جامعة عبد المالك السعدي
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Université Abdelmalek Essaadi

Pole for Doctoral Studies
Center for Doctoral Studies Sciences and Techniques and Medical Sciences

ANNOUNCEMENT OF DOCTORAL THESIS DEFENSE

Centre des Etudes Doctorales Sciences et Techniques et Sciences Médicales

M. JADOULI Ayoub

Will present their research work with the aim of earning a Doctorate

Doctoral program: **Science and Technique Engineering**
Discipline: **Computer Science**
Specialty: **Computer Science, Engineering and Artificial Intelligence**

On 19/09/2026 at 10H00 at the Mohammed ADDOU Conference Hall, Faculty of Sciences and Techniques of Tangier, UAE
Under the Theme

Prediction of Wildfire Risk Based on Satellite Data and Deep Learning Algorithms

Front of the jury composed of :

First Name & Last Name	Establishment	Designation
Pr. FENNAN Abdelhadi	FST of Tangier, UAE	President
Pr. BOUHORMA Mohammed	FST of Tangier, UAE	Reviewer
Pr. EN-NAIMI El Mokhtar	FST of Tangier, UAE	Reviewer
Pr. HADDOUCH Khalid	ENSA of Fez, USMBA	Reviewer
Pr. GIBET TANI Hicham	FST of Tangier, UAE	Examiner
Pr. ZAOUI SEGHROUCHENI Yassine	FS of Rabat-Agdal, UM5	Examiner
Pr. EL AMRANI Chaker	FST of Tangier, UAE	Supervisor

Host Research Structure: Computer Science and Smart Systems Laboratory (C3S)

Abstract

This thesis investigates wildfire-risk prediction in Morocco as a multi-source data fusion and short-lead forecasting problem at the intersection of Earth observation, environmental modelling, and deep learning. It addresses three recurring limitations of operational wildfire-warning systems: the difficulty of combining heterogeneous satellite and meteorological sources, the weak representation of anthropogenic ignition factors, and the gap between accurate research models and deployable near-real-time pipelines. The work follows a progressive research path, beginning with the detection of human activities in wildland areas from high-resolution satellite imagery, then moving toward a national-scale prediction framework based on tabular, spatial, temporal, and environmental indicators.

The central contribution is the Morocco Wildfire Predictions dataset, covering 2010-2022 at 2 km spatial resolution. It integrates MODIS, VIIRS, Sentinel-2, SMAP, ERA5, population indicators, ground observations, temporal variables, vegetation indices, soil-moisture information, and engineered lag features. After harmonisation, quality control, balancing, and feature engineering, the dataset contains 934,586 instances and 277 predictive variables plus the wildfire target. This resource supports reproducible experimentation and provides a structured basis for short-lead wildfire-risk modelling in a data-scarce Mediterranean and semi-arid context.

On top of this dataset, several deep-learning architectures are designed and evaluated: Parallel Multi-path Feed Forward Neural Networks, positional-encoding enhancements, a hybrid FFN-CNN-LSTM architecture with attention-based integration, a physics-embedded entropy model, and an Internal World transfer architecture using frozen pretrained intermediate layers. The hybrid model obtains the strongest overall balanced-set performance, reaching 91.7% accuracy and reducing false negatives compared with single-model baselines, while the Internal World model reaches 94.3% recall on fire cases. The thesis finally translates these contributions into a near-real-time prototype for daily data reconstruction, inference, and cartographic risk visualisation. Overall, the work demonstrates that carefully engineered multi-source data and task-specific neural architectures can improve 24-hour wildfire-risk forecasting, while also identifying remaining challenges in calibration, leakage control, delayed satellite products, operational validation, and transferability beyond Morocco.

Keywords : Wildfire-risk prediction; deep learning; satellite remote sensing; multi-source data fusion; short-lead forecasting; near-real-time systems; Morocco.