

JRD-AGITSI 2026

Poster

Auteurs des posters – session 25 juin 2026

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Hybrid Multiple Linear-Circular Regression for GNSS Carrier-Phase Positioning**Safae ABOUELOUFA^{1,2}, Georges STIENNE¹, Serge REBOUL¹, Adnane LATIF²**¹Laboratoire d'Informatique, Signal et Image de la Côte d'Opale (LISIC), Université Littoral
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In many signal processing problems the response is angular and lies on a circular domain such as $[-\pi, \pi)$, where standard linear regression is no longer suitable since it does not account for the periodic structure of the observations. This leads to a multiple linear-circular regression problem, where the response is circular while the explanatory variables and the unknown regression parameters are defined in the linear domain. This problem appears naturally in GNSS differential carrier-phase positioning, where the three components of the inter-antenna baseline in the local North-East-Up frame (N_{A_2}, E_{A_2}, h) are the unknown linear parameters and the phase difference is the circular observation. We propose a hybrid estimator that recovers the regression vector in the linear domain after a local unwrapping step, while preserving the circular structure of the angular observations. Since the phase varies rapidly, especially under noisy conditions, a global unwrapping is unstable; the observation window is therefore segmented into intervals, each associated with a common phase branch, making local unwrapping possible. The segmentation and regression steps are alternated until convergence. On synthetic carrier-phase data, the proposed estimator remains comparable to the Gaussian-mixture reference at high signal quality and significantly more robust at low C/N_0 .

Fusion multi-capteurs tolérante aux fautes par graphe de facteurs pour la localisation et la cartographie aéro-terrestre**Clovis ADELER, Cindy CAPPELLE, Maan EL BADAoui EL NAJJAR, Denis POMORSKI
Université de Lille- Laboratoire CRISTAL**

La cartographie autonome en environnement extérieur reste un défi central de la robotique mobile. Des méthodes comme LIO-SAM combinent odométrie LiDAR-inertielle et optimisation par graphe de facteurs (FGO) avec un GPS optionnel, mais demeurent vulnérables aux dégradations du signal GNSS.

Nous proposons une architecture de fusion multi-capteurs tolérante aux fautes, basée sur GTSAM, conçue pour des plateformes terrestres et extensible à des configurations aériennes. Quatre sources sont fusionnées au sein d'un graphe de facteurs : LiDAR, IMU, encodeurs de roues et GPS. Un module de diagnostic assure la détection et l'exclusion automatique des défaillances capteurs, notamment sur le GPS. L'estimation de position résultante remplace l'entrée GPS brute de LIO-SAM, préservant intégralement son pipeline de cartographie et de fermeture de boucle.

Des expériences menées sur un robot AgileX Ranger Mini V2 en environnement extérieur réel montrent que notre approche réduit l'erreur de fermeture de boucle et améliore la cohérence des cartes 3D produites, comparativement à LIO-SAM seul et à LIO-SAM avec GPS brut. La robustesse aux pannes GPS est également validée expérimentalement.

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Design of Compliant Control Law for Soft Robots

Antoine Alessandrini, Alexandre Kruszewski, Laurentiu Hetel, Christian Duriez
University of Lille UMR 9189 CRISTAL, CNRS, Centrale Lille, Inria, F-59000 Lille, France

Soft robots, made of flexible and deformable materials, offer natural compliance and adaptability, making them promising candidates for cobotic applications where safe human-robot interaction is essential. However, most existing control methods treat environmental contact as a disturbance to reject, destroying the intrinsic compliance of these robots.

This work addresses the challenge of designing control laws that preserve compliance while guaranteeing precision and speed. Achieving compliant control requires a precise and reliable baseline controller which itself demands an accurate dynamic model. We therefore propose a complete data-driven pipeline for dynamic control of deformable robots, from FEM simulation to real robot implementation.

The robot dynamics are approximated by a low-order polytopic LPV model, enabling the use of existing control theory tools with formal stability guarantees. Based on this model, a state feedback controller and a Luenberger observer are synthesized using LMI constraints.

Experimental results on Emio, a planar soft robot, demonstrate significant improvements in reference tracking and disturbance rejection compared to open-loop and linear approaches.

Future work will focus on compliant control design and pick-and-place task implementation.

Development of an AI-Based Prediction Methodology for the Automation of the Robotic 3D Printing Process with Low-Carbon Cement Inks

Ame Saleh Ali, Othman Lakhal, Abdelkader Belarouci, and Rochdi Merzouki

Abstract

Robotic Three-Dimensional Concrete Printing using low-carbon cementitious inks offers significant potential for sustainable construction. However, achieving consistent geometrical quality remains challenging due to time-dependent material rheology, environmental variability, and complex process interactions. Current quality control strategies are predominantly reactive, correcting defects only after occurrence, which limits industrial scalability under uncontrolled environmental conditions. This research proposes an Artificial Intelligence-based predictive control methodology structured into two complementary phases: real-time geometrical defect prediction and anticipatory defect control. Within a System-of-Systems framework, filament quality is treated as an emergent property of coordinated subsystems including robotic motion, material extrusion, printed geometry, and environmental conditions.

Advanced temporal deep learning models, particularly Mixture-of-Experts Long Short-Term Memory architectures, achieve real-time filament width prediction with mean absolute errors of 0.22 to 0.41 percent and sub-millisecond inference latency of 0.15 milliseconds per sample, enabling prediction four to eight seconds ahead. The anticipatory control phase employs Model Predictive Control for coordinated regulation of robot velocity and material flow rate, enabling predictive parameter adjustment before defect occurrence. Conducted within the European Interreg 3DFORMWORKS project, this work transitions Three-Dimensional Concrete Printing from reactive correction to proactive quality assurance, supporting autonomous, reliable printing under uncontrolled environmental conditions for scalable sustainable construction.

Keywords: Three-Dimensional Concrete Printing, Predictive Control, Machine Learning, System-of-Systems, Quality Control

Développement, modélisation, optimisation et contrôle avancé de capteurs photovoltaïques-thermiques (PV/T) intégrant des perturbateurs à orientation variable

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Alors que les conséquences du changement climatique s'intensifient, la transition vers des systèmes énergétiques propres devient de plus en plus urgente. Les systèmes photovoltaïques/thermiques (PV/T) constituent une solution prometteuse en permettant la production simultanée d'électricité et de chaleur à partir d'une même surface. Toutefois, l'amélioration de leurs performances thermiques repose souvent sur l'intégration de perturbateurs d'écoulement dont la géométrie est généralement optimisée pour maximiser le transfert de chaleur.

La question scientifique centrale est la suivante : comment adapter dynamiquement la géométrie interne d'un capteur PV/T afin de maximiser son gain énergétique ? L'objectif est de développer une stratégie de contrôle permettant d'ajuster l'orientation des perturbateurs en fonction des conditions d'exploitations (irradiation solaire, température, débit, demande thermique) afin d'obtenir le meilleur compromis entre amélioration du transfert thermique et consommation énergétique.

Pour répondre à cette problématique, nous développerons un modèle dynamique d'un capteur PV/T intégrant des perturbateurs à orientation variable. La modélisation et la conception des stratégies de contrôle seront réalisées sous Simulink et Dymola. Le contrôle sera assuré par une stratégie de contrôle prédictif (MPC).

Les performances seront évaluées à travers des indicateurs tels que la production électrique, l'énergie thermique utile récupérée, la puissance de pompage requise et le gain énergétique net global du système.

Vers une modélisation prédictive dépendante du temps pour le contrôle des robots souples**Mohamed Amine Ammar, Fahmi Zaïri, Othman Lakhal
Université de Lille, CRISTAL, ANR**

Les robots souples exploitent la compliance des matériaux polymères pour réaliser des mouvements continus, adaptatifs et sûrs dans des environnements complexes. Leur fonctionnement repose souvent sur des actionneurs pneumatiques en silicone, capables de produire de grandes déformations sous l'effet de pressions internes. Cependant, la prédiction précise de leur comportement reste un défi majeur, car ces matériaux présentent des réponses fortement non linéaires, viscoélastiques et dépendantes de l'historique de chargement. Ce travail vise à développer une approche de modélisation prédictive reliant le comportement matériau à la déformation globale du robot souple. La stratégie proposée repose d'abord sur des simulations éléments finis haute-fidélité, intégrant une loi constitutive Visco-hyperélastique afin de générer une base de données pression-déformation représentative de différents scénarios d'actionnement. Ces données sont ensuite utilisées pour construire un modèle réduit capable de prédire rapidement la forme du robot en fonction des pressions appliquées et de l'état interne du matériau. À terme, ce modèle pourra être intégré dans une boucle de contrôle afin de compenser les effets temporels tels que la relaxation, l'hystérésis et le vieillissement du silicone. Cette méthodologie vise à améliorer la précision, la robustesse et la répétabilité du contrôle des robots souples pneumatiques.

**Assessing the Impact of Radio Frequency Interference on Low Earth Orbit
Satellite Signals****Kenza AYYADA¹, Syed Ali KAZIM², Juliette MARAIS¹****¹ Univ. Gustave Eiffel, COSYS, LEOST, F-59000 Lille, France****² IRT Railenium, Valenciennes, France**

Global Navigation Satellite Systems (GNSS) provide Positioning, Navigation, and Timing (PNT) services that are essential to modern society, supporting applications from personal use to safety-critical operations. However, they remain highly susceptible to interference, particularly jamming, notably due to the very low received power of their signals. Nowadays, there is a growing interest in exploring additional PNT sources, among which Low Earth Orbit (LEO) satellite constellations are being investigated as a complementary system for GNSS augmentation. Yet, their resilience to jamming remains an open question. This paper compares the impact of jamming on conventional GPS (L1 C/A), Galileo (E1) and GNSS-like signals (E1) for LEO constellations under identical conditions. These signals are generated using the Skydel simulator, which are then subjected to representative jamming waveforms, including single-tone amplitude-modulated (AM), frequency-modulated (FM), frequency-hopping, and pulsed chirp signals. The resulting signals are processed using a software-defined receiver, where the effects of interference along the receiver chain are studied using metrics such as Root-Mean-Square (RMS) signal power, carrier-to-noise density ratio (C/N_0), and the variances of the delay-locked loop (DLL) and phase-locked loop (PLL). The results indicate that LEO constellations show greater resilience to jamming, with higher C/N_0 and reduced tracking errors compared to GNSS.

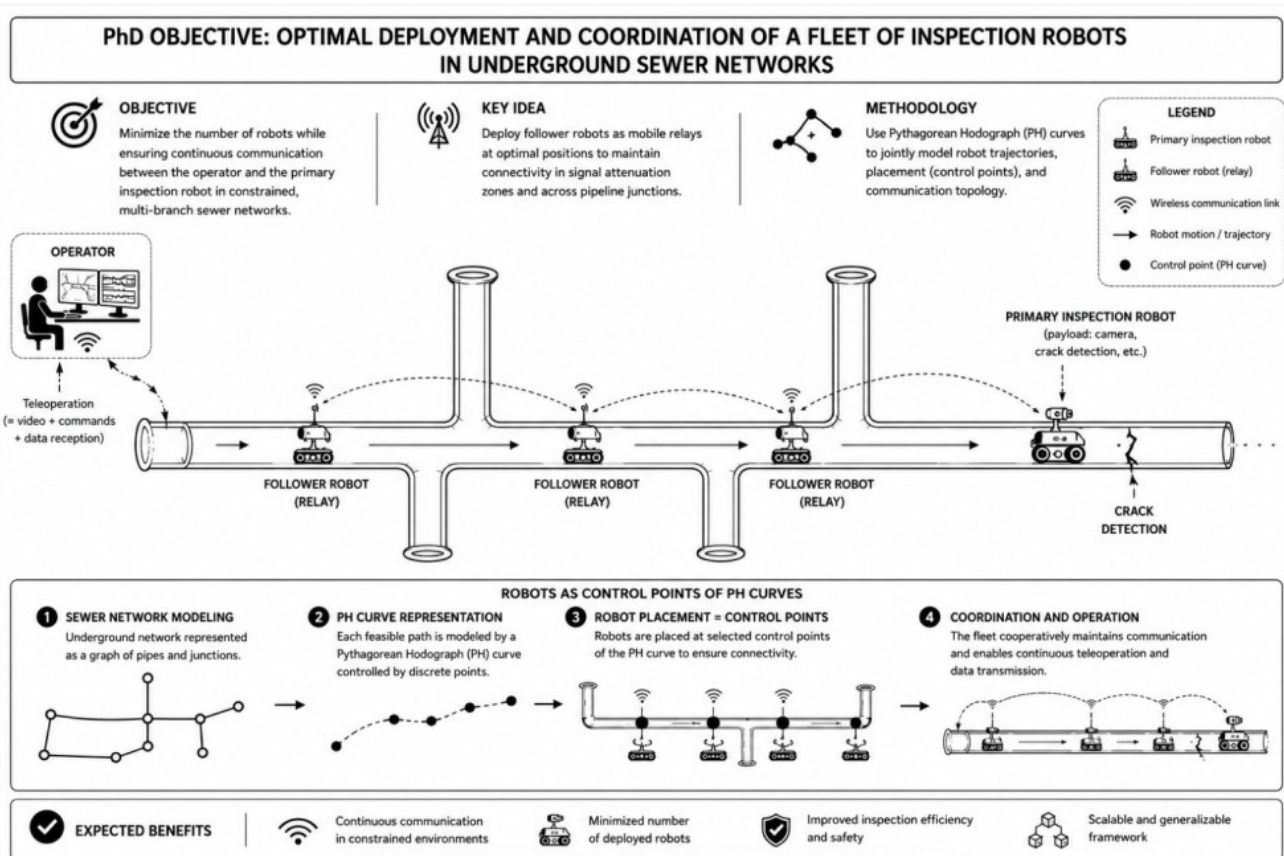


Vers une navigation autonome de satellites robotiques hétérogènes dans un environnement non structuré

Loïc Bal, Steeve Mbakop, Guilherme Espindola-Winck, Christophe Sueur and Rochdi Merzouki, Pierre Yves Lempire (Bathydrone)

CRISAL Lab and Bathydrone Solutions are developing a cooperative robotic inspection system for underground networks. The approach combines a primary robot equipped with sensing and defect-detection capabilities with auxiliary robots that act as mobile communication relays.

This multi-robot architecture ensures continuous communication with operators while extending the range and reliability of inspection missions in complex underground environments. Expected benefits include more accurate defect localization, reduced excavation and traffic disruption, shorter intervention times, improved safety, and scalable deployment across large urban sewer networks.

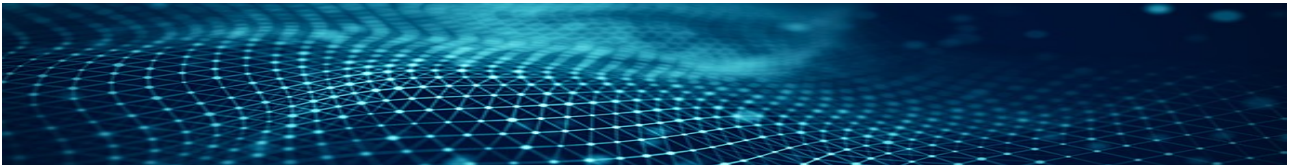


Groupes d'Intérêt Scientifique de Recherche en Automatisation Intégrée et Systèmes Homme-Machine



Région Hauts-de-France





Neuromarker of inner speech

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Résumé en 200 mots max – Abstract of max 200 words.

Auditory verbal hallucinations (AVHs) are one of the most disabling symptoms for people suffering from psychiatric disorders like schizophrenia (SCZ). From a brain activity point of view, these experiences are pretty similar to "inner speech", a task routinely performed when we mentally generate sentences without speaking them aloud. In this work, we investigated to what extent detecting inner-speech periods from electroencephalographic (EEG) signals is feasible. If this first objective can be achieved, it will constitute a first milestone towards the putative detection of AVH in schizophrenic patients using EEG.

In a systematic review, we gathered 48 studies that investigate electrophysiological markers of inner speech. Methodologies and definitions for IS can significantly diverge between studies. However some consistent findings still emerge: high gamma activation in auditory, sensory-motor, and pre-motor cortices including Broca's area, alpha and beta deactivation in the same areas, and connectivity alterations.

Results from a pilot study show encouraging results toward the classification of inner speech periods against relaxation periods. We plan to extend these findings in a subject-paced protocol which will be adapted to record AVHs as well.

Etude et prédiction du vieillissement des vêtements pour enfants**Anaïs Dahan^{a,b}, Romain Benkirane^a, Corinne Touitou^b, Sébastien Thomassey^a**

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b) Petit Bateau, Troyes, France

L'industrie textile est responsable de 8 à 10 % des émissions mondiales de gaz à effet de serre, utilise d'énormes volumes d'eau et génère 9 % de la pollution microplastique dans les océans [1]. Allonger la durée de vie des produits représente un levier clé pour une mode plus durable : un allongement de 3 mois pourrait réduire son empreinte environnementale de 5 à 10% [2]. Par ailleurs, les entreprises sont soumises à de nouvelles réglementations encourageant à intégrer cette démarche, mais qui sont coûteuses et leur nécessitent de nombreux essais.

Cette thèse CIFRE, réalisée en collaboration avec Petit Bateau, a pour objectif d'identifier et comprendre les causes de fin de vie dues à l'usage, afin de développer des méthodes d'essais plus représentatives. Pour cerner la réalité d'usage, un test au porter a été mis en place sur un panel diversifié d'enfants. Les méthodes d'essais visent à accélérer le vieillissement en laboratoire, portant sur le boulochage et la dégradation des coloris.

Dans un objectif d'optimisation, il est primordial que ces essais soient réalisés dans un minimum de temps. Différentes méthodes de prédiction ont ainsi été étudiées, portant sur le vieillissement des coloris, le boulochage et la stabilité dimensionnelle.

- [1] United Nations Environment Programme, "Full Report - UNEP Sustainability and Circularity in the Textile Value Chain A Global Roadmap," 2023. Accessed: Oct. 14, 2024. [Online]. Available: <https://www.oneplanetnetwork.org/sites/default/files/2023-10/Full%20Report%20-%20UNEP%20Sustainability%20and%20Circularity%20in%20the%20Textile%20Value%20Chain%20A%20Global%20Roadmap.pdf>
- [2] T. Cooper, S. Claxton, H. Goworek, H. Hill, A. McLaren, and L. Oxborrow, "Pilling in knitwear – a clothing longevity problem beyond design," 2017, pp. 89–93. doi: 10.3233/978-1-61499-820-4-89.

Résumé en 200 mots max – Abstract of max 200 words.

Lara & Safire – Alignment-free detection of gene fusions from long-read RNA sequencing

Lara – Lightweight and Accurate Read Analyser · Safire – Splicing And Fusion Inspector using Relational Engine

Bastien Degardins¹ · Charles Paperman¹ · Alicia Oshlack² · Camille Marchet¹

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Gene fusions in cancer

Gene fusions arise when chromosomal rearrangements join two genes into a single chimeric transcript. They are key oncogenic drivers – including **BCR-ABL1** in leukaemia and **RUNX1-RUNX1T1** in AML.

Long-read sequencing (ONT, PacBio) captures **complete fusion transcripts** in a single read. Existing tools remain alignment-dependent.

Lara & Safire detect fusions without any genome alignment – using only k-mer composition

Human genome index (GRCh38 · k = 31)

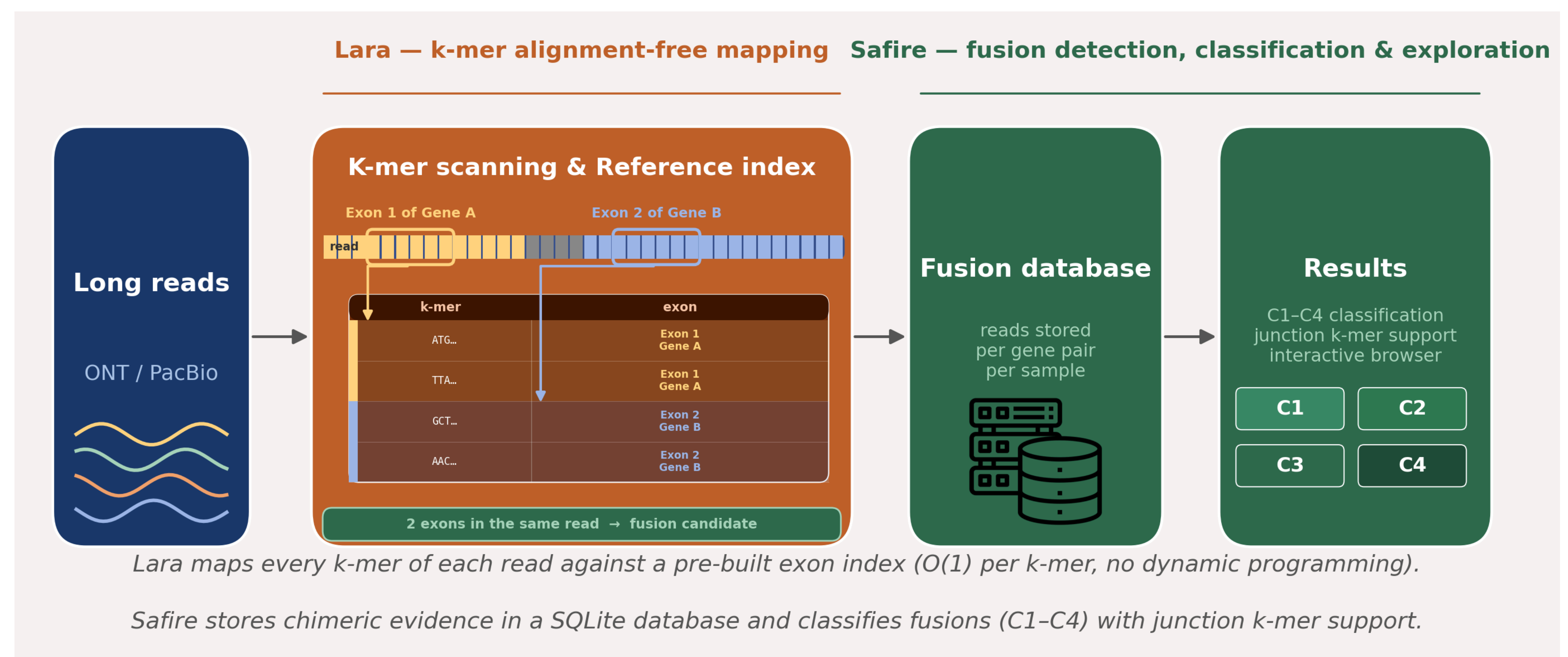
43,569 genes · 276,427 exons
197 M unique 31-mers – O(1) lookup per k-mer indexed via minimal perfect hash function

Dataset – SG-NEx^[13] MCF7

9 Oxford Nanopore samples · 3 protocols
cDNA · directcDNA · directRNA

21.9 M reads processed in a single Safire experiment

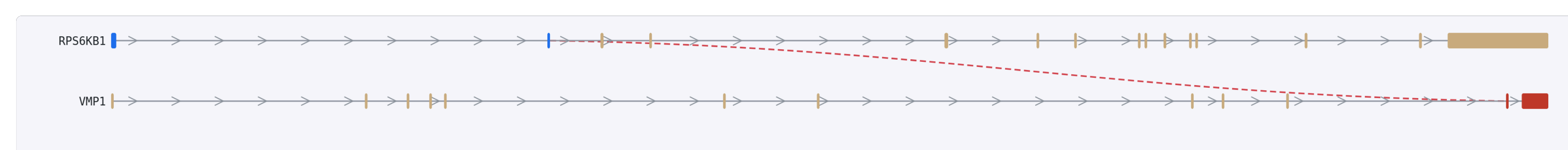
Alignment-free pipeline in two components



RPS6KB1-VMP1: recurrent MCF7 fusion, detected across all 9 samples

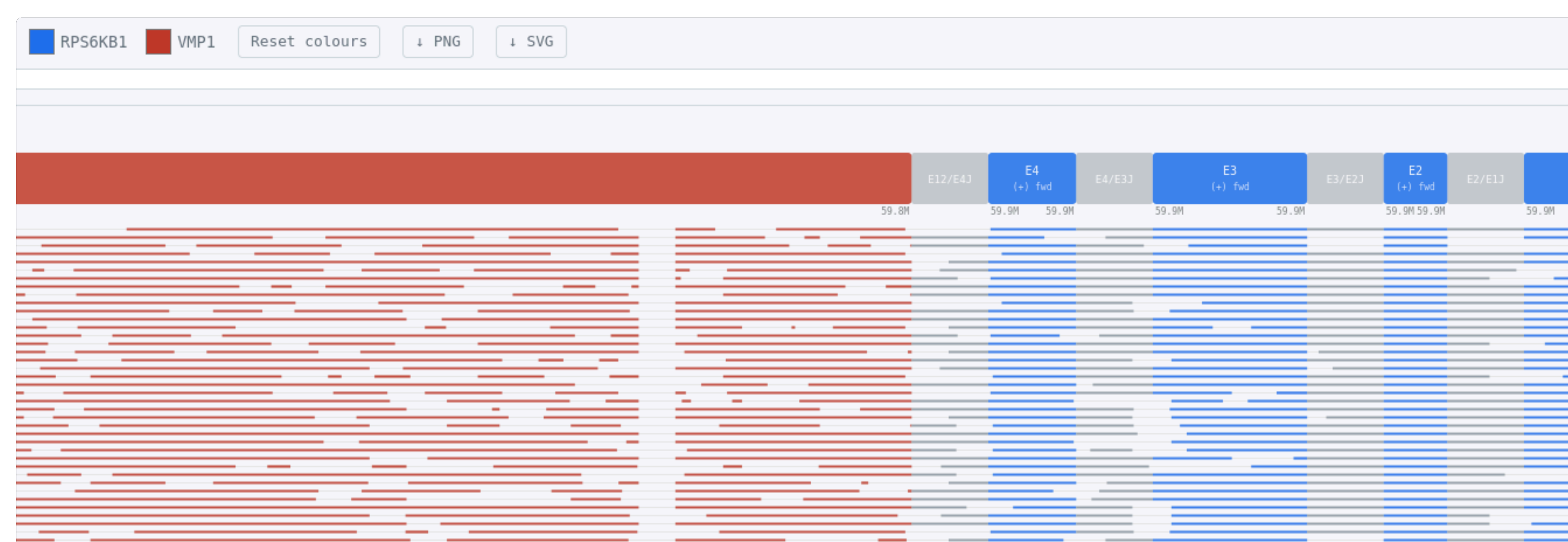
Safire captures the full chimeric transcript on both sides of the junction – not just the breakpoint coordinate

Exon traversal – all splicing configurations



Each track is a distinct splicing configuration supported by ≥ 1 read. Alternative splicing of the chimeric transcript is resolved simultaneously.

Per-read k-mer support – junction evidence



Each row is a single ONT read. **Grey junction blocks** are k-mers spanning the fusion boundary – conclusive proof that a single RNA molecule crosses the junction.

CATSPER1-TYW5-BMP2: three-gene fusion resolved from a single read

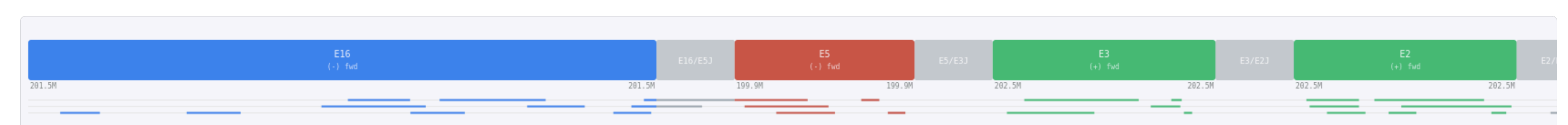
Two fusion junctions resolved simultaneously from a single chimeric RNA – a capability unique to long reads

Genomic configuration – three-gene co-occurrence



Three genes on chr2 in a single transcript. Each gene occupies its own track; red dashed lines mark both fusion junctions.

Splicing view – dual-junction k-mer support



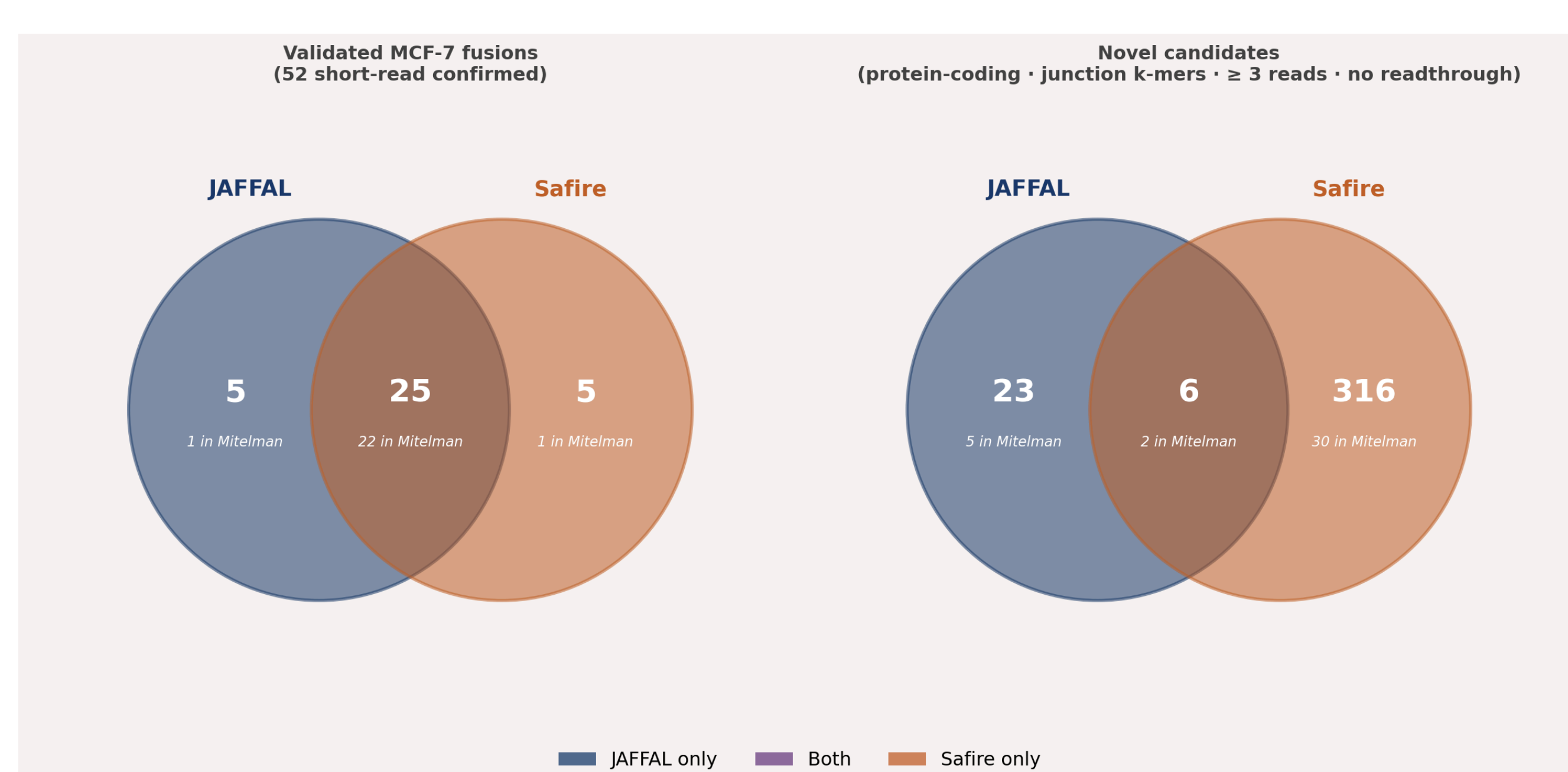
Chimeric transcript: CATSPER1:E16 → TYW5:E5 → BMP2:E1. Junction k-mers (grey) confirm both splice boundaries simultaneously.

Safire Browser – interactive exploration

- C1** Readthrough – same chr, same strand, ≤ 200 kb
- C2** Cis – exon-exon junction, ordered
- C3** Cis, inverted – chromosomal rearrangement
- C4** Same locus, opposite strands

- ▶ Filter by gene, sample, class or k-mer junction support – instantly
- ▶ Export splicing views as SVG · integrate any gene-pair database (Mitelman^[10], COSMIC^[9])

Safire recovers validated fusions and finds novel candidates^[14-18]

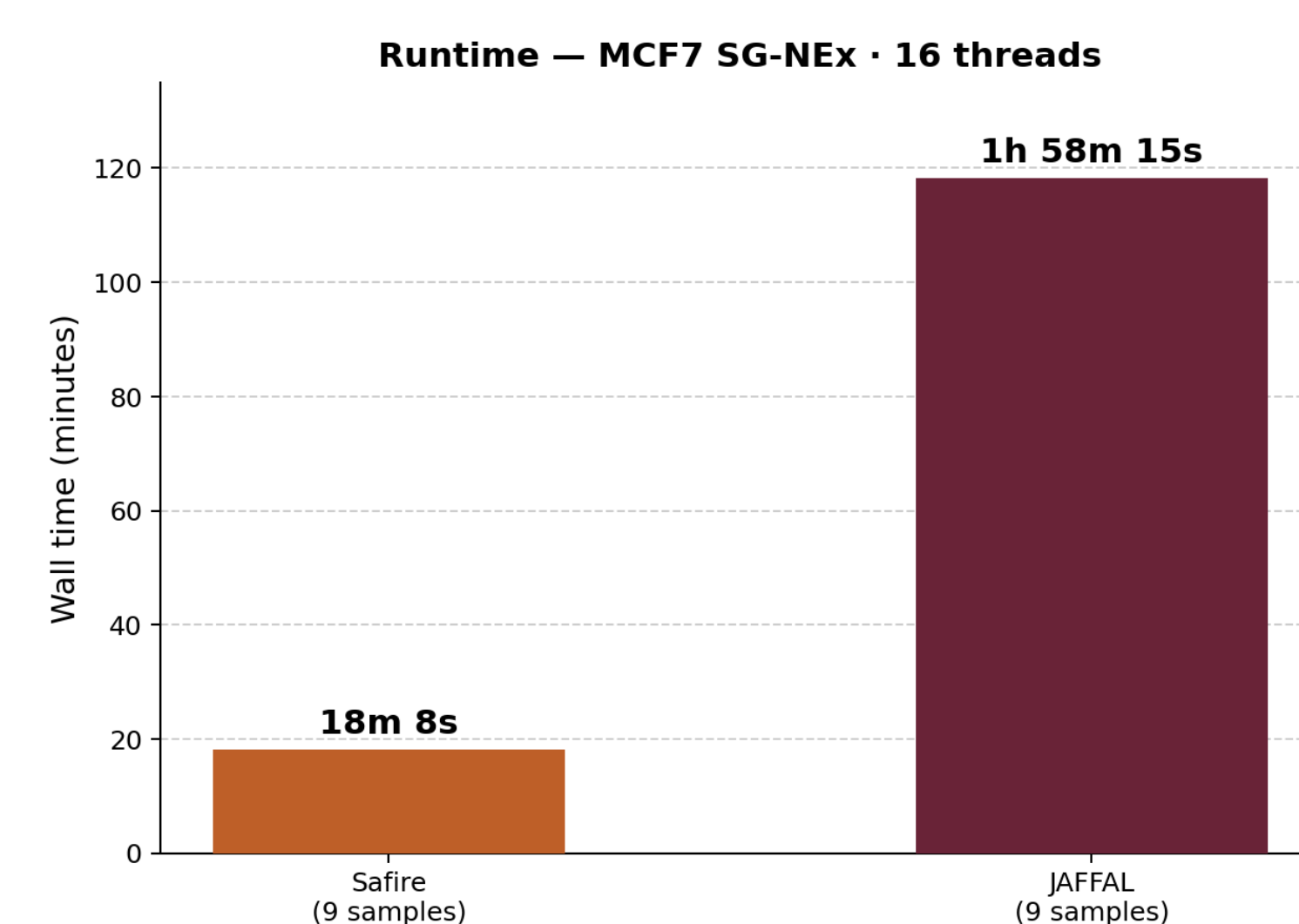


Left: 52 MCF7 fusions validated by short-read sequencing^[14-18] · Right: novel candidates (protein-coding, junction k-mers, ≥ 3 reads, no readthrough)

Speed: Safire vs JAFFAL

9 samples · 16 threads · same machine

Safire 18 min 8 s
JAFFAL 1 h 58 min 15 s



Safire processes 21.9 M reads across all samples in **under 30 minutes** on a standard workstation – alignment-free O(1) k-mer lookup eliminates the alignment bottleneck.

Why Lara & Safire?

No alignment – no bottleneck

Each read becomes a vector of integer k-mer hits. No dynamic programming, no reference alignment overhead.

Full transcript context

Every exon **before and after** the junction is resolved – not just the breakpoint coordinate. Junction k-mers provide conclusive single-molecule evidence.

Multi-sample, one database

All samples load into a single SQLite database. Filter, compare, and export across samples interactively.

Multi-gene fusions

Long reads spanning two junctions allow three-gene (and higher) fusions to be resolved from a **single read** – impossible with short reads.

Towards Smarter PV-Hydrogen Microgrids: AI-Driven Predictive Energy Management Using Real Operational Data**Chaymae DENDEN^{1,2}, Abdelhamid RABHI¹, Jeffrey TOURNEUR³, Jérôme BOSCHE¹, and Bekkay HAJJI²**¹Modelization, Information and Systems Laboratory, Picardie Jules Verne University, 80000 Amiens, France²Laboratory of Energy, Embedded System and Information Processing, National School of Applied Sciences, Mohamed First University, Oujda 60000, Morocco³H2X Ecosystems, 20 Louis Bleriot St., 35170 Bruz, France

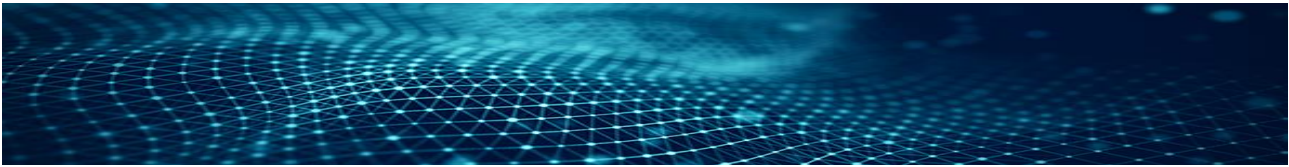
Renewable energy integration is transforming modern microgrids, but the intermittency of photovoltaic generation and the variability of electrical demand remain major challenges for efficient energy management. In this work, we propose an AI-driven framework for predictive energy management in the H2X PV-Hydrogen microgrid using real operational data. The proposed methodology combines data preprocessing, feature engineering, and machine learning techniques to accurately forecast short-term load demand, providing decision support for future Energy Management Systems (EMS). Four state of the art models were evaluated: Random Forest, Extra Trees, LightGBM, and XGBoost. Experimental results demonstrated excellent forecasting accuracy, with XGBoost achieving the best performance ($R^2 = 0.995$, RMSE = 9.22 kW). By anticipating future energy demand, the proposed framework enables smarter utilization of battery storage, hydrogen production, and energy resources within PV-Hydrogen microgrids. These results highlight the potential of artificial intelligence to support the transition toward more reliable, efficient, and intelligent hydrogen-based energy systems.

Millisecond-Level GPS Positioning Using Interpolated IGS Satellite PositionsOthmane EL ATTIQ^{1,2}, Georges STIENNE¹, Serge REBOUL¹, Adnane LATIF²

¹ Laboratoire d'Informatique Signal et Image de la Côte d'Opale (LISIC), Université du Littoral
Côte d'Opale, Calais, France

² Laboratoire de Modélisation et Systèmes Complexes, Université Cadi Ayyad, Marrakech,
Maroc

Millisecond-level GPS positioning requires consistency between signal-derived pseudorange observations and satellite positions. In a GNSS receiver, the tracking stage provides high-resolution timing information, with the millisecond corresponding to the code-period resolution of the GPS L1 C/A signal. In contrast, precise satellite orbit products provided by the International GNSS Service are available at fixed sampling intervals, such as 5 min or 15 min depending on the product. This difference creates a temporal mismatch between the reconstructed pseudoranges and the satellite geometry used for receiver position estimation. To address this issue, satellite position interpolation is formulated as a time-dependent regression problem. A feed-forward artificial neural network is used to reconstruct satellite coordinates at millisecond epochs from low-rate IGS orbit samples. The interpolated coordinates are then integrated into a pseudorange-based GPS positioning framework. Synthetic and real GPS data show that millisecond-level interpolated satellite positions preserve positioning consistency and provide stable receiver position estimates.



TRAME: Masquer le radar pour mieux voir les voitures

Yassine Janati* , Justin Bescop* , Christelle Garnier* , Benjamin Allaert* , Jean-Philippe Vandeborre*

La détection radar est une modalité prometteuse pour la perception autonome en raison de sa robustesse face aux conditions météorologiques et d'éclairage défavorables. Cependant, la plupart des pipelines radar existants s'appuient sur des représentations fortement prétraitées qui peuvent écarter des informations précieuses issues des signaux FMCW bruts. Dans ce travail, nous présentons TRAME, un cadre auto-supervisé combinant reconstruction par ViT-MAE et modélisation temporelle pour apprendre des représentations radar structurées directement à partir d'observations radar de bas niveau bruitées. Nous proposons également un cadre d'annotation pour les signaux radar reproductible basé sur des projections RGB-D synchronisées aux signaux. Notre méthode améliore la classification des patches radar par rapport aux références. Ces résultats démontrent l'efficacité de la combinaison de la reconstruction radar auto-supervisée et de la supervision intermodale pour une perception robuste basée uniquement sur le radar.

An Advanced ANN-ANFIS Based MPPT Strategy for Microgrid PV-Wind Applications

KADIRI Zineb, BOSCHE Jérôme, RABHI Abdelhamid, BOSSOUFI Badre
Laboratory of Modelisation, Information & Systems, UPJV

Hybrid photovoltaic–wind energy systems offer a promising solution for reliable and efficient renewable power generation. However, extracting maximum power under continuously varying irradiance and wind speed conditions remains a critical challenge. This work proposes intelligent Maximum Power Point Tracking (MPPT) controllers based on Artificial Neural Networks (ANN) and Adaptive Neuro-Fuzzy Inference Systems (ANFIS), applied simultaneously to a 100 kW PV system and a 4.7 kW wind turbine.

1. INTRODUCTION

- Renewable energy sources such as photovoltaic (PV) and wind systems play a key role in sustainable power generation and smart grid development.
- However, environmental condition variations such as solar irradiance and wind speed fluctuations reduce the efficiency of conventional MPPT techniques and affect maximum power extraction.
- Artificial Intelligence techniques such as ANN and ANFIS provide intelligent and adaptive MPPT control strategies capable of improving tracking performance, dynamic response, and system stability.



2. MPPT Control Strategy

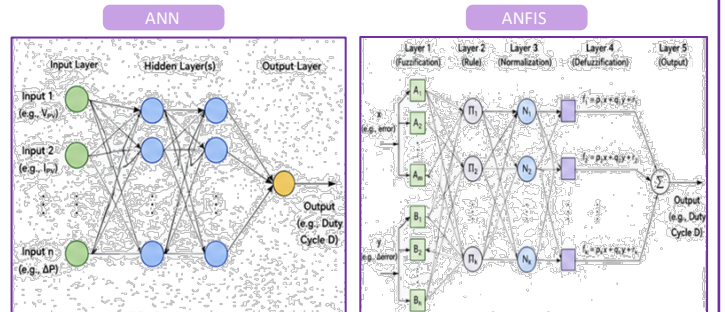
PV MPPT (Boost Converter)

- A DC/DC boost converter is used to regulate the PV operating point.
- ANN and ANFIS controllers generate the optimal duty cycle for maximum power extraction.

WIND MPPT (Speed Control)

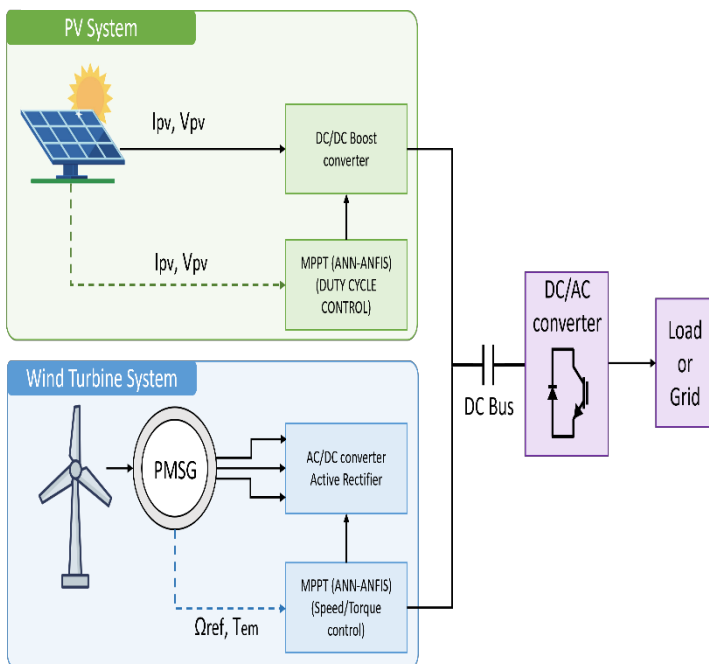
- A DC/DC boost converter is used to regulate the PV operating point.
- ANN and ANFIS controllers generate the optimal duty cycle for maximum power extraction.

AI Control Structure



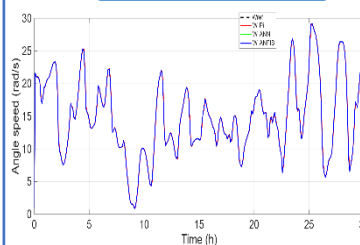
4. Hybrid PV-WIND System

The proposed hybrid system combines photovoltaic and wind energy sources.

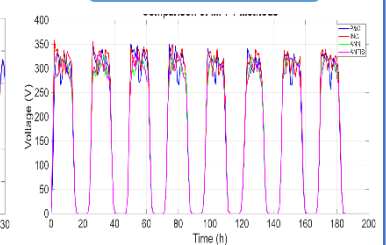


5. SIMULATION RESULTS

Speed Angular Comparison



PV Voltage Comparison



3. Conclusion

- The proposed ANN and ANFIS-based MPPT strategies improve maximum power extraction in the hybrid PV–Wind energy system.
- The intelligent controllers provide fast dynamic response, reduced oscillations, and enhanced stability under variable environmental

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Poster

Toward robust and frugal AI Models for capture and analysis of Physiological Signals

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This study introduces a compact and highly accurate ECGTinyTranformer model suitable for processing ECG signals with class imbalances (accuracy 90%). Furthermore, by employing model compression techniques such as Model Pruning and Model Quantization, this method reduces the memory used to store model parameters by up to 82% and reduces computation time by up to 30% compared to the original model. The model performs well with sensor-based ECG signals. The results highlight the potential for building efficient AI models in healthcare systems, particularly for analyzing physiological signals, which require significant processing time and power. Despite this success, future challenges include improving accuracy for rare classes and increasing model compression.

Méthodes tensorielles conjointes pour la fusion multi-capteurs Sentinel et la reconstruction hyperspectrale sur-résolue

Fatima Zahrae M'Rani^{1,2}, Matthieu Puigt¹, Cédric Jamet², Gilles Delmaire¹, Claire Guilloteau¹, Gilles Roussel¹, Vincent Vantrepotte²

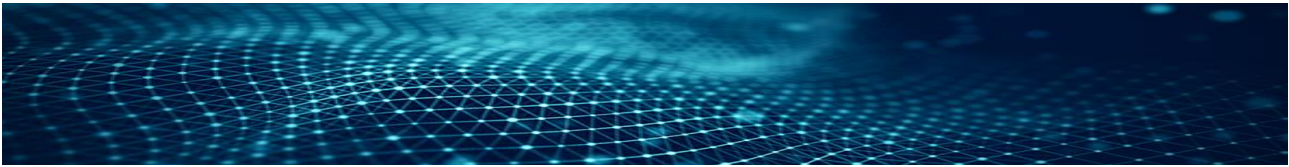
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L'observation des écosystèmes marins par télédétection satellitaire joue un rôle essentiel dans le suivi des zones côtières. Toutefois, les capteurs présentent un compromis inhérent entre résolutions spatiale et spectrale. Les missions Sentinel-2 et Sentinel-3 offrent ainsi des informations complémentaires. La première fournit des images à haute résolution spatiale, tandis que la seconde dispose d'une résolution spectrale plus riche. Leur exploitation conjointe constitue donc une voie prometteuse pour améliorer la caractérisation des environnements côtiers. Dans ce travail, nous proposons un cadre généralisé de fusion multi-observations visant à reconstruire une image à haute résolution spatiale et spectrale à partir d'une image Sentinel-2 (vue comme plusieurs images multispectrales à différentes résolutions spatiales) et d'une image Sentinel-3. Deux approches de fusion tensorielle sont développées. La première, G-STEREO-2, repose sur une décomposition canonique polyadique et une descente de gradient avec moment. La seconde, G-SCOTT, s'appuie sur une décomposition de Tucker et utilise un gradient conjugué préconditionné. Les résultats obtenus sur des données synthétiques et réelles montrent que les méthodes proposées exploitent efficacement la complémentarité des missions Sentinel-2 et Sentinel-3, tout en offrant des performances de reconstruction élevées, une complexité de calcul maîtrisée et une bonne robustesse opérationnelle.

Tracking control for switched affine systems**Bassim Maaloul, Ying Tang, Denis Efimov, Laurentiu Hetel (CRISAL / Inria)**

This work addresses the tracking problem for switched affine systems. A Lyapunov-based control law is proposed to guarantee the stability of the closed-loop system and the convergence of the tracking error. The approach is developed under the assumption that the reference model is bounded. An analysis of the tracking error is carried out under a set of assumptions to establish general conditions ensuring the desired tracking behavior. It is also shown that the chattering set is forward invariant and attractive within the considered domain of attraction. The proposed approach offers a structured framework for analyzing stability and tracking performance for switched affine systems. Numerical simulations are provided to illustrate and validate the theoretical results.



**Commande en temps prescrit pour les systèmes à paramètres distribués hybrides :
Systèmes multi-agents**

**NABI Wenpagnagde Justin - CRISTAL UMR 9189, Université de Lille
Encadrants : Nicolas Espitia Hoyos et Ying Tang**

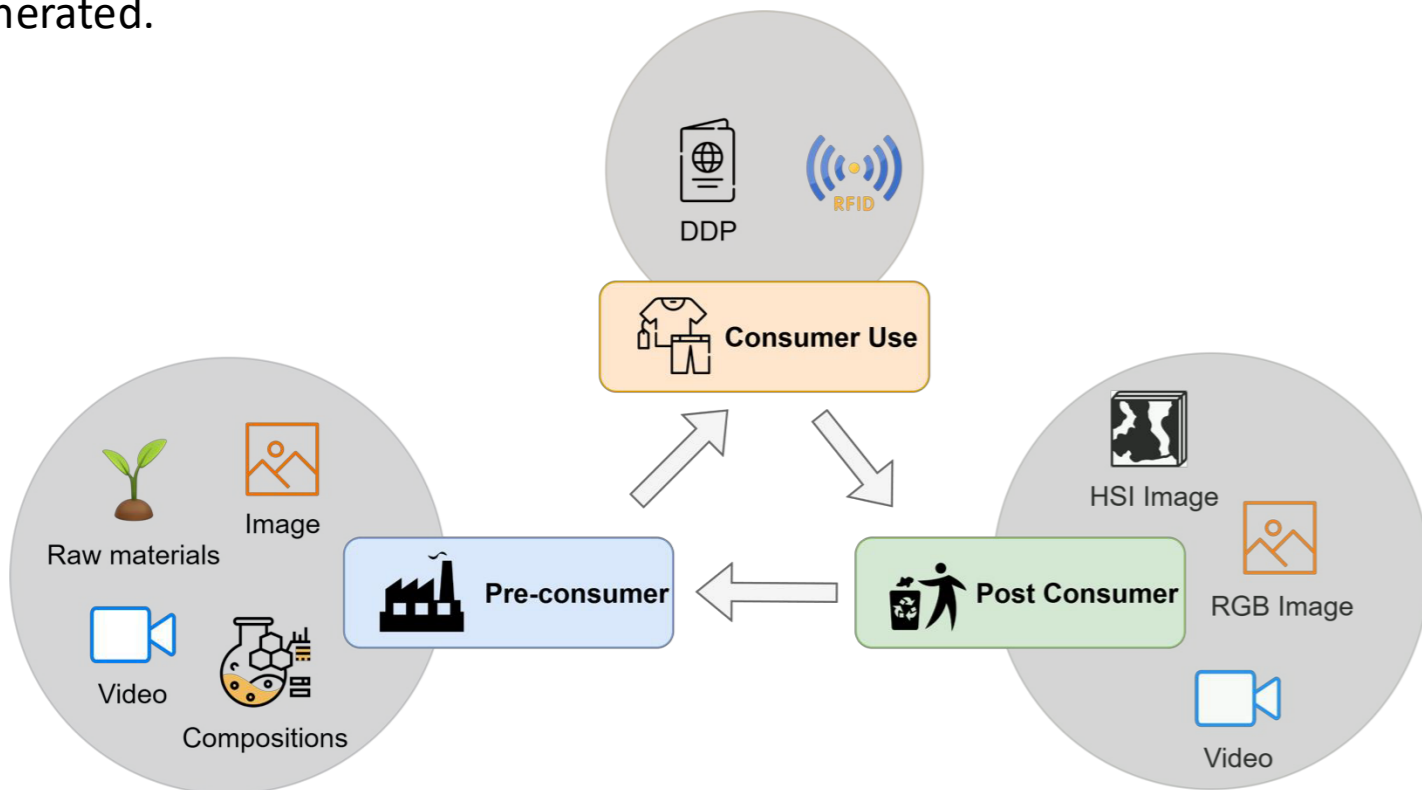
Résumé - Ce travail porte sur le déploiement de systèmes multi-agents le long de courbes planes à l'aide d'une approche par équations aux dérivées partielles. Lorsque le nombre d'agents est grand, leur position est décrite par une variable spatiale continue. L'agent situé à une extrémité joue le rôle d'ancre, tandis que le leader agit à l'autre frontière pour guider la formation. Dans un premier temps, une commande par backstepping est étudiée afin d'assurer une stabilisation exponentielle du profil désiré. Des lois de retour d'état et de retour de sortie sont considérées lorsque toute l'information sur les agents n'est pas disponible. Dans un second temps, l'objectif est renforcé par une commande en temps prescrit : les agents doivent atteindre la courbe souhaitée avant un temps fixé à l'avance. Cette approche utilise des gains variables dans le temps et un observateur.

Methodological Challenges and Opportunities for Systemic Material AI Recycling: Federated Learning, Product Passports, and Multi-Scale Methodologies for Sustainable Value Chains

Dac Hieu NGUYEN
GEMTEX, ENSAIT, University of Lille

Context and Challenges

The rapid growth of waste creates urgent environmental and resource challenges. AI offers new opportunities to improve recycling. In the recycling value chain, large amounts of heterogeneous data are generated.



However, leveraging these data to train AI models remains difficult because of the following main challenges:

- **Complex data fusion:** data from different sources and formats
- **Security risks of sharing data:** factories may not share raw data due to privacy, ownership, and competition.
- **Lack of data standardization:** data formats, labels, and product information are inconsistent across actors.

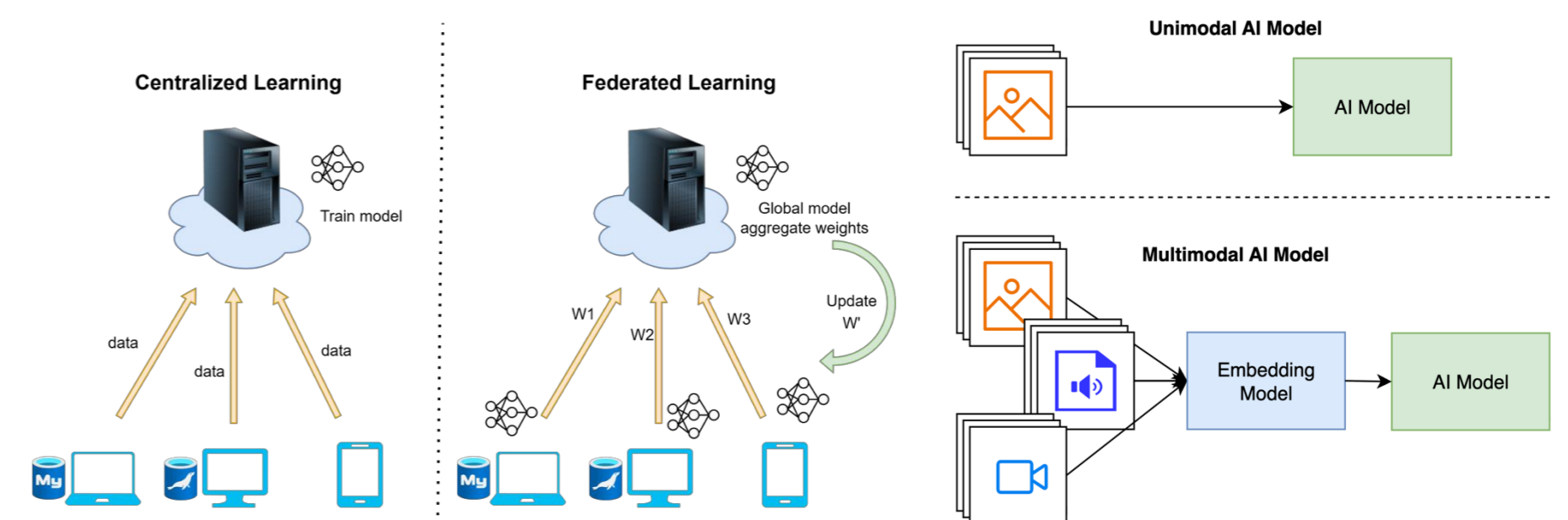
Core Methodologies

Federated Learning (FL): enables factories to collaboratively train AI models without sharing raw data, reducing privacy and security risks.

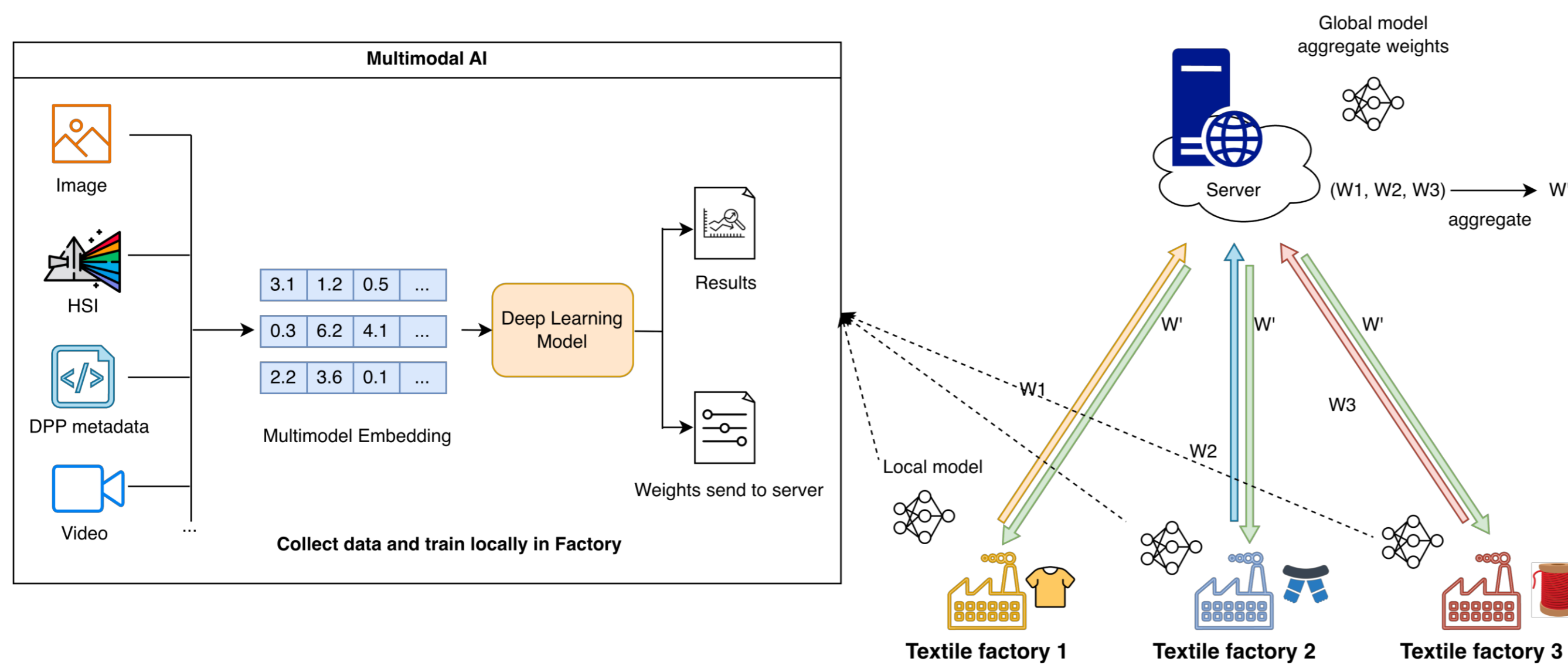
Digital Product Passport (DPP): provides a digital identity for each product, linking material composition, lifecycle information, usage history, and recyclability data.

Multimodal AI: integrates multiple sources (e.g., images, videos, compositions,...) to improve recycling decisions in AI systems.

Edge AI Deployment: focuses on deployment on edge devices (e.g., FPGA) to enable real-time data processing.

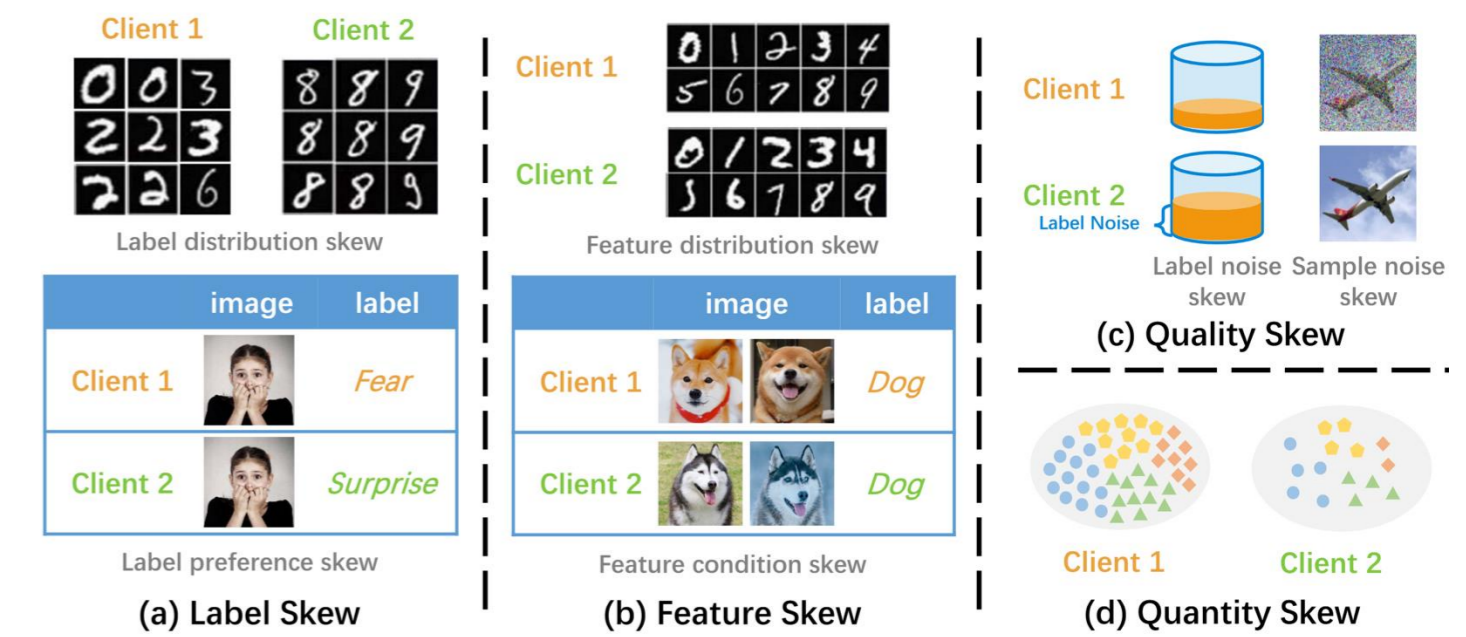


Proposed Framework for Systemic AI Recycling



Challenges in the Real-World Industry

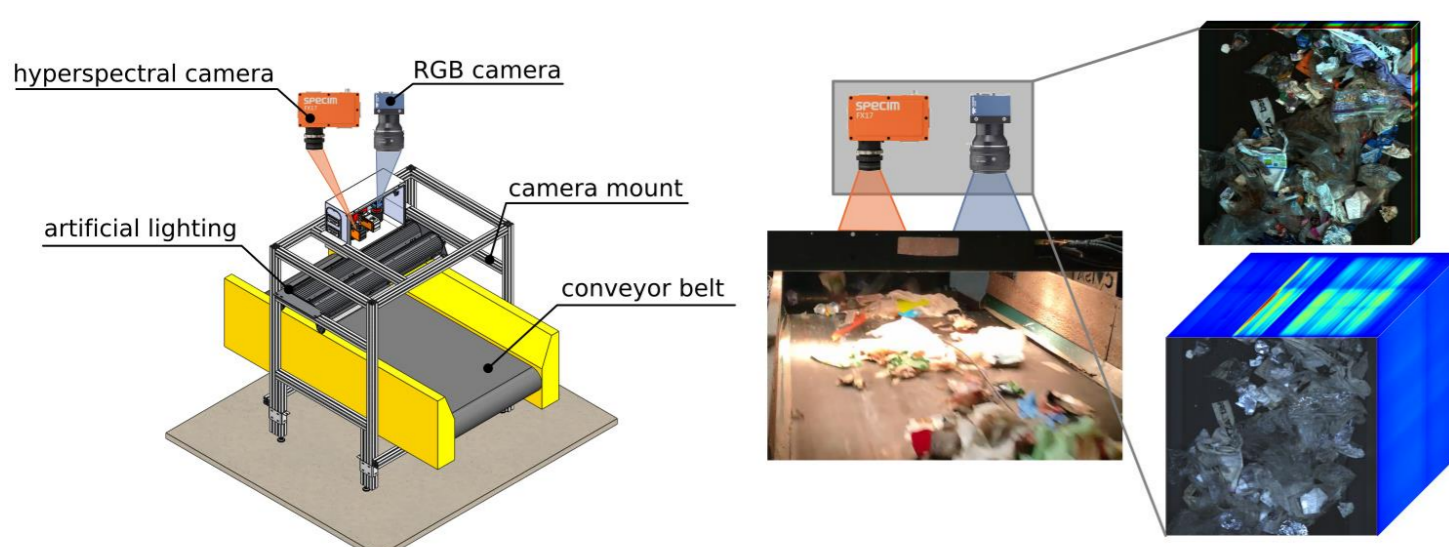
Data are collected from many factories with different sensors, devices, and operating conditions. In federated industrial settings, this creates different forms of skew, including label, feature, quality, and quantity skew, as shown below.



Implementation Steps

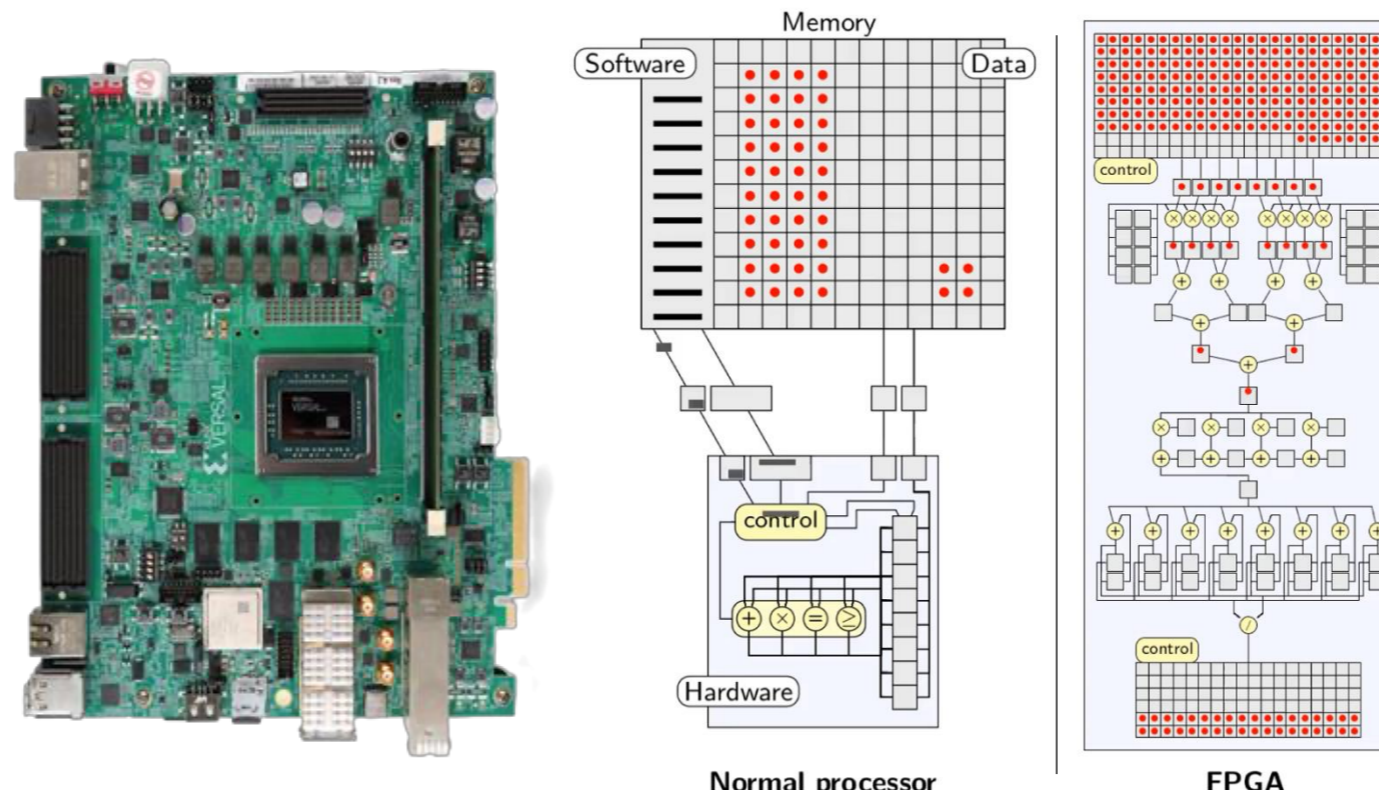
1. Data Collection

Collect data from both public datasets and self-collected datasets from recycling conveyor belts, including RGB images, hyperspectral images, material composition information,...



2. Multimodal AI Development

Build a multimodal AI model that integrates different data sources while balancing performance and deployability on edge devices (FPGA AMD VCK190).



3. Federated Learning Deployment

Deploy the model in a federated learning setting to handle heterogeneous data across factories, while keeping raw data local.

4. Explainable AI Integration

Explain why the AI makes a decision and reduce the black-box problem, helping experts verify the correctness of AI predictions

Further work will address concept drift, continuous learning, long-term model adaptation...

Références

- [1] United Nations Environment Programme, "Unsustainable fashion and textiles in focus for International Day of Zero Waste 2025," UNEP News & Stories, 27 Mar. 2025. [Online]. Available : <https://www.unep.org/news-and-stories/press-release/unsustainable-fashion-and-textiles-focus-international-day-zero>
- [2] S. F. Jensen, J. H. Kristensen, S. Adamsen, A. Christensen, and B. V. W. hrens, "Digital product passports for a circular economy : Data needs for product life cycle decision making," Sustainable Production and Consumption, vol. 37, pp.242–255, 2023, doi : 10.1016/j.spc.2023.02.021.
- [3] D. L. Hall and J. Llinas, "An introduction to multisensor data fusion," in Proceedings of the IEEE, vol. 85, no. 1, pp. 6-23, Jan. 1997, doi : 10.1109/5.554205.

Better Inversion of Diffusion Models for Generative Steganography

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Technical University
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ABSTRACT

Traditional inversion algorithms attempt to directly invert the diffusion sampling equation. In this work, built on Latent Diffusion Models (LDMs), we propose a family of algorithms with varying time complexities that perform the search of an antecedent within the latent space and/or the Variational Autoencoder (VAE) decoder.

This antecedent search involves optimizing the input to each step of the generation pipeline, such as a single diffusion step. The goal is to minimize the distance between the output of the given step and the variable initially observed by the receiver. We also introduce a novel algorithm, Global Greedy Gradient Descent (3GD), which extends this search to multiple pipeline operations, enhancing both precision and stability.

Our results, using Stable Diffusion 2.1 and the widely-used s-SS Leveque et al. (2026) scheme, demonstrate that our step-by-step antecedent search achieves error-free performance in 56% of cases at a rate of 1 bit per sample (bps) when using PNG encoding. Furthermore, with Gaussian Shading Yang et al. (2024) at 1 bps, our algorithm reduces the average error by 50%. We show a clear trade-off between computational complexity and faithful inversion across our algorithms.

The code for this work is available in the following gitlab repository <https://gitlab.cristal.univ-lille.fr/noirault/better-inversion.git>

CCS CONCEPTS

• **Security and privacy** → *Information-theoretic techniques*.

KEYWORDS

Data Hiding, Steganography, Generative Steganography, Diffusion Model, Rectified flow Model

ACM Reference Format:

Aurélien Noirault, Tomáš Pevný, Jan Butora, Vincent Itier, and Patrick Bas. 2026. Better Inversion of Diffusion Models for Generative Steganography. In *ACM Workshop on Information Hiding and Multimedia Security (IH&MMSec*

'26), June 17–19, 2026, Firenze, Italy. ACM, New York, NY, USA, 11 pages. <https://doi.org/10.1145/3785353.3815088>

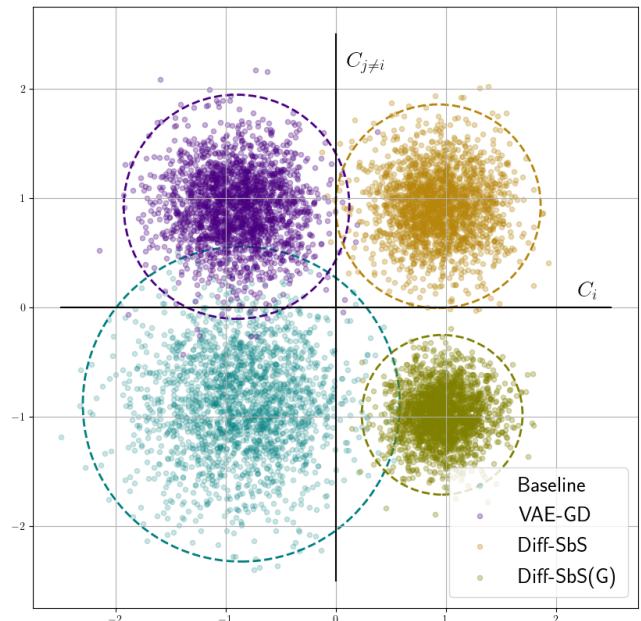
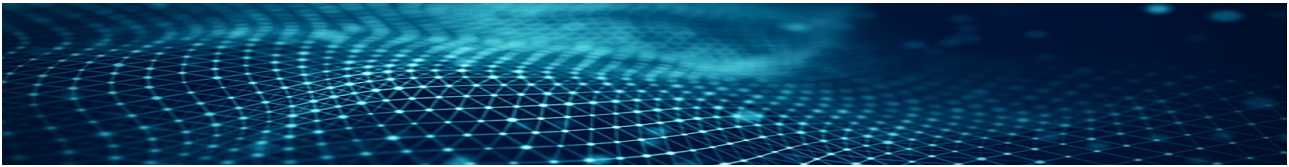


Figure 1: Visualization of the inversion noise of Stable Diffusion 2.1 with a PNG compressed image, and s-SS by projecting the inverted latent image on 2 carriers C_i and $C_{j \neq i}$. The corrected samples show the effect of the correction strategies presented in Section 5.

1 INTRODUCTION

Steganography has two main requirements: (1) to embed the largest possible payload and (2) to do so in the least detectable manner, particularly within popular content like digital images. With this in mind, a new category of steganographic algorithms based on generative models and grounded in the principle of generative steganography Fridrich (2009) has recently emerged. A key distinction from classical steganography is that, rather than embedding



Human-in-the-Loop Multichannel NMF for Speech Separation in Aircraft Incident Safety Investigations

Guillaume PESTELLE (LISIC), Gilles DELMAIRE(LISIC), Matthieu Puigt(LISIC), Benjamin BIGOT(AMIAD), Gilles ROUSSEL(LISIC)

Lors d'incidents ou d'accidents aéronautiques, des enquêteurs spécialisés doivent en comprendre les causes en retrouvant puis analysant les deux boîtes noires de l'appareil. L'une d'entre elles, le Cockpit Voice Recorder (CVR), enregistre l'ensemble des sons émis dans le cockpit. L'analyse des CVR est complexe en raison de la superposition de multiples sources sonores. L'analyse automatique des CVR sur ces segments de parole superposée s'apparente alors à un problème de séparation de sources. Cependant, les contraintes des enquêtes de sécurité interdisent le recours aux modèles de Deep Learning qui seraient entraînés sur des données CVR très sensibles.

Pour y remédier, nous proposons un formalisme séquentiel fondé sur la factorisation matricielle non-négative multicanal (MNMF) dans lequel l'analyste audio juge si les signaux estimés sont intelligibles ou pas. Notre formalisme complexifie au fur et à mesure l'algorithme de MNMF afin d'aller chercher des informations complémentaires et d'améliorer ses performances. En particulier, nous proposons une version informée de la MNMF qui prend en compte les sorties de méthodes d'analyse en composantes parcimonieuses.

Les évaluations menées sur 50 simulations démontrent qu'une des approches informées proposées surpasse non-seulement les versions aveugles et supervisées de la MNMF mais aussi les approches de Deep Learning testées.

Formal Methods for Safe Moving-Block Route Management

Araaf Recta¹, Rim Saddem-Yagoubi², Julie Beugin¹, and Mohamed Ghazel¹

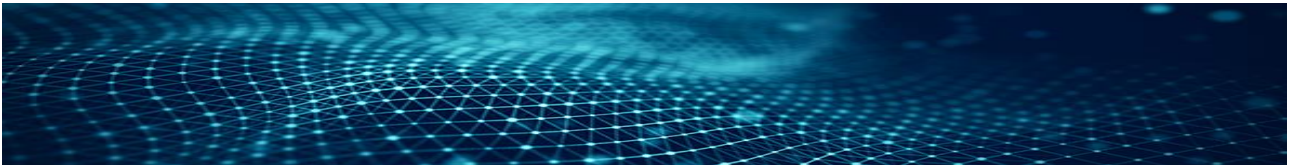
¹ Univ. Gustave Eiffel, COSYS, ESTAS, F-59650 Villeneuve d'Ascq, France

² Aix Marseille Univ, CNRS, LIS, Marseille, France

Railway control-command and signalling systems are safety-critical, as failures can result in significant losses, making formal verification essential to ensure safety. In this context, we present a formal model for analysing the future Moving Block (MB) safety of the European Train Control System (ETCS), focusing on train route management. These models have been developed using UPPAAL Timed Automata, combining those from the PERFORMINGRAIL project with newly designed trackside control models.

The European Train Control System (ETCS), as part of the broader European Rail Traffic Management System (ERTMS), is transitioning toward the Moving Block (MB) concept to enhance railway capacity and operational flexibility. Unlike traditional Fixed Block systems, which rely on fixed track segments for train separation, MB systems enable trains to follow each other at dynamically adjusted speeds, maintaining only the minimum safe braking distance. This approach allows for reduced headways between trains, hence increasing network capacity.

However, this increased flexibility introduces new challenges for safety assessment, particularly with regard to train routing management and track switch control. In this context, this article focuses on the Full Moving Block operation of ETCS, with particular attention to the main MB trackside control function, namely the Route Management and its related functions, and their integration within the overall system architecture. Our objective is to contribute to the ongoing development of reliable and scalable formal verification frameworks for MB systems



Integrated Design of SPARC Smart Wheelchair

Yehya SHARIF^{1,2}, Abdul Salam Rasmi ASRAF ALI², Gilles TAGNE^{1,2}, Rochdi Merzouki²,

Christophe Sueur^{2,3}

1: JUNIA ISEN

2: CRISAL Laboratory

3: Ecole Centrale Lille

This poster describes the integrated design of the **SPARC smart wheelchair**, an assistive mobility solution that enhances the mobility of disabled and elderly individuals. Inspired by innovative **commercial smart wheelchairs** such as the Path Fynder W2000 [1], the ROBINT [2], and the Abbychair [3], as well as **R&D smart wheelchairs** such as the Vulcan 2.0 [4], the Co-Nav Chair [5], and the IMASEN wheelchair [6], we have developed the SPARC smart wheelchair from a conventional electric wheelchair by integrating four LiDARs, an RGBD camera, two inductive encoders on each motorised wheel, and an IMU. This instrumentation system enables real-time data acquisition for smart functionalities such as **visual servoing for QR code-based navigation** using the VISP controller and RGBD camera and **lidar-based tracking for April-Tag following**, and IMU-Odometry based fleet applications. This modular architecture could support other smart functionalities in the future, such as obstacle avoidance and AI-driven path planning. This SW could enhance autonomy and mobility in the healthcare field.

Commande robuste d'un peloton de véhicules connectés vis-à-vis des retards et des défauts

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Résumé : Les pelotons de véhicules connectés permettent d'améliorer la sécurité routière, la fluidité du trafic et l'efficacité énergétique. Cependant, leur fonctionnement peut être affecté par des retards de communication et des pertes d'efficacité des actionneurs.

Dans ce travail, le peloton des véhicules est modélisé en introduisant le risque de perte d'efficacité des actionneurs et de transmission retardée des informations. Une commande robuste est développée pour le contrôle longitudinal d'un peloton de véhicules connectés en prenant en considération ces contraintes et en se basant sur la technique des inégalités matricielles linéaires (LMI) pour calculer les gains.

Les résultats de simulation obtenus sous la topologie de communication PF montrent la convergence des erreurs de position, de vitesse et d'accélération malgré la présence des retards et des défauts d'actionneurs. Par conséquent ces résultats montrent l'efficacité de la méthode proposée et sa capacité à maintenir les performances de stabilité du peloton.

Anomaly Detection in Multivariate Time Series under Evolving Normality: A Decision Policy Framework

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Abstract

Anomaly detection for industrial time series is essential for predictive maintenance, process monitoring, and fault diagnosis in smart manufacturing and industrial IoT systems [5]. However, real-world industrial data are often high-dimensional, non-stationary, and affected by evolving operating conditions, machine load, environmental changes, sensor aging, and maintenance actions. These factors induce concept drift, which remains a major challenge for practical deep anomaly detection, together with generalization and lightweight deployment constraints [1]. A critical issue is that not every deviation from learned normality corresponds to a true fault: some deviations indicate abnormal or unsafe behavior, while others reflect benign distribution shifts. Existing drift-aware methods have improved adaptation and robustness through dynamic system modeling and concept drift suppression [2], [3], while lightweight IIoT-oriented models highlight the need for efficient edge deployment [4]. Nevertheless, limited attention has been given to decision mechanisms that explicitly distinguish true anomalies from evolving normal behavior. This work motivates a drift-aware decision policy framework for multivariate time-series anomaly detection, aiming to support cost-aware, interpretable, and adaptive decisions under evolving industrial normality. To address this gap, we propose a cost-aware decision policy framework for anomaly detection in multivariate time series under evolving normality. The framework first employs a frozen Transformer-based score model to estimate per-timestep reconstruction errors. These errors are then transformed into drift-robust representations through CUSUM-based feature engineering, capturing both instantaneous deviations and persistent distributional changes. Finally, a PPO reinforcement learning agent learns a budget-constrained alerting policy with asymmetric penalties that reflect practical operational costs. As a result, the proposed framework aims to balance anomaly detection performance and alerting cost while adapting decision behavior under evolving industrial normality.

References:

- [1] Xudong Jia, Peng Xun, Wei Peng, Baokang Zhao, Haojie Li, Chiran Shen, "Deep anomaly detection for time series: A survey," *Computer Science Review*, vol. 58, p. 100787, 2025.
- [2] Renat Kermenov, Giacomo Nabissi, Sauro Longhi, Andrea Bonci, "Anomaly detection and concept drift adaptation for dynamic systems: a general method with practical implementation using an industrial collaborative robot," *Sensors*, vol. 23, no. 6, p. 3260, 2023.
- [3] Licheng Yang, Yu Yao, Daoqing Yang, Wei Yang, Yuming Hao, "A Generalizable Anomaly Detection Framework with Dynamic Concept Drift Suppression for Non-stationary Time Series," *Knowledge-Based Systems*, p. 115380, 2026.
- [4] Lei Chen, Xinzhe Cao, Tingqin He, Yepeng Xu, Xuxin Liu, et al., "A lightweight AllMLP time-frequency anomaly detection for IIoT time series," *Neural Networks*, vol. 187, p. 107400, 2025.
- [5] M. Orabi, K. P. Tran, P. Egger, S. Thomassey, "Anomaly detection in smart manufacturing: An Adaptive Adversarial Transformer-based model," *Journal of Manufacturing Systems*, vol. 77, pp. 591–611, 2024.

Maintenance des infrastructures routières et portuaires par robots collaboratifs duals.

Timothé WURMLINGER, Rochdi MERZOUKI, Richard ASSAKER
CRISTAL Softe

Cette thèse s'inscrit dans le développement de solutions robotiques pour la maintenance préventive et corrective des infrastructures routières, portuaires et bâties. Elle vise à concevoir, modéliser et contrôler un système robotique dual capable d'intervenir sur des surfaces dégradées, notamment pour l'inspection, la préparation, le nettoyage et la réparation in situ de fissures ou de défauts localisés. L'architecture étudiée repose sur deux bras manipulateurs coordonnés : l'un peut assurer l'analyse de l'état de surface et la préparation de la zone, tandis que l'autre réalise le dépôt continu de matériau de réparation.

Le cœur scientifique du travail porte sur la coordination sûre et efficace de ces deux bras dans des environnements contraints et incertains. La thèse combine modélisation cinématique et dynamique, commande hybride position/force, planification de trajectoires sans collision, partage d'espace de travail, allocation de tâches et optimisation énergétique. L'objectif est de garantir la précision du geste, la stabilité lors du contact avec des surfaces irrégulières et la robustesse du système en conditions réelles.

Les résultats attendus sont un cadre de commande et de planification pour robots collaboratifs duals, des algorithmes validés expérimentalement et des démonstrateurs de réparation autonome, contribuant à améliorer sécurité, coût, durabilité et résilience des infrastructures critiques modernes exposées.

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Poster

Development of an intelligent recommendation system for personalized 3D garment design

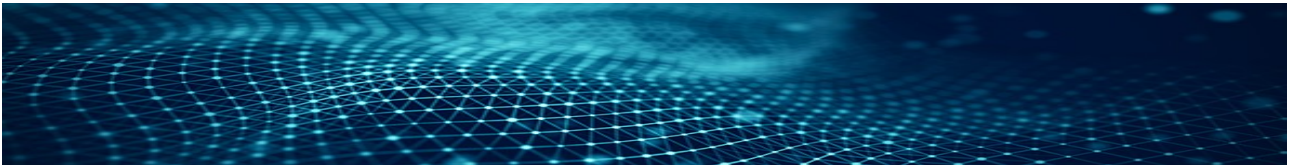
Wen YANG, Xuyuan TAO, Xianyi ZENG

Univ.Lille, ENSAIT ULR 2461-GEMTEX-Génie et Matériaux Textiles

Traditional garment design is complex and inefficient, while current recommendation systems often lack flexibility, accuracy, and human-centered perception. This study proposes an intelligent recommendation system for personalized 3D garment design by integrating garment knowledge, artificial intelligence, and interactive user selection. The system is supported by multiple databases, including 3D human body, garment pattern, and fabric databases, and follows a workflow from avatar generation to pattern generation, 3D garment creation, virtual try-on, and recommendation output. A garment pattern semantic structure model is developed to represent garment components, structural relationships, and design constraints, enabling knowledge-guided pattern generation and fine adjustment. A case study demonstrates personalized garment generation based on individual body parameters, such as height and weight, and user-selected avatar, fabric, and pattern options. The current work has achieved personalized 3D garment pattern generation. Future work will focus on establishing an evaluation mechanism and automatic modification function to improve recommendation accuracy, adaptability, and garment fit. This research contributes to the development of flexible, knowledge-driven, and AI-guided tools for personalized digital fashion design.

Development of a Personal Thermal Comfort Prediction System Based on Hybrid ModelYiqu ZHANG¹, Xianyi ZENG¹, Xuyuan TAO¹¹Univ.Lille, ENSAIT ULR 2461-GEMTEX–Génie et Matériaux Textiles, F-59000 Lille, France

Thermal comfort plays an important role in human health, and work productivity. Therefore, personalized thermal comfort prediction is important for understanding thermal responses. However, existing thermal comfort models often simplify clothing factors, insufficiently consider individual differences, and mainly provide static and global comfort evaluation. To address these limitations, this study proposes a personal thermal comfort prediction system based on a hybrid model integrating human physiology, clothing properties, and environmental conditions. The proposed framework first constructs a multidimensional dataset using the thermophysiological model to generate skin temperature and thermal sensation data. A transfer learning-based physiology-informed LSTM model is then established to predict dynamic and localized thermal comfort responses. Experimental data from different subjects are collected for model fine-tuning and validation. A clothing insulation model is developed to estimate local and total clothing insulation using thermal resistance equations. This clothing insulation model is then integrated into the thermal comfort prediction model to form a hybrid model, enabling more comprehensive and accurate prediction of personal thermal comfort by considering both clothing effects and individual physiological differences. This hybrid framework supports personalized, dynamic, and local thermal comfort evaluation and provides a basis for virtual garment comfort assessment without physical try-on.



Spatio-Spectral Correlation Measure For Multispectral Images

Matteo Zotto, Olivier Losson, Benjamin Mathon, and Ludovic Macaire - Univ. Lille, CNRS, Centrale Lille, UMR 9189 - CRISTAL – Centre de Recherche en Informatique Signal et Automatique de Lille, F-59000 Lille, France

Multispectral imaging captures image data with K spectral channels. Spatial and spectral correlation measures are commonly used to assess properties on multispectral images. MultiSpectral Filter Array (MSFA)-based cameras acquire sub-sampled raw images where each pixel is associated with one among K bands, according to an underlying MSFA lattice. We extend the analysis and propose a new measure to assess spatial and spectral properties on raw images. With respect to the distribution of the filters within the MSFA lattice, our method generalizes spatial and spectral correlation measures to raw images. We conducted an experiment to assess assumptions about spatial and spectral properties in raw images. We present and discuss a result computed on the image balloons of the dataset CAVE.