



Pole for Doctoral Studies
Center for Doctoral Studies
Sciences, Technologies, and Medical Sciences

ANNOUNCEMENT OF DOCTORAL THESIS DEFENSE



Ms. LAROUI Sara

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

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

Discipline: New Technologies

Specialty: computer science

**On 12/07/2025 at 10H 00 at the meeting room of the National
School of Applied Sciences of Tetouan, UAE
Under the Theme**

**Optimized Deep Learning and Feature Engineering Approaches
for Brain tumor Classification**

Front of the jury composed of :

First Name & Last Name	Establishment	Designation
Pr. Al ACHHAB Mohammed	ENSA of Tetouan, UAE	President
Pr. ZOUHAIR abdelhamid	FST of Tangier, UAE	Reviewer
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Pr. LAZAAR Mohamed	ENSIAS of Rabat, UM5	Examiners
Pr. EL HICHAMI Othman	ENS of Tetouan, UAE	Examiners
Pr. OMARA Hicham	FS of Tetouan, UAE	Co-Supervisor
Pr. MAHBOUB Oussama	ENSA of Tetouan, UAE	Supervisor

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Abstract



This doctoral thesis focuses on the development and optimization of Convolutional Neural Networks (CNNs) for automated brain tumor detection. The goal is to enhance diagnostic accuracy and reduce dependency on manual medical interpretation, which is often time-consuming, subjective, and prone to error. By leveraging the power of deep learning, this work aims to provide a reliable, scalable, and efficient solution for medical image classification.

The methodology is structured in three main experimental phases. The first phase involves a comparative study of various activation functions, including ReLU, Tanh, and Sigmoid, in order to evaluate their influence on the learning performance of CNN architectures in the context of brain tumor detection. This study lays the groundwork for understanding the effect of non-linearity on feature extraction and classification capability.

In the second phase, we explore the integration of pretrained CNN architectures such as VGG16, VGG19, and Xception with traditional machine learning classifiers such as Logistic Regression and LSVM. This hybrid approach combines the robust feature extraction capabilities of deep models with the decision-making power of conventional classifiers. Among these combinations, VGG16 with LSVM achieved remarkably high accuracy in classifying tumor images.

The third and final phase presents a custom-built CNN architecture optimized for brain tumor classification. This model is fine-tuned through advanced hyperparameter optimization techniques using metaheuristics like RSHO-E2, and further improved with ensemble classifiers such as XGBoost and LightGBM. This phase demonstrates the value of model customization and algorithmic synergy to achieve state-of-the-art classification results, with overall accuracy reaching up to 99.2% in the aggregation voting strategy.

This research contributes significantly to the field of medical image analysis by proposing a flexible and high-performing diagnostic pipeline. It showcases the potential of hybrid and optimized deep learning strategies to address real-world challenges in brain tumor detection and sets a foundation for further advancements in AI-assisted healthcare systems.

Keywords: Brain Tumor Detection, CNN, MRI, Hyperparameter Optimization, RSHO-E2, VGG16, LSVM, Transfer Learning, Ensemble Models, Medical Imaging, Deep Learning, Classification, Feature Engineering, Energy Efficiency.