Université de Rennes

Direction de la Recherche et de l'Innovation

Appel à projets - Année 2026

Contrats doctoraux «Ordinaires»

ECOLE DOCTORALE : MATISSE **POLE DE RECHERCHE : Mathématiques-numérique**

Unité de recherche d'accueil

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Equipe : MALT

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HDR : × oui □ non **Nb de thèses en cours** : 6 (dont 3 terminent en 2026)

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Sujet

Titre : Characterization of motion anomalies in videos: Application to the detection of AI-generated videos

Mots clés : Motion in image sequences, time series, learning, anomaly characterization, detection of AI-generated videos

Cotutelle internationale (oui/non) : non **Si oui, préciser l'établissement et le pays de rattachement** :

Descriptif (15-30 lignes) :
Contexte socioéconomique et scientifique ; Les hypothèses et questions posées ; Les grandes étapes de la thèse et démarche ; Approches méthodologiques et techniques envisagées

A video is more than just a succession of images because it incorporates the fundamental temporal dimension of motion. Motion indeed carries intrinsic information in videos. This characteristic is essential to the analysis. Additionally, motion properties become more explicit over time. Motion is fully represented by the velocity field computed between two images at every time instant of the video. In the long term, the consecutive velocity fields can be viewed as a multivariate time series.

The first objective of the thesis is to create parsimonious time series through learning that can adequately represent motion content and are semantically suitable for generic tasks such as detection, recognition, and classification. More specifically, we will explore anomaly detection in videos, a challenge shared by many applications, albeit in various forms. We will focus on the characterization of motion anomalies based on learned time series. Motion anomalies can manifest themselves in three
main ways: deviations from normal behavior or context (e.g., a vehicle driving the wrong way on a highway), sudden divergences (e.g., a vehicle leaving the road, panic in a crowd), or non-natural motion (e.g., presumably in AI-generated videos).

This last category will lead us to address the detection of AI-generated videos, whose rapid rise and growing ability to mimic reality raise major societal and economic issues. While the detection of AI-generated still images has been the subject of much research and even challenges, methods dedicated to videos remain few and far between [1,2,3]. Methods developed for detecting AI-generated images are not effective for videos because they fail to recognize an essential video characteristic: its temporal dimension. This thesis will build on our recent work, particularly on salient trajectory detection [4], long-term unsupervised motion segmentation [5], and automatic detection of AI-generated content [6]

[1] Q. Liu, P. Shi, Y.-Y. Tsai, C. Mao, and J Yang, Turns out I'm not real: Towards robust detection of AI-generated videos. arXiv:2406.09601, June 2024.
[2] K. Park et al., VidGuard-R1: AI-generated video detection and explanation via reasoning MLLMs and RL. arXiv:2510.02282, October 2025.
[3] C. Zheng et al., D3: Training-free AI-generated video detection using second-order features. International Conference on Computer Vision (ICCV'2025), Honolulu, October 2025.
[4] L. Maczyta, P. Bouthemy, and O. Le Meur. Trajectory saliency detection using consistency-oriented latent codes from a recurrent auto-encoder, IEEE Transactions on Circuits and Systems for Video Technology, 32(4):1724 – 1738, April 2022.
[5] E. Meunier and P. Bouthemy. Segmenting the motion components of a video: A long-term unsupervised model, IEEE Transactions on Pattern Analysis and Machine Intelligence, 48(1):500-511, January 2026.
[6] G. Charbel, N. Kindji, E. Fromont, L. M. Rojas-Barahona, and T. Urvoy. Robust detection of synthetic tabular data under schema variability, 40th Annual AAAI Conference on Artificial Intelligence (AAAI'2026), Singapore, January 2026.