**Image-based crop disease detection with federated learning**

## Abstract

Crop disease detection and management is critical to improving productivity, reducing costs, and promoting environmentally friendly crop treatment methods. Modern technologies, such as data mining and machine learning algorithms, have been used to develop automated crop disease detection systems. However, centralized approach to data collection and model training induces challenges in terms of data privacy, availability, and transfer costs. To address these challenges, federated learning appears to be a promising solution. In this paper, we explored the application of federated learning for crop disease classification using image analysis. We developed and studied convolutional neural network (CNN) models and those based on attention mechanisms, in this case vision transformers (ViT), using federated learning, leveraging an open access image dataset from the “PlantVillage” platform. Experiments conducted concluded that the performance of models trained by federated learning is influenced by the number of learners involved, the number of communication rounds, the number of local iterations and the quality of the data. With the objective of highlighting the potential of federated learning in crop disease classification, among the CNN models tested, ResNet50 performed better in several experiments than the other models, and proved to be an optimal choice, but also the most suitable for a federated learning scenario. The ViT\_B16 and ViT\_B32 Vision Transformers require more computational time, making them less suitable in a federated learning scenario, where computational time and communication costs are key parameters. The paper provides a state-of-the-art analysis, presents our methodology and experimental results, and concludes with ideas and future directions for our research on using federated learning in the context of crop disease classification.

**An efficient IoT based crop disease prediction and crop recommendation for precision agriculture**

## Abstract

Internet of Things (IoT) frameworks generates data for large and remote agricultural areas through sensors and use this data for crop predictions by several machine learning algorithms. Farming is the practice of producing crops, rearing of livestock, cultivation of soil and it is important for economic development of the country. Farmers have been following traditional farming practices till now. These techniques were imprecise and reduced productivity and time consumption. Determining the steps that essential for practicing at its appropriate season helps to increase the productivity of precision farming. In this research, the primary objectives are to enhance precision farming practices by introducing a comprehensive IoT-based framework and employing advanced machine learning algorithms. Therefore, this research work introduces crop recommendation and disease prediction that helps farmers to increase productivity and reduce manual labor. The proposed Multi-level Kronecker Guided Pelican Convolutional Neural Network (MKGPCNN) focuses on crop recommendation, providing forecasts for suitable crops in the agricultural sector. Simultaneously, the Combined Graph Sample and Aggregate Attention Network (CGSAAN) are introduced for crop disease identification and recommending appropriate fertilizers to manage diseases and enhance harvests. The evaluation of both systems on publicly accessible datasets, namely the crop recommendation dataset and the new plant diseases dataset, demonstrates higher accuracy rates of 99% and 98%, precision of 99.5% and 99%, recall of 99.6% and 98.9%. The results suggest that the introduced system have the potential to significantly assist farmers in smarter crop management and harvesting, contributing to increased productivity and reduced manual labor.

**Crop Disease Prediction Using Computational Machine Learning Model**

## Abstract

The crop yield disease identification plays a significant role for improving overall crop production in agriculture field. Sustainable production in agriculture field conventionally depends on environment change, quality of soil and global warming. All prominent parts of cultivated plants get naturally affected by various diseases, and that diseases can be found in growing, flowering, fruiting phases of the plant. In this paper, an alternative approach proposed the training model which is used to accurately detect the various diseases occurring merely on plant’s life span. In machine learning process, properly training the dataset is reliably to gain precise accuracy. During training, various factors are considered functionally to achieve precisely more appropriate performance of the experimental model. The training and validation efficiently implemented on cultivated crop disease dataset by considering the contemporary approach.

**Seasonal Crops Disease Prediction and Classification Using Deep Convolutional Encoder Network**

## Abstract

Agriculture plays a significant role in the growth and development of any nation’s economy. But, the emergence of several crop-related diseases affects the productivity in the agriculture sector. To cope up this issue and to make aware the farmers to prevent the expansion of diseases in crops and to implement effective management, crop disease diagnosis plays its significant role. Researchers had already used many techniques for this purpose, but some vision-related techniques are yet to be explored. Commonly used techniques are support vector machine, *k*-means clustering, radial basis functions, genetic algorithm, image processing techniques like filtering and segmentation, deep structured learning techniques like convolutional neural network. We have designed a hybrid approach for detection of crop leaf diseases using the combination of convolutional neural networks and autoencoders. This research paper provides a novel technique to detect crop diseases with the help of convolutional encoder networks using crop leaf images. We have obtained our result over a 900-image dataset, out of which 600 constitute the training set and 300 test set. We have considered 3 crops and 5 kinds of crop diseases. The proposed network was trained in such a way that it can distinguish the crop disease using the leaf images. Different convolution filters like 2 × 2 and 3 × 3 are used in proposed work. It was observed that the proposed architecture achieved variation in accuracy for the different number of epochs and for different convolution filter size. We reached 97.50% accuracy for 2 × 2 convolution filter size in 100 epochs, while 100% accuracy for 3 × 3 filter size which is better than other conventional methods.