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Université Abdelmalek Essaadi

Pôle des Etudes Doctorales
Centre des Etudes Doctorales
Sciences et Techniques et Sciences Médicales

AVIS DE SOUTENANCE DE THESE DE DOCTORAT

Monsieur LAMRINI Mimoun

Présentera ses travaux de recherche en vue de l'obtention du Doctorat

Formation Doctorale : Sciences Mathématiques, Physique et Nouvelles Technologies
Discipline : Informatique
Spécialité : Informatique

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Sous le thème

Usage of Embedded Artificial Intelligence for Sustainable Development: Towards Artificial Intelligence Supported Automated Analysis of Environmental Acoustics and Water Quality

Devant le jury composé de :

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Résumé

The exponential growth of data has transformed many areas of our lives, making it crucial to use sophisticated techniques for analysis to make smart decisions. Techniques for reducing the dimensionality of data have become essential, allowing us to simplify complex data while preserving the most important information.

This research introduces novel approaches for optimizing data visualization through the integration of principal component analysis, matrix by block decomposition, and K-means clustering. These techniques collectively facilitate effective data segmentation and visualization, enabling the simplification of huge data into more comprehensible formats. Additionally, the use of Hu invariant moments in this research significantly simplifies data analysis and reduces information redundancy. This dual strategy not only increases the efficiency of large-scale data processing but also enhances data visualization for users.

Furthermore, our research addresses the computational and accuracy challenges in environmental sound recognition when implemented in embedded systems. It presents the MosAIc hybrid approach, which combines classical machine learning classifiers with a lightweight deep learning-based convolutional neural network model, the results demonstrate that the MosAIc approach, can achieve similar accuracy results as our developed deep learning model. This approach is particularly advantageous in applications constrained by device capabilities with limited computational efficiency.

Moreover, our study evaluates the effectiveness of pre-trained YAMNet model for transfer learning on platforms like Raspberry Pi and Coral TPUs. This not only highlights the potential for reducing computational requirements but also accelerates the development and deployment of real-time applications, opening new horizons for embedded Artificial Intelligence.

Lastly, the thesis contributes to addressing water quality monitoring. It proposes an integrated evaluation method using the national sanitation foundation water quality index and world health organization standards, with the aim of improving the accuracy and reliability of sensor data. By applying classical machine learning algorithms for outlier detection, this research significantly enhances the data integrity of smart water sensing technologies, laying a strong foundation for informed decision-making in water management.

Mots clés: Dimensionality Reduction techniques, Data Visualization, Environmental Sound Recognition, Embedded Systems, Machine Learning, Deep learning, Water Quality Monitoring, Sensor Data Integrity, Outlier Detection.