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

M. OHAMOUDDOU Mohamed

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

Doctoral program: Engineering Sciences and Techniques
Discipline: Engineering Sciences and Techniques
Specialty: Embedded Systems and Artificial Intelligence

On 11/07/2026 at 11H00 at the Conference Hall, Polydisciplinary Faculty of Larache, UAE
Under the Theme

Intelligent Embedded Systems for Precision Floriculture: Knowledge Distillation and Architecture Optimization for Real-Time Edge Deployment in Moroccan Rosa Damascena Monitoring

Front of the jury composed of :

First Name & Last Name	Establishment	Designation
Pr. SETTI Larbi	FP of Larache, UAE	President
Pr. ACHKARI BEGDOURI Mohammed	FP of Larache, UAE	Reviewer
Pr. LAGMICH Youssef	FP of Larache, UAE	Reviewer
Pr. LAKHDAR Yissam	CRMEF of Fez, USMBA	Reviewer
Pr. EL ABDERRAHMANI Abdellatif	FS of Fez, USMBA	Examiner
Pr. OULHAJ Otman	ENS of Tetouan, UAE	Examiner
Pr. LASRI Rafik	FP of Larache, UAE	Supervisor

Host Research Structure: Technologies Émergentes Durables : Agriculture, Environnement et Énergies Propres

Abstract

Rosa damascena, the Damask rose, is a central crop of the Dades Oasis in southeastern Morocco, where farmers around Kelaat M'Gouna cultivate thousands of kilometres of hedges for essential oil and rose-water production. Maturity assessment and yield estimation are still carried out by eye, and no automated tool supports them. State-of-the-art deep learning methods exist, but their hardware requirements—GPU workstations or cloud services—are out of reach in this setting, where the realistic deployment platform is a Raspberry Pi 4B. This thesis develops and deploys four lightweight deep-learning methods that bring accurate real-time monitoring onto that hardware.

The work follows a thesis-by-publication format and is built around four peer-reviewed publications, evaluated on a single field collected dataset from the Dades Oasis (3,114 maturity-labelled images; 2,807 annotated detection images) and benchmarked on the same Raspberry Pi 4B. ATMS-KD is an adaptive knowledge-distillation framework whose compact student reaches 97.11% accuracy at 72.19 ms per image, exceeding eleven distillation baselines by 1.60 pp. YOLOv10-N, fine-tuned on rose imagery, achieves 92.12% precision and 90.65% mAP@0.5, and is coupled with a statistical sampling procedure that predicts field-level yield within 3.2% of actual harvest.

GWOEdgeNet uses the Grey Wolf Optimizer to design an ultra-lightweight CNN (10,946 parameters); trained with decoupled distillation, it reaches 95.15% ± 0.96 accuracy at 38.1 ms (26.2 FPS)—the only model in an eight baseline comparison that crosses the 24 FPS real-time threshold on the target hardware. Wavelet Scattering replaces the learned front-end with a frozen Morlet transform and trains only a 61,410-parameter CNN head, reaching 96.0% accuracy and F1 = 0.96 with 5.6 to 383 times fewer trainable parameters than six ImageNet-pretrained baselines. The thesis shows that accurate deep-learning monitoring can be deployed on affordable hardware under the specific conditions of the Dades Oasis.

Keywords : Knowledge distillation; decoupled knowledge distillation; neural architecture search; Grey Wolf Optimizer; YOLOv10; Rosa damascena; edge AI; embedded systems; Raspberry Pi 4B; TinyML; Dades Oasis