

Internship

Developing image processing tools to characterize lignocellulosic biomass deconstruction using confocal microscopy images

Keywords: 4D(space + time) image processing, segmentation, confocal microscopy, lignocellulosic biomass

Hosting laboratory: [FARE Laboratory](#), INRAE / URCA, 2 esplanade Roland-Garros, 51100 Reims, France.

Duration: 6 months + opportunity to continue the research with supervisors as a PhD student, see description below.

Deadline: Open until filled

Objective: The main objective of the internship is to develop image analysis tools to compute different structural parameters to characterize the lignocellulosic biomass deconstruction during hydrolysis.

Description

Renewable resources from agriculture and forestry such as lignocellulosic biomass (LB) is foreseen as an alternative to fossil carbon to produce biofuel, bio-based chemicals and materials in biorefineries to limit climate change. Nevertheless, due to chemical and structural complexity of LB, it is recalcitrant to biochemical deconstruction by enzymes and requires expensive pretreatment steps. To achieve a cost-effective deconstruction, it is necessary to understand and overcome the chemical and structural parameters conferring the recalcitrance to LB. Despite extensive research on identifying such parameters, no universal parameter (not specific to biomass species and pretreatment type) has yet been found. To identify key structural parameters underlying recalcitrance, our team has recently investigated the importance of structural parameters at the cellular / tissular scale. At this end, wood samples are imaged during enzymatic hydrolysis by confocal microscopic time-lapse imaging, providing the observation of the hydrolysis at a cellular level. A first 4D (space + time) image processing including segmentation and tracking has been set up at FARE laboratory, that gives access to a binary representation of individual cell walls and their evolution over time. Starting from this pipeline and the available 4D dataset, the successful candidate will further develop the pipeline to extract the dynamics of voxel intensity representing LB deconstruction captured in time series. The extracted values will be used to extract cellular structural parameters (e.g. cell wall thickness, neighbour numbers). A correlation analysis between the temporal evolution of voxel intensities and structural cell parameters will be conducted.

FARE lab offers an outstanding scientific and technical infrastructure (such as computing facilities of the [ROMEO HPC centre](#), state of art confocal microscope facility, etc), a highly motivated research team, as well as an international and interdisciplinary working environment. Depending on the progress of the internship and the motivation of the candidate, he/she will also have the opportunity to continue the research work within our team as a PhD student.

Requirements

Candidates should have a MSc in computer science, engineering, applied mathematics, or related fields. Applicants should have good skills in Python/C++ programming languages. Experience in image processing would also be advantageous. Excellent communication and reporting skills are essential as the successful candidate will need to work in an interdisciplinary team and write up progress reports and make oral presentations.

Application

Applicants should send a letter of motivation and a CV, including the contact details of at least two academic referees to supervisors:

[Dr. Yassin Refahi, yassin.refahi@inrae.fr](mailto:yassin.refahi@inrae.fr), +33 (0)3 26 77 35 86

[Dr. Grégoire Malandain, gregoire.malandain@inria.fr](mailto:gregoire.malandain@inria.fr), +33 (0)4 89 15 43 21

[Dr. Gabriel Paës, gabriel.paes@inrae.fr](mailto:gabriel.paes@inrae.fr), +33 (0)3 26 77 36 25

Salary: ca. 550 euros net/month.