



## 3-YEAR POSTDOC / ENGINEER POSITION IN COMPUTER SCIENCE, IMAGE ANALYSIS AND PLANT MODELING

**Title: 3D+t reconstruction and segmentation from non-destructive imaging for grapevine trunk diseases diagnosis.**

**Keywords:** Image Analysis, Deep Learning, Vine, Trunk diseases detection, 3D reconstruction, X-rays and MRI imaging.

**Position opening:** From January 2023.

**Location:** Montpellier, France.

**Contact:** Romain Fernandez ([romain.fernandez@cirad.fr](mailto:romain.fernandez@cirad.fr)) and Cédric Moisy ([cedric.moisy@vignevin.com](mailto:cedric.moisy@vignevin.com)).

**PROJECT BACKGROUND:** Our research aims to develop imaging approaches for non-destructive detection and diagnosis of trunk diseases in grapevines (*Vitis vinifera* L.). Protocols [1] and methods [2][3] for 3D imaging and analysis of trunks under controlled conditions (i.e., laboratory) have already been developed in our lab. We now aim to transfer this non-destructive diagnosis directly into the field, using a portable device that can be used to detect and quantify these diseases. This transfer involves the development of novel solutions for data analysis (project "Scan Me If You Can", 2023-2026). For this purpose, we seek a highly motivated and initiative-taking candidate, qualified for the conception of innovative image analysis pipelines (see below)

**MISSIONS:** Your mission will be to scale up different approaches to work across two work streams.

**Whole plant 3D+t reconstruction and segmentation from multi-angle X-ray images:** You will be in charge of retrofitting models to allow the deployment of these solutions in the field, on a larger scale, and for temporal monitoring of tissue condition. In order to estimate the degradations present in the plant and their progression over time, you will design solutions for image analysis and 3D+t reconstruction applicable to 2D images collected in situ on living plants.

**3D+t characterization of degradation by MRI monitoring under controlled conditions:** You will build upon the developments of FijiYama [1] and FijiRelax [3] plugins to analyze a large set of MRI data collected during the dynamic monitoring of living vines inoculated with fungal pathogens. You will design pipelines to study the host-pathogen interaction in 3D+t; and develop tools for the comparison of grapevine varieties tolerance, and pathogen aggressiveness.

**QUALIFICATIONS:**

**Titles/Diplomas:** PhD or M.Sc. in computer science, mathematical modeling, image analysis, with a demonstrated capacity for publication in image analysis and/or design of solutions.

**Advanced skills in:**

- Image Analysis (3D reconstruction, segmentation).
- Programming (Java and Python).
- Machine Learning (scikit-learn, ...) and Deep Learning (TF / Pytorch, ...).
- 2D/3D image processing and visualization (Fiji, Napari, VTK, ...).

**Optional:**

- Basic knowledge in 3D imagery (X-rays tomography, MRI);
- plant biology and anatomy; and/or pathogens.

- French speaking.

#### **Aptitudes:**

- Interpersonal skills and ability to work with multiple stakeholders.
- Autonomy in programming and image processing.
- Organizational skills and rigor.
- Adaptability and reactivity.
- Ability to synthesize and pedagogy (interactions with non-specialists in image processing).
- Scientific English.
- Driving license.

#### **WORKING ENVIRONMENT:**

The selected candidate will work in interaction with two research teams located in Montpellier, France (at Campus Lavalette, 389 Av. Agropolis, 34980 Montferrier-sur-Lez, France). The team “**GénoVigne**”, IFV (French Institute for Vine and wine, [www.vignevin.com](http://www.vignevin.com)), is specialized in grapevine genetics and diseases. The team “**Phenomen**”, CIRAD (French Agricultural Research Centre for International Development), is specialized in mathematics and computer science for plant modeling. The candidate will also interact with several scientific and technical partners, including INRAE, Montpellier University, CIVC Champagne and BIVB Bourgogne, as well as imaging platforms.

Remuneration: between 2.4 and 2.6KEUR, raw, monthly, depending on qualification.

Advantages: meal vouchers, paid holidays, and Health Mutual.

- APPLICATION:** Please, send CV, application letter, and references to [romain.fernandez@cirad.fr](mailto:romain.fernandez@cirad.fr) and [cedric.moisy@vignevin.com](mailto:cedric.moisy@vignevin.com). **Deadline:** Applications will be reviewed until the position is filled. **Position opening:** Starting in January 2023.

#### **BIBLIOGRAPHY:**

[1] R Fernandez, L Le Cunff, S Mériageud, *et.al.* An end-to-end workflow based on multimodal 3D imaging and machine learning for nondestructive diagnosis of grapevine trunk diseases. bioRxiv preprint (BioRxiv 2022) <https://doi.org/10.1101/2022.06.09.495457>

[2] R Fernandez, and C Moisy, FijiYama: a registration tool for 3D multimodal time-lapse imaging, *Bioinformatics*, Volume 37, Issue 10, 15 May 2021, Pages 1482–1484, <https://doi.org/10.1093/bioinformatics/btaa846>

[3] R Fernandez, and C Moisy: FijiRelax: Fast and noise-corrected estimation of MRI relaxation maps in 3D + t (under review in JOSS) current version: <https://github.com/Rocsg/FijiRelax/actions/runs/3307397950>

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