



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

ANNOUNCEMENT OF DOCTORAL THESIS DEFENSE

Ms. Mariam EL GHAZI

**Will present his research work with the aim of earning a
Doctorate**

**Doctoral program: Mathematical and Physical Sciences and New
Technologies**

**Discipline: Computer Science
Specialty: Artificial Intelligence**

**On 29/12/2025 at 15H00 at the Defense room of the Faculty of
Sciences of Tetouan**



Under the theme

**Optimizing Deep Learning Models for Sensor-Based Human Activity
Recognition Through Hyperparameter Tuning And Sampling Strategies**

Front of the jury composed of:

First Name & Last Name	Establishment	Designation
Pr. Mohammed BOUHORMA	FST Tangier, Abdelmalek Essaadi University	President
Pr. Anouar ABTOY	ENSA Tetouan, Abdelmalek Essaadi University	Reviewer
Pr. Tawfik AL-HADHRAMI	Nottingham Trent University	Reviewer
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Pr. Souad AMJAD	FS Tetouan, Abdelmalek Essaadi University	Examiner
Pr. Mohamed CHRAYAH	ENSA Tetouan, Abdelmalek Essaadi University	Examiner
Pr. Noura AKNIN	FS Tetouan, Abdelmalek Essaadi University	Supervisor

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Abstract



Human Activity Recognition (HAR) has potential in sports, security, and healthcare, especially for monitoring elderly people's activity in smart homes. We conducted a Systematic Literature Review following the PRISMA Methodology (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) to identify gaps and challenges in sensor-based HAR using deep learning, including diverse sensor modalities, models, datasets, and limitations. A noticeable gap has emerged in determining the optimal hyperparameters for deep learning models due to their vital impact on performance. An automatic method is needed for optimal performance. Additionally, we notice a need to address the class imbalance challenge using deep learning models. This issue arises particularly in real-world scenarios where activity samples vary due to differences in duration. This class imbalance can result in biased models favoring dominant activities. In response to these gaps, Our thesis focuses on two main challenges: hyperparameter tuning and addressing class imbalance. We propose an LSTM-based model with batch normalization and rigorous hyperparameter tuning using Bayesian Optimization to address the first challenge. We train the proposed model on the PAMAP2 dataset. The model outperforms previous studies, achieving remarkable performance metrics, including accuracy at 97.71%, F1 score, precision, and recall approaching 96.66%, 96.85%, and 96.55%, respectively. The study investigates the impact of class imbalance on deep learning models for sensor-based HAR. It compares three sampling techniques: Synthetic Minority Over-sampling Technique (SMOTE), random undersampling, and a hybrid sampling approach. Four deep-learning models were trained on an imbalanced PAMAP2 dataset, with Bayesian optimization used. The hybrid sampling technique was found to be most effective, with the three stacked LSTM models outperforming previous studies by 98.28% in evaluation metrics. This thesis advances the field of HAR by addressing class imbalance and hyperparameter tuning in deep learning models. It provides valuable insights for improving the accuracy and dependability of HAR systems in real-life settings, with future research exploring new datasets and methods. Future research will explore new datasets, advanced deep learning models, and diverse sampling methods to enhance the capabilities of HAR systems even further.

Keywords: Human Activity Recognition, sensors, deep learning, Sampling Strategies, Hyperparameter Tuning, Class Imbalance, PAMAP2 Dataset.