

Département
D1: Algorithms, Computation, Image & Geometry

Équipe Team ADAGlo

Computer science beyond the realm of
reason

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Loria



Laboratoire lorrain de recherche
en informatique et ses applications

Rapport d'activité 2025



En partenariat avec
Inria



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Team ADAGIo

Keywords

Discrete Geometry, Discrete Structures, Imagery

1 Team members, visitors, external collaborators

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Faculty Members

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- Philippe Even [UL, Professor, HDR]
- Phuc Ngo [Team leader, UL, Associate Professor, HDR]
- Hugo Rositi [UL, Associate Professor]

PhD Students

- Aude Marêché [UL, PhD Student, Since September 2022]
- Dorian Martinetto [UL, PhD Student, Since October 2024]

Associate Members

- Jui-Ting Lu [UL, ATER, Since October 2024]
- Mohamad Janbein Slutn [UL, ATER, Since October 2025]

2 Overall objectives

Our team is interested in Discrete Geometry with theoretical fields of study and applications in image analysis through numerous collaborations. The realization of applications in concrete frameworks has given rise to interesting theoretical problems solved with discrete geometry approaches.

3 Research program

We intend to deepen the following areas of discrete geometry : (i) *Study of discrete geometric primitives and transforms*, (ii) *Analysis of discrete objects*, (iii) *Applications to Image Analysis*. Collaborations are underway on certain subjects but new ones are also planned through the submission of projects.

3.1 Study of discrete geometric primitives and transforms

Connectivity of discrete hyperplanes and numeration systems

Following the progress made in the study of the connectedness of discrete arithmetic hyperplanes in Bastien Laboureix's thesis, there are still a number of points to be clarified and directions to be explored.

An algorithm has been proposed for calculating the connecting thickness for any neighborhood. However, this algorithm obtains the connecting thickness as the limit of a sequence whose rate of convergence is currently unknown. The initial aim was to determine an algorithm operating by reduction

like the fully subtractive algorithm used in the case of facet connectedness. This objective has not yet been achieved, but the study that has been carried out suggests new avenues that we hope to explore.

Such a reduction algorithm can generally be seen as a gcd calculation algorithm, and we'd like to explore this relationship in the general case.

Lastly, the study of facet connectedness revealed a numbering system that was studied in greater detail in Bastien Laboureix's thesis. We'd like to generalize this study to other numeration systems derived from these reduction algorithms.

Geometric transformations for digital images

Geometric transformations considered in the discrete space of digital images behave very differently from their continuous counterpart. Considering for instance the rigid motions which are composed of translation and rotations, they are well-known as bijective and shape-preserving transformations in \mathbb{R}^n ($n \geq 2$). Such transformations when applied on the Cartesian grids \mathbb{Z}^n need to be digitized and thus called *digital rigid motions* (DRMs). Due to this digitization process, DRMs are no more isometric and bijective. In particular, the transformed objects by DRMs lost generally their geometric and topological properties with respect to the original objects. It should be mentioned that rigid motions are among the most fundamental transformations in digital image processing, besides, many free digital transformations can be locally approximated by DRMs. Several works have been done for DRMs with various purposes such as describing the combinatorial structure of such transformations, bijectivity characterisation of DRMs, preserving geometric and topological properties of transformed objects by DRMs, ... In this context, we are interested in the following directions:

1. Geometric and topological-preserving rigid motions in \mathbb{Z}^n

Recently, we have proposed the notion of *quasi-regularity* as a condition for connectivity invariant of continuous objects under the Gauss digitization. A method of quasi-regular verification for polygon objects has been developed by using the notion of medial axis. Furthermore, it also is applied in the context of topology-preserving rigid motions of digital objects. More precisely, using the polygonal representation of digital objects together with quasi-regular condition, the method allows not only the connectivity invariant but also the preservation of convex and concave parts of the transformed objects. Following this direction, we would like to study the other geometric properties such as perimeter, area, tangent, etc. of objects under DRMs. In addition, we will also investigate not only simply connected objects, but more generally arbitrary-topology objects (this is tractable in 2D, but less simple in 3D and higher dimension).

2. Bijectivity characterization of digitized rigid motion using geometric algebra

Geometric algebra allows to reformulate and redefine problems involving digitized geometric transformations in a more intuitive and general way. More specifically, in a recent study of Stéphane Breuils (Laboratoire de MATHématiques – Université Savoie Mont Blanc) and Yukiko Kenmochi (Le Laboratoire GREYC) who work on 2D bijective digitized rotations and reflections, a new framework of digitized reflection based on geometric algebra has been proposed. In this context, we have discussed on the subjects with Stéphane Breuils and Yukiko Kenmochi, and proposed a collaboration to work on DRMs. In particular, through geometric algebra, we would like to characterize the set of bijective DRMs in the plane, and further the extension to higher dimension as well as other class of geometric transformations.

3. New framework of affine transformation in \mathbb{Z}^n with cellular complexes

Affine transformations gather a large family of simple, yet important geometric transformations which are useful in various applications of image processing, geometrical modeling or computer graphics. As for rigid motions, topology preservation is a property of affine transformations in \mathbb{R}^2 , but not in \mathbb{Z}^2 . In a recent work, we proposed a way of tackling the problem of affine transformations under the constraint of topological invariant. More precisely, we formulate the construction of the binary discrete object $X \subset \mathbb{Z}^2$ resulting from an affine transformation as an optimization problem in the space of cellular complexes, and we solve this problem under topological constraints. Continuing this direction, we would like to investigate our approach with other kinds of topological models (e.g. the well-composed sets), but also with non-binary images.

3.2 Analysis of discrete objects

Analysis of discrete curves and surfaces

We develop new tools to analyse discrete objects and to reconstruct some continuous representations of them. Two main axes can be distinguished.

On the one hand, the *multi-resolution analysis* of discrete curves and surfaces provides progressive analysis and new information. This analysis is based on the arithmetical, geometrical and combinatorial properties of the discrete primitives that permit to obtain efficient algorithms (recognition, scanning, ...) and to extract geometrical parameters (perimeter, curvature, normal vector, area, ...) on the discrete curves and surfaces. It is useful for the comparison, the classification or the simplification. On the other hand, the *reconstruction of geometrical models* with a controlled precision with respect to the original discrete curves or surfaces open perspectives for the use of a post-processing task based on Euclidean geometry. We plan to develop the following topics:

1. *Recognizing digital 3D lines that fit the digital plane model and extension to nD*

The general problem of approaching a digital line definition by hyperplanes intersections of any connectivity is still open. Beside the recognition of nD dimensional digital lines, it is of primary interest to guide the choice of digital lines definition by planes and hyperplanes intersections. We intend to try and unify the different approaches proposed in the literature.

2. *Representation using digital planes.* The tangential cover is a fundamental tool in the study of 2D digital curves as it encodes all linear digital segments included in a curve. Its extension to 3D is however not straightforward since there is no canonical ordering of voxels on a digital surface. Moreover, the poset of plane pieces relative to the partial order given by inclusions can be rather huge. Our proposal is to build upon strategies used to classify surfaces such as introducing a progressive notion of neighbourhood of a voxel. Using disk-like patterns, decomposed into sectors, with increasing radius we propose to test sectors for planarity and to introduce maximality with respect to sectors inclusions. This original approach will also be applied to propose efficient algorithms for the reversible and scale independent polyhedrization of digital objects.

3. *Tool to analyse noisy 3D curve*

We have proposed in 2D the concept of Adaptive Tangential Cover (ATC) in order to analyze the 2D discrete curves taking into account the noise present in them. We want to extend this approach in 3D. Within this framework, an estimator of the noise level present in the 3D curves must be developed from which algorithms for calculating geometric parameters will be deduced.

Estimation of 3D orientation accuracy from input visual features quality

Achieved works on blurred segment detection from gray-level images provide a solution to assort the extracted straight edges with a thickness value related to the edge quality. These edges are possibly used to derive 3D orientations. Our purpose is to inject the edge thickness value in the orientation algorithm to provide relevant information about 3D output validity. We also plan to speed up the blurred segment extraction tool by an earlier detection of false positives.

3.3 Applications to Image Analysis

Extraction of geometric discrete structures from LiDAR data

In continuation of achieved works on the extraction of linear structures from LiDAR raw data, we aim at extending the developed approach in two directions. The first one deals with a more thorough exploitation of the point cloud data and the insertion of topological constraints to provide a richer geometric characterization of the extracted structures. At present only points classified as "ground" are used, but the other classified points, in particular "vegetation" points, may provide useful information to confirm or discard the tested hypotheses. This potential could be explored through the case of the extraction of new types of ridge or hollow structures (field systems or irrigation networks) in possible collaboration with geomorphologists. Then, inserting topological constraints into the extraction process could help to detect false positive or to refine the detection in areas where extracted sections are incomplete or interrupted. To that end, we started a collaboration with ONF – the french organism for forest management – on the extraction of road networks.

The second research direction deals with the development of tools to extract higher dimension structures, in particular plane structures. We started a new collaboration with archaeologists on the extraction of ancient charcoal hearth platforms. This project aims at developing new tools based on discrete geometry to efficiently recognize blurred planes in LiDAR data and get a fine geometric characterization of the extracted objects.

Study of wood quality

As part of collaborations with INRAE, two ANR projects, TreeTrace and WoodSeer, will continue until 2023 and 2024 respectively.

The work undertaken in the Franco-Austrian TreeTrace ANR project focuses on finding a unique signature for each tree cut in the forest and then moved to a sawmill providing a follow-up. This signature is based on geometric and biometric characteristics such as pith, rings, heartwood and sapwood, ... A PhD student worked on this subject (end in 2022) and results were published in 2024.

The final objective of WoodSeer ANR project is to predict the internal structure of the tree based on the defects detected on the bark of the tree trunk in order to optimize the cuts of the logs in the sawmill. The work undertaken so far has focused on external defects, detection and classification are still to be carried out in the case of particular species as well as the link with the internal structure. Data are in preparation by colleagues of INRAE and ONF and we will allow progress on this work. A PhD thesis was defended at the end of 2024.

Biomedical images

Since September 2023 (Hugo Rositi's recruitment), ADAGIO team opens to new application opportunities around the health context and especially the application of its development around discrete structures in image processing for biomedical images. The main application concerns characterization of the hepatic vascular network in small animals with phase contrast imaging. To process this analysis of blood vessels network, we need to detect it (with enhancement filters), extract it, reconstruct it as a network and analyze it as a discrete object. The recent methodological developments made in the team can fit in all of these steps. Two specific steps can be of particular interest : enhancement filter and limitation of discontinuities in the network.

When we seek the detection of blood vessels in images, one way to do it is to perform an enhancement filtering of these structures through different kind of filters. One common basis of these filters (Sato 1997, Frangi 1998, Jerman 2015, Zhang 2018) is the analysis of the Hessian matrix on each voxel. The Hessian matrix is based on partial derivatives. Yet we are working on discrete dataset, computation of derivatives can be done in several ways and the impact of it on this enhancement step is yet to be described.

Secondly, after reconstruction of the vascular tree, discontinuities are often observed and tear in two or more a vascular branch. The idea here is to consider the vascular tree as a true discrete object and then perform operation to reconnect several parts of a singular branch or link together several branches at a bifurcation. Extension of branches at its extremities is also a work that can be addressed based on pure intensity information (image level) or based on geometric properties (object level) such as direction vector at each extremity.

4 New results

4.1 Study of discrete geometric primitives and transforms

4.1.1 Recognition of discrete hyperplanes

Participants: Bastien Laboureux, Isabelle Debled-Rennesson.

We study the problem of discrete structure recognition. We focus on naive line segments and, more generally, naive arithmetic hyperplanes, and we present a new approach to recognise these discrete structures based on the Stern-Brocot tree. The algorithm for line segments in dimension 2 proposes

an alternative method to the state of the art, keeping the linear complexity and incremental character. While most of the concepts can be generalised to planes in dimension 3 and hyperplanes in higher dimensions, certain points in the process of descending in the Stern-Brocot tree need to be explored further. The proposed algorithm calculates separating chords characterising the membership of planes to cones generated by the branch of the Stern-Brocot tree. This generalisation shows the close link between arithmetic hyperplanes and the generalised Stern-Brocot tree and opens up interesting perspectives for the recognition of pieces of arithmetic hyperplanes. A paper on this subject has been presented to DGMM 2024 conference [2] and an extended paper was published in the journal JMIV, in collaboration with Alban Mattei, a student who worked on this topic during his internship with our team, and Jacques-Olivier Lachaud, who also contributed to this article [0].

4.1.2 Reachability in discrete hyperplanes

Participants: Bastien Laboureix, Eric Domenjoud.

We studied the reachability problem in arithmetic discrete hyperplanes. A neighbourhood \mathcal{V} of the origin in \mathbb{Z}^d is a finite and symmetric subset of \mathbb{Z}^d which generates \mathbb{Z}^d . Two distinct points x et y in \mathbb{Z}^d are \mathcal{V} -neighbours if and only if $x - y \in \mathcal{V}$. Given two points x and y in a discrete hyperplane \mathbb{P} in \mathbb{Z}^d , the problem is to decide whether a \mathcal{V} -path exists in \mathbb{P} between x and y .

We adapted theorems and algorithms already known for the connectedness problem and which can be extended to reachability. The first algorithm presented, adapted from that of Y. Gérard [8] for connectedness, decides reachability in any dimension and for any notion of neighbour. In the case of integer parameters, it terminates in time $O(\omega)$ where ω denotes the thickness of the hyperplane and can be adapted to be performed in polynomial space in $\ln(\omega)$.

In the particular case of facet connectedness, we propose a method derived from the fully subtractive algorithm and its adaptation for deciding connectedness. The same algorithm can be used to decide the reachability in polynomial time in the number of bits of ω .

4.1.3 Geometric transforms

Participants: Phuc Ngo.

In Euclidean spaces (\mathbb{R}^d , $d \geq 2$), rotations preserve distances and angles; they are also bijective. These important properties are no longer guaranteed when rotations are considered in discrete spaces. This is especially the case in the Cartesian spaces (\mathbb{Z}^d , $d \geq 2$), where rotations are however crucial for various applications, from image processing to computer graphics.

In this context, we are interested in the issue of bijectivity of discrete rotations in the 2-dimensional case (\mathbb{Z}^2). In particular, we contribute to the state of the art from two points of view. First, we investigate the structure of the (finite and infinite) rotations in \mathbb{Z}^2 , and we shed light on the nature of this combinatorial space, which is analogue to a watershed tree. Second, we focus on the finite rotations, i.e. rotations that act on (finite) Euclidean balls instead of the (infinite) set \mathbb{Z}^2 . Under these hypotheses, we investigate the bijective rotations either as the restrictions of bijective rotations on \mathbb{Z}^2 , or as injective rotations on the Euclidean balls (thus bijective from their domain to their image). We provide two algorithmic schemes for building the combinatorial space of these finite rotations (see figure 1).

This work was presented in DGMM 2024 [4] and an extended version was published in the journal JMIV [0].

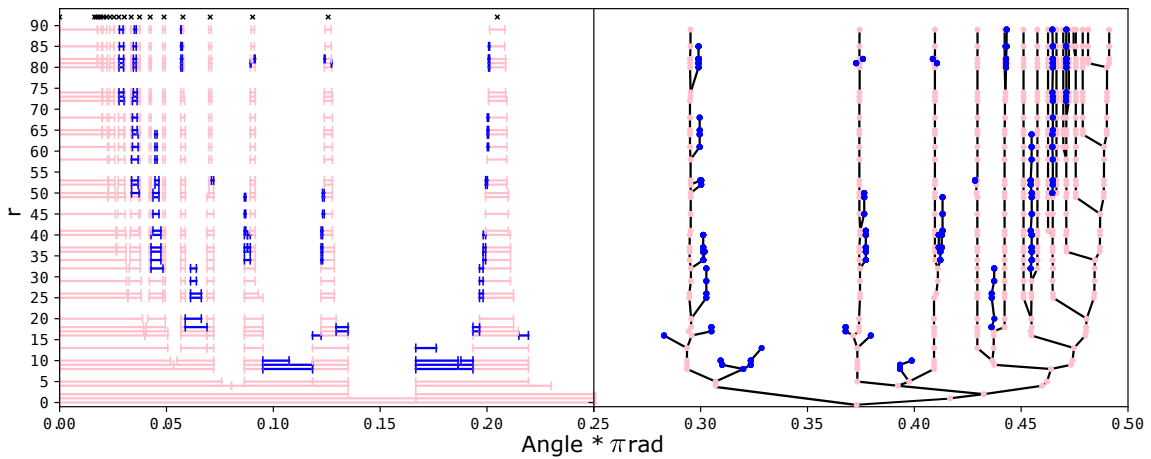


Figure 1: Hierarchical structure of the bijective discrete rotation.

4.2 Δ -numeration

Participants: Bastien Laboureix, Eric Domenjoud.

We studied a numeration system we had previously introduced as a tool to prove combinatorial properties in discrete geometry: the Δ -numeration. Since this system, introduced via the fully subtractive algorithm, had been seen mainly as a tool, we investigated more deeply its properties from the point of view of numeration systems. In particular, we make the link with β -numeration and Cantor real bases. We reintroduce the rewriting system introduced to calculate in Δ -numeration. This system is based on the properties of the fully subtractive algorithm and is normalising. Finally, we study the ultimately periodic case, a special case of alternate bases, and show that the ultimately periodic words represent exactly the elements of $\mathbb{Q}[\beta]$ where β is the inverse of a Pisot number. This work has been presented at the WORDS 2025 conference [0].

4.3 Analysis of discrete objects

4.3.1 Analysis of discrete surfaces

Participants: Aude Mareché, Isabelle Debled-Rennesson, Phuc Ngo.

The processing of 3D digital objects often requires the computation and analysis of their geometrical features. The normal vectors on an object's surface in particular provide important information used in image processing applications. As part of Aude Mareché's PhD thesis, which began in October 2022 and is co-supervised by LIMOS, we are studying a new method for estimating the surface normal vectors of a 3D digital object, using classical tools from computational geometry, a theoretical framework particularly well-suited to the processing and analysis of digital images. This method is local and parameter-free, and experimental evaluations show that it is both faster and more robust than leading methods in the field. Aude presented the first results at ISPR 2024 [3]. An extension has been submitted to JMIV [0].

4.4 Applications to Image Analysis

4.4.1 LiDAR data

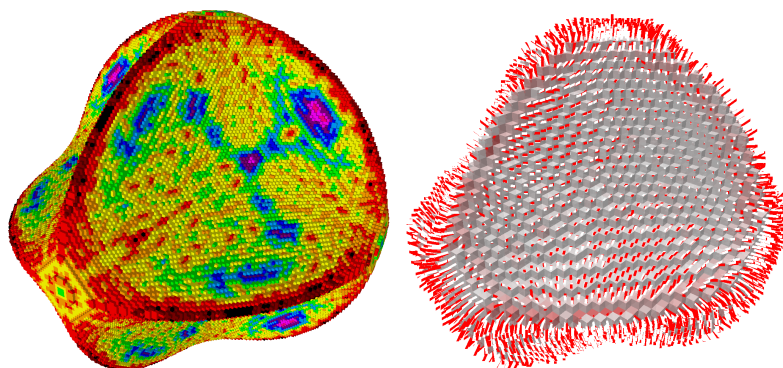


Figure 2: Normal estimator on a digital surface. Left: Distribution of the neighborhood radii. Right: Normal estimation on the surface.

Participants: Philippe Even, Hugo Rositi, Phuc Ngo.

A new framework was developed to detect a blurred plane in a point set using digital geometry tools. A digital blurred plane is a finite set of points with controlled thickness. This notion can be used to characterize a real world object surface, considered as planar at a large scale, but actually quite irregular at finer scale. The framework relies on the analysis of two orthogonal height profiles extracted from the point set in order to recognize two blurred segments and to enclose them in a thick digital plane. A directional scan is then used to collect next points in the set, that belong to this digital plane.

This framework has been applied to the interactive extraction and geometrical characterization of relict charcoal platforms from an airborne LiDAR point cloud (see figure 4.4.1). This process was tested on two sets of geolocated platforms obtained by on-site prospecting or visual survey of the LiDAR digital terrain model. Experimental validations showed that a large amount of them was successfully extracted and that their estimated extent closely matched the ground truth. This work was presented last November at the International Conference on Discrete Geometry and Mathematical Morphology, held at Groningen in the Netherlands [0].

Besides, a pointwise neural network has been developed to automatically detect platforms in Lidar point clouds, in the scope of the internship of Thibault Pesson (2nd year of Telecom Nancy) from June to August 2025. The network was trained using 3D points in annotated LiDAR areas of a large forest area. It achieves good results in precision. Some improvements are planned in future works to reach effective performance in recall, and then combine it with the extraction tool to automatically characterize charcoal platforms at large scale.

4.4.2 Development of BIOMetric methods for the identification and TRACEability of oak logs – Project: BIOMTRACE

Participants: Dorian Martinetto, Phuc Ngo.

The traceability of wood from the forest to the industry is a crucial matter for economic and social reasons as well as ecological reasons, especially in the case of large-scale deforestation. It aims to ensure the origin of wood, combat illegal forest exploitation, contribute to the local and sustainable maintenance of a resource for present industries, and optimize material flows and the transformation of this resource by better considering its characteristics.

In this context, the BIOMTRACE project was proposed in collaboration between Sylvia, INRAE and Adagio, LORIA. The objective of this project is to develop and test different traceability methods for oak

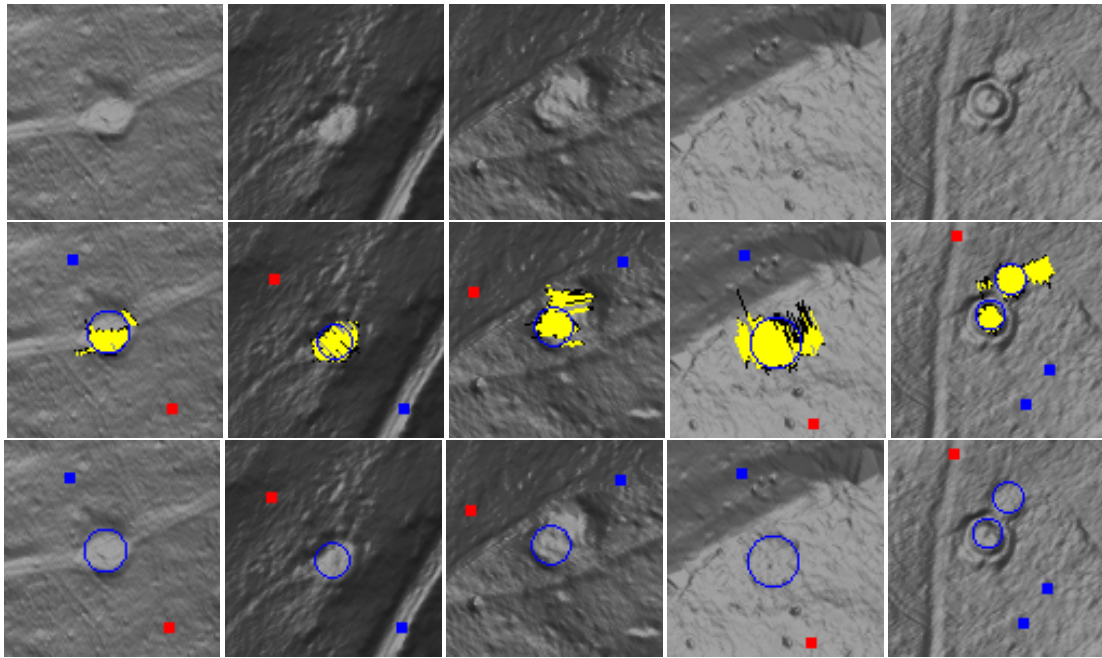


Figure 3: Successful charcoal platform extractions in complex cases: detected blurred plane in yellow and extracted platform workplace (blue circle).

logs based on intrinsic log characteristics (referred to as biometric methods) extracted from photos of log ends taken in the forest and after transportation using conventional sensors such as cameras or smartphones. These methods would serve as an alternative to physical markers such as plastic tags or RFID chips.

The experience acquired during the ANR TreeTrace project is extremely useful with the built image datasets [11]. In particular, the segmentation the logs in the images will be used for choosing the initial traceability algorithms. Dorian Matinetto was recruited as a research engineer, pursued a PhD, and is currently working on the subject. As a first approach, we consider methods based on deep learning with PointRend [9] and PointGlue [10] neural networks, combined with classical image processing approaches like SIFT feature extraction [12] (see figure 4). The results obtained are promising and have been published in Smart Agricultural Technology journal [0], IEEE Access [0] and Annals of Forest Science [0].

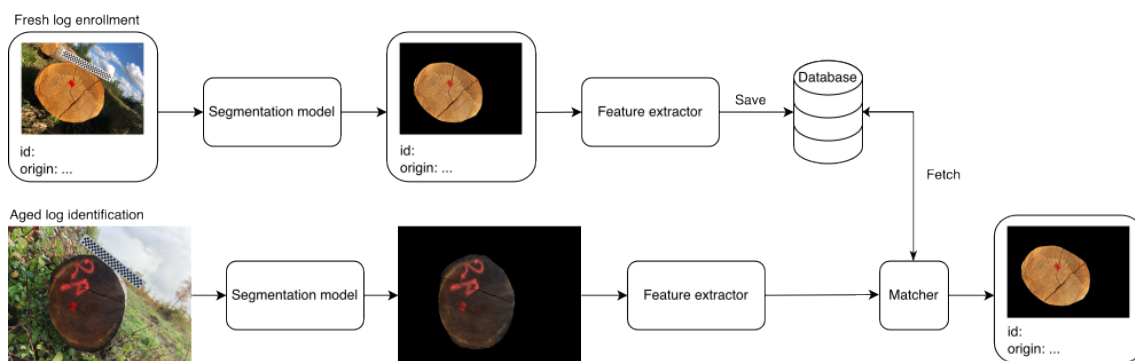


Figure 4: Pipeline proposed for the biometric traceability of oak logs.

4.4.3 Wood defect detection from bark tree

Participants: Florian Delconte, Jui-Ting Lu, Isabelle Debled-Rennesson, Phuc Ngo.

The ANR WoodSeer project focuses on defect detection, deep learning, and the internal/external connection of logs. A doctoral student, Florian Delconte, co-supervised by LIRIS, defended his thesis in December 2024 as part of this project. The aim of the thesis is to develop deep learning-based methods combined with geometric methods that characterize defects. Following on from this work, together with Jui-Ting Lu, we presented a paper on a compact 3D descriptor for shape recognition at the IWCIA 2025 [0].

4.4.4 Quality assessment of wood log from images

Participants: Rémi Decelle, Isabelle Debled-Rennesson, Phuc Ngo.

In the context of ANR TreeTrace project for log tracing and wood quality estimation, Rémi Decelle realised his thesis, under the supervision of F. Longueteau, F. Mothe (INRAE) and I. Debled-Rennesson, P. Ngo (Loria), on the estimation of wood quality from log cross-section (CS) images taken by smartphones or digital cameras. During his thesis, various methods have been developed for extracting geometric and biological features of wood log on images. Among them, we can mention the following results: pith detection [7] using a probabilistic approach based on the optimization of ant colonies, wood log segmentation [5] and heart wood segmentation [6] using deep-learning approach with the proposition of a new morphological attention module, and tree ring detection [1] using directional filter with discrete geometrical tools.

4.4.5 Biomedical images

Participants: Hugo Rositi, Phuc Ngo.

In 2024 and 2025, through the internship of (respectively) Baptiste Ruault (FST L3 Informatique - duration of 3 months) and Noé Edouard (INP Grenoble Phelma - Duration 3 months), we started to investigate the way to compute the Hessian matrix on discrete datasets (*e.g.* 3D images of biological samples). During those internships, we manage to test and adapt several methods to compute partial derivatives in the three directions of the images. This works allow us to assess that there is no real improvement on 2D images to compute the Hessian matrix and then improve the enhancement filtering step described in section 3.3 with these new methods. Yet, this work invite us to complete this study in the 3D case, which will be the purpose of a new internship in 2026.

5 Partnerships and cooperations

5.1 Regional initiatives

Our team has been working regularly with INRAE in Champenoux for over 10 years. These have taken the form of projects on wood quality that have continued (or ended) this year: WoodSeer, BIOMTRACE,

TreeTrace.

An ANR project, *EQUALIA: Quality Assessment of hardwood using Artificial Intelligence* is submitted in 2025 and passed in 2nd phase. The consortium includes INRAE-SILVA, CentraleSupélec (LORIA), CNRS (Georgia Tech Lorraine), Université de Lorraine (LORIA), Université Lumière Lyon 2 (LIRIS) and ONF.

Last year activities on LiDAR processing were led in collaboration with INRAP (Institut National de Recherches Archéologiques Préventives) and LIEC (Laboratoire Interdisciplinaire des Espaces Continents).

5.2 International initiatives

An ANR/DFG project, TiCharLeg - for *Times of Charcoal Legacy: Impact of historical charcoal production on ongoing socio-ecosystem dynamics*, will be resubmitted in 2026, in collaboration with UL laboratories (LIEC, LOTERR, LRGP and GeoRessources), INRAe SILVA, Landesamt für Denkmalpflege (LAD) Stuttgart, Technical University of Darmstadt, and University of Freiburg. ADAGIo team will be involved with LiDAR data processing.

6 Dissemination

6.1 Promoting scientific activities

6.1.1 Scientific events: selection

- Mars, Journées Nationales IFM, Bordeaux, France.
- May, Journées thématiques Imagerie vasculaire du GDR IASIS, Paris, France.
- July, Journées de Géométrie Discrète et Morphologie Mathématique (GDMM), 9-10 2025, Chambéry, France.
- June-July, WORDS 2025, Nancy, France.
- August, Summer school on Deep learning, Porto, Portugal.
- September, IWCA 2025, Szeged, Hungary.
- November, DGMM 2025, Gronigen, the Netherlands.

Member of the conference program committees

I. Debled-Rennesson is a member of the Steering Committee of DGMM conference

Reviewer

Several members of ADAGIo team were asked to review papers for DGMM, ICPR and ICIP conferences.

6.1.2 Journal

Reviewer - reviewing activities of the team

- Bioengineering
- Computers in Medicine and Biology
- Multimedia Tools and Application
- Pattern Recognition Letters
- J. of Mathematical Imaging and Vision

- Theoretical Computer Science
- Journal of Signal Processing: Image Communication
- Computers & Graphics
- Construction and Building Materials
- Journal of Combinatorial Optimization
- Soft Computing
- Journal of Magnetic Resonance Imaging
- Measurement

6.2 Teaching - Supervision - Juries

6.2.1 Teaching

- P. Ngo is co-responsible since april 2024 of the second year of the IA2VR computer science Master.
- P. Ngo and I. Debled-Rennesson give courses in image processing and analysis at Masters level.

6.2.2 Supervision

- Dorian Martinetto (PhD student, since October 2024). Title : *Development of biometric methods for the identification and traceability of oak logs*. Supervisors : P. Ngo, F. Longuetaud.
- Aude Marêché (PhD student, since October 2022). Title : *Approaches by polyhedral neighborhoods for the study of digital surfaces*. Supervisors : I. Debled-Rennesson, F. Feschet and P. Ngo.

6.2.3 Juries

- Phuc Ngo is referent member of the *Comité de suivi individuel* of Lysandre Macke's PhD thesis, Université de Strasbourg. Title : *Surfaces en trois dimensions préservant leurs propriétés géométriques et topologiques sous un processus de discrétisation*.
- Isabelle Debled-Rennesson took part in a PhD defence jury of Louis Abel at LORIA
- Isabelle Debled-Rennesson participated to one selection committee for the engagement of associate professors in computer science at Université Lyon 2.

6.3 Popularization

6.3.1 Internal or external responsibilities

Isabelle Debled-Rennesson chairs the "conseil restreint" of the Nancy Charlemagne IUT. She is co-responsible for the third-year RA-IL course of the BUT. Since 2020, she has been a member of the CA of the SIF (Société Informatique de France) and, since february 2021, she has been Vice President Education.

7 Scientific production

7.1 Publications of the year

7.2 Cited publications

- [1] R. Decelle, P. Ngo, I. Debled-Rennesson, F. Mothe and F. Longuetaud. ‘Directional Filter for Tree Ring Detection’. In: ICPRAM. Rome, Italy: SCITEPRESS - Science and Technology Publications, 2024, pp. 852–859. DOI: [10.5220/0012457000003654](https://doi.org/10.5220/0012457000003654). URL: <https://hal.science/hal-04362561>.
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