series of multispectral Earth images, we will identify types of moving objects, areas with different types of vegetation or constructions, and model the evolution of their characteristics, which may correspond to changes in their activity or life cycle. Ultimately, experts will still be needed to select relevant visual structures and perform analysis, requiring to work closely with them, to design relevant features in our algorithms and adapted interfaces for interaction.

3. Position description

The goal of this position is to build web interfaces enabling non-experts (typically historians) to test the algorithms developed by the team - such as [1,2], but also algorithms currently in development.

It will require interacting with:
- Computer Vision experts from the team.
- external researchers/historians experimenting with the developed interface.
- research engineers from the VHS and EIDA projects, to build compatible tools.

One of the key challenges of the position will be to develop open-source well documented modular code, that can be easily re-used in other projects and combined with other existing tools.

[1] Deep Transformation-Invariant Clustering
T. Monnier, T. Groueix, M. Aubry
NeurIPS 2020

[2] Learning Co-segmentation by Segment Swapping for Retrieval and Discovery
X. Shen, A. Efros, A. Joulin, M. Aubry
ArXiv 2021, CVPR 2022 workshops

4. Application

The ideal candidate would have :

- knowledge of and experience with back-end and front-end web development technologies.
- knowledge of and experience with python programming.
- 3+ years of experience as a research engineer.
- experience with computer vision or digital humanity projects.
- experience with open-source software development.
- a Master degree or equivalent.

Being able to propose and implement solutions independently and to interact with an interdisciplinary and international team are also key expectations.

Please send a CV and a cover letter that specifies employment availability date, contact information of two academics who can provide reference letters upon request, and examples of past projects to mathieu.aubry@enpc.fr with 'DISCOVER RSE application' as a topic.

Timeline: Applications expected by September 3rd, 2023. Candidate selection and interview might be conducted as soon as the application is received, and might last until September 30th. The starting date is expected between December 1st 2023 and February 1st 2024.

Contract: 1 year renewable contract, with salary depending on experience. Part time position possible.

Location: Position based in CHAMPS-sur-MARNE (cité Descartes) - France Access: RER A, 25 minutes from Paris city center. Remote work possible 2 days per week.