Détection des feux de forêt par le son émis

Filière Métiers de la Recherche – Sujet 17

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1 Synthèse de nos recherches bibliographiques

	Title	Author	Journal	Publisher	Date	Approach
[1]	Wildfire Detection Using Sound Spectrum Analysis Based on the Internet of Things	Shuo Zhang, Demin Gao, Haifeng Lin, Quan Sun	Sensors	MDPI	2019	Wildfire detection system using sound spectrum analysis based on the Internet of Things (IoT), which utilizes a wireless acoustic detection system to probe wildfire and distinguish the difference in the sound between the crown and the surface fire.
[2]	Audio-Based Wildfire Detection on Embedded Systems	Hung-Tien Huang, Austin Downey, Jason Bakos	Electronics	MDPI	2022	This work presents a machine learning wildfire detecting data pipeline that can be deployed on embedded systems in remote locations
[3]	Sound Events Recognition and Classification Using Machine Learning Techniques	Sulakna Karunaratna, Pasan Maduranga		ResearchGate	2021	This work compares three different techniques to classify audio data on the a sample of the ESC-50 dataset. It compares Support Vector Machines (SVM), convolutional neural networks (CNN) and a feed-forward dense network. For each of these networks, the input is a Mel frequency ceptstrum (MFCC).
[4]	Environmental Sound Classification using Hybrid Ensemble Model	Anam Bansal, Naresh Garg	Procedia Computer Science	ScienceDirect	2023	This paper presents an approach of classifying environmental sounds using a hybrid ensemble classifier. It uses differents techniques of preprocessing such as MFCC and compares the performance of the model with differents approaches in ESC. The models used are logistic regression, KNN, SVM, decision trees and Naive Bayes.
[5]	Forest Fire Detection and Monitoring Through Environment Sound Spectrum using Deep Learning	Mounir Grari, Mohammed Boukabous, Mimoun Yandouzi, Berrahal Mohammed, Idriss Idrissi, Omar Moussaoui, Mostafa Azizi, Mimoun Moussaoui	Journal of Theoretical and Applied Information Technology	JATIT	2023	This paper presents a study on the identification of wildfire sounds through deep learning. The model is trained on a data set of fire sounds and other environmental sounds, gathered on 3 different sources including the Kaggle data set. The time-series signal are converted to spectrograms using short time Fourier Transform. The deep learning model has a total number of parameters of 1789, which makes it light enough to be suitable for IoT applications. They achieve roughly 95 percent accuracy.
[6]	Fight Fire with Fire: Detecting Forest Fires with Embedded Machine Learning Models Dealing with Audio and Images on Low Power IoT Devices	Giacomo Peruzzi, Alessandro Pozzebon, Mattia Van	Sensors	MDPI	2023	This work presents an ML-based identification technique for wildfires recognition by adding image analysis to constant sound analysis when a suspect sound is detected.

[7]	Hybrid Computerized Method for Environmental Sound Classification	Silvia Ullo, Smith Khare, Varun Bajaj, G. Sinha		IEEE	2020	This work presents the results of a environmental sound classification model using ESC-10 dataset and preprocessing techniques such as Optimum Allocating Sampling (OAS), Fourier transform and CNN models to extract deep features. It then uses classification techniques like KNN, SVM and Softmax and has a higher accuracy than other existing methods.
[8]	Bird sound classification based on ECOC-SVM	Xue Han and Jianxin Peng	Applied Acoustics	Elsevier	2023	This work presents a bird sound classification method based on Error Correction Output Coding (ECOC) and SVMs and compares it to other models like RF, CNN. The authors used Mel Frequency Cepstrum Coefficients (MFCC) to extract acoustic features from audio recordings of bird sounds
[9]	A new pyramidal concatenated CNN approach for environmental sound classification	Fatih Demir and Muammer Turkoglu and Muzaffer Aslan and Abdulkadir Sengur	Elsevier	Applied Acoustics	2021	This paper presents a new deep learning approach for environmental sound classification using a pyramidal CNN. The method involves converting sound signals into images using Short-time Fourier Transform (STFT), followed by feature extraction with pre-trained CNN models and afterwards SVM for classification.
[10]	A novel study for depression detecting using audio signals based on graph neural network	Chenjian Sun, Min Jiang, Linlin Gao, Yu Xin, Yihong Dong	Biomedical Signal Processing and Control	ScienceDirect	2024	Work on classifying depression using audio recording with GNN, intra-class consistency and inter-class variability.
[11]	Smart audio signal classification for tracking of construction tasks	Karunakar Mannem, Eyob Mengiste, Saed Hasan, Borja Soto, Rafael Sacks	Automation in Construction	ScienceDirect	2024	This work presents a model of classifying sounds in construction using a combination of mel spectrograms and MFCC in a CNN-LSTM model to extract deep features. It uses features such as Chroma features, PLP Coefficients, Wavelet transforms and Scalograms.
[12]	A Survey of Audio Classification Using Deep Learning	Khalid Zaman, Melike Sah, Cem Direkoglu, Masashi Unoki		IEEE	2023	This paper represents the CNN importantce in order to predict the class of audio files −>classification based only on CNNs+FFNN after the preprocessing step
[13]	Whisper-{AT}: Noise-Robust Automatic Speech Recognizers are Also Strong General Audio Event Taggers	Yuan Gong, Sameer Khurana, Leonid Karlinsky, James Glass		arXiv	2023	Paper about how Whisper is actually not a noise invariant ASR (Automatic speech recognition) model. This paper shows that Whisper encodes noise and not only the speech itself, therefore it could be relevant to audio classification. The team has made some experiments on the ESC-50 data, and shows that using intermediate hidden representation of Whisper actually leads to high accuracy score when classifying the data. This paper introduces a new model, Whisper-AT, that uses the Whisper model as a backbone, with Whispers weighs frozen, and adds tranformer and dense layers on top. This new model is capable of classifying sounds (i.e. audio tagging) as well as transcribing speech.

[14]	Sound Event Detection: A Tutorial	Annamaria Mesaros, Toni Heittola, Tuomas Virtanen, Mark Plumbley	Signal Processing Magazine	IEEE	2021	Overview of all different techniques used in sound classification. they list and explain different feature extraction methods and different models but they dont provide any results: this is basically a course on audio classification
[15]	{AST}: Audio Spectrogram Transformer	Yuan Gong, Yu-An Chung, James Glass		arXiv	2021	This paper introduces the Audio Spectrogram Transformer (AST) as a new model to classify audio. This approach is new because when transformers were used in audio classification, it was always on top of a CNN model. In this work, no CNN is used, only the attention mechanism of a transformer. The feature used is a log mel spectrogram, splitted in mutliple patches of 16x16 with an overlap. Each of these patches is flatten to get a 1D patch embedding of size 768 using a linear layer. The Transformer encoders output of the CLS token serves as the audio spectrogram representation. This model achieves new state of the art accuracy on classic audio classification datasets, such as AudioSets and ESC-50.
[16]	End-to-End Environmental Sound Classification using a 1D Convolutional Neural Network	Sajjad Abdoli, Patrick Cardinal, Alessandro Koerich		arXiv	2019	This paper represent a new approach based on the End to end learning. We have as input the audio file and all the steps(preprocessing, modelling) are done using the DL approach

2 Conclusion - Approaches that can be used

Data Preprocessing Use of dimensionality reduction techniques (OAS)[4, 7] to keep only relevant datas.	**Feature Extraction** Use of CNN models and LSTM to extract deep features to complete the already used features in audio classification [3, 11, 15]
Classification Model Adapt and test SVM and Random Forest models on our dataset[8, 9]. Integrate the Whisper model to our dataset [14], and exploit pre-trained transformers to get a new structure of dataset to run classification models [13]	

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