A SURVEY ON DEEP LEARNING IN AGRICULTURE

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ABSTRACT

Deep learning (DL), is a technique for processing large amounts of data and images and has a lot of potential. While it has already been effectively applied in other industries, deep learning is still a relatively new technique in the agriculture sector. This paper provides an overview of various deep-learning methods that have been used for various agricultural problems, including disease detection and diagnosis, fruit counting, crop yield prediction, Weed Detection and Management, Precision Farming, Soil Health Assessment, Climate Modelling and Forecasting and Supply Chain Optimization. The purpose of this survey is to explore potential integration with autonomous robotic platforms by examining the specific models used, the data source, the performance of each research, the hardware used, and the possibilities for real-time application. The results demonstrate that deep learning generates extremely accurate results, with rare exceptions.

Key Words: Deep Learning, Robotic Platforms, Real-Time Applications, robotic and Supply Chain.

1. Introduction

Many nations view agriculture as a crucial sector with a big economic influence. Computer-based techniques play a vital role in all fields such as Agriculture, Medical, Education, etc. These techniques reduced human work in innovative ways like applying Deep Learning and Machine Learning. DL is a cutting-edge and recently developed technique and system for data analysis and image processing. A recent application of DL in agriculture follows its successful use in several other fields. As a result of the employment of sophisticated models that provide extensive parallelization, it also can address complicated issues more effectively and swiftly. These comprehensive DL models are expected to improve classification accuracy and reduce regression problem

flaws, but only if there are sufficiently sizable databases that can be used to explain such problems. Deep Learning techniques have been increasingly employed in various applications within agriculture due to their ability to handle complex data, recognize patterns, and make predictions with high accuracy.

2. Deep Learning Techniques

Machine learning techniques known as "deep learning" perform significantly better with unstructured data. Currently, deep learning methods are better than machine learning methods. This allows computer models to gradually learn properties from different levels of data. Deep learning became increasingly popular as the availability of information expanded and powerful computers enabled hardware improvements. This study focused on applications of deep learning in agriculture. Learning is classified as supervised, unsupervised, and semi-supervised. Deep learning methods using deep neural networks are becoming more and more common. Deep learning offers more functionality and flexibility because it can handle different tasks when working with unstructured data. Data is sent through multiple layers using deep learning algorithms. Each layer can gradually take functions and send them to the next layer. Low-level features are extracted in the first layer, followed by layers that combine features to create a complete representation. Deep learning developed hand in hand with time, which brought with it a flood of information about all structures and corners of the world. This data, sometimes called "big data", is collected from various places, including social media, internet searches, online business platforms, and online movies. This massive amount of data is immediately available and can be shared using economic tools such as distributed computing.

2.1 Convolutional Neural Networks

Convolutional neural networks (CNNs) are a specific class of artificial neural networks used in image processing and recognition, designed specifically to analyze pixel input. CNNs are artificial intelligence systems for image processing that use deep learning to perform both generative and descriptive tasks. Compared to CNN, NLP, and recommendation systems, machine vision, which includes image and video recognition, is more commonly used in processing. A hardware or software system known as a neural network is designed to mimic the activity of neurons in the human brain. Traditional neural networks have to feed images piece by piece because they are not designed for image processing. CNN and Neuron Anatomy is more than the frontal lobe, which is responsible for processing visual information in both humans and other

animals. By placing layers of neurons to cover the entire field of view, classical neural networks are not plagued by irregular image processing problems. In agriculture, crop forecasting and disease detection and diagnosis are recorded using CNN concepts.

2.2 Recurrent Neural Networks (RNNs)

RNNs were originally developed to help predict sequences; for example, the LSTM method (Long Short-Term Memory) is known for its adaptability. These networks depend exclusively on data sequences of varying lengths. The RNN uses the information from its previous state as the input value for the current prediction Because of this, it can help the network achieve short-term memory that allows it to effectively manage changes in stock prices or other time-based information systems. The performance prediction is also predicted using RNN concepts.

2.3 Generative Adversarial Networks (GANs)

GAN or Generative Adversarial Network is a generative modelling tool that uses deep learning techniques such as convolutional neural networks. The generative modelling technique is unsupervised learning in machine learning. This task involves automatically searching, learning, regularities, and patterns in incoming data, whereby the pattern can be used to show new instances of results derived from the original dataset. A generative adversarial network model for training a generative model involving the prediction of a supervised learning problem with two sub-models such as a generative model and a discriminative model. You can practice creating new instances in the generator model. In the discriminator model, one can try to classify real examples from the domain and false examples from outside the domain. A competitive zero-sum game is used to train both models.

2.4 Long Short-Term Memory(LSTM)

LSTMs are a type of RNN that are particularly effective for time-series forecasting tasks such as predicting pest outbreaks, disease spread, or market demand fluctuations.

2.5 Auto encoders:

Auto encoders can be employed to detect anomalies in agricultural data such as unusual patterns in soil nutrient levels or irrigation system performance, which may indicate underlying issues requiring attention.

3. Deep Learning Applications

3.1 Natural Language Processing

It is a form of understanding the core of a language, such as its expressions, syntax, and semantics, which are most difficult for humans to understand. NLP aims to achieve the same result by using machine learning deep learning to recognize linguistic nuances and formulate appropriate responses. Deep learning-based natural

language processing aims for the same goal by teaching machines to distinguish the nuances of language and generate relevant responses. Document summaries are widely used tried and tested in the legal field, making assistants obsolete.

Deep learning is gaining ground in several areas of natural language processing, including question answering, language modelling, text classification, Twitter analysis, and sentiment analysis.

3.2 Sentiment Analysis

Sentiment analysis is the technique of deciphering and analyzing customer sentiments utilizing natural language processing, text analysis, and statistics. Tweets, comments, reviews, and other kinds of social media can be used to gather feedback from customers.

A company collects these emotions from Twitter, Facebook, and other Social Media sites based on organized or unorganized formats. Organized Data is called Structured Data and it's easy to analyze. Among other things, it could come in the form of a survey, customer reviews, a chat, or data from a call center.

Unstructured data describes datasets that don't belong to a company or a specific person. They are only statistics that have been compiled from different or unrelated sources.

3.3 Deep Reinforcement Learning

Deep reinforcement learning algorithms can optimize agricultural decision-making processes by learning to allocate resources for example water and fertilizer in real time to maximize crop yields while minimizing costs and environmental impact.

3.4 Transfer Learning

Transfer learning techniques enable the transfer of knowledge from pre-trained models to specific agricultural tasks with limited labeled data, facilitating the development of robust and accurate predictive models.

Conclusion

This article analyzed recent research initiatives concerning the application of deep learning techniques in agriculture over the previous five years. Important contributions that have been published as well as difficulties that have been resolved were discussed. In this study, technical aspects of the datasets employed, deep learning models, the work environment, data pre-processing, and data augmentation strategies were taken into consideration. This work is beneficial for researchers experimenting with deep learning and applying it to various classification or prediction problems in agriculture as well as difficulties relating to computer vision, image analysis, and data analysis in general.

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