MJSAT

Malaysian Journal of Science
and
Advanced Technology

journal homepage: https://mjsat.com.my/

Blockchain based Agriculture Using the Application of UAV and Deep Learning Technique: Alexnet CNN

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KEYWORDS

AlexNet
Blockchain
Supply Chain
Sustainable Development Goals
Unmanned Air Vehicle

ARTICLE HISTORY

Received 1 March 2023
Received in revised form
6 April 2023
Accepted 21 May 2023
Available online 27 May 2023

ABSTRACT

Due to the warm and humid environment of Bangladesh, it is highly exposed to occurring perpetuation of various viruses which cause diseases in crops. A huge number of crops are wasted because of these occurring diseases and it directly hurts the production rate and forces import of crops in bulkier amount. Unmanned aerial vehicle usage is one of the smart agriculture technologies being researched for agricultural applications (UAVs) in these days. UAV technology allows farmers to quickly gather information on field conditions by providing overhead images of their agricultural fields or even allowing them to zoom in on a particular area. Using UAV technology, farmers may identify specific areas that need immediate attention and perform the necessary agricultural improvements. Drones collect data that farmers can use to detect crop disease by applying deep learning algorithms to make long-term decisions about planting, land mapping, damage control, and other things. This research uses blockchain technology to establish connection between suppliers and customers by enabling information to be tracked throughout the supply chain and enhances food supply chain safety. It offers a secure method of broadcasting data, focusing on enhancement of supply chain management and prediction of crops which makes it possible to implement and deploy data-driven technologies for smart farming. The research uses UAVs as a means of collecting crop images, implements a prediction model using AlexNet CNN and analyses how it performs with a real Bangladeshi crop disease dataset to help farmers from excessive crop damage. Furthermore, the overall process is carried out using the Blockchain technology to enhance the existing supply chain management process.

1. INTRODUCTION

Bangladesh is vulnerable to the recurrence of numerous viruses that cause diseases in crops due to its warm and humid climate. In Bangladesh, these diseases significantly reduce agricultural yield [1]. Due to the widespread crop loss caused by these diseases, the production rate is harmed, and more crops may need to be imported in larger quantities.

It is possible to take the required precautions to avoid potentially fatal damage if the emergence of these diseases could be predicted in advance. Deep Learning allows to construct prediction models which can anticipate probable diseases of a crop if the model is fed properly with enough information about these diseases. DL is a collection of methods for learning from several layers of neural networks. It is a branch of machine learning that is supported by both supervised and unsupervised learning. The system is taught using a collection of algorithms in a tiered architecture, where it gradually picks up knowledge on higher layers depending on lower layers. It automatically extracts crucial metrics from unprocessed datasets and strengthens the system in relation to various inputs [2]. AlexNet CNN was the first CNN to win an

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https://doi.org/10.56532/mjsat.v3i2.147

ImageNet LSVR challenge back in 2012 [3]. It showed significantly less error than the other competitors. Therefore, this CNN became a choice for the construction of the prediction model by keeping computational cost, accuracy, and efficiency in mind.

Smart farms will spend money on pricey fiber, wireless connections, or acquiring a full satellite to improve connectivity. Horticulture advancement is significant for social and monetary advantage, as it expands food production, builds total compensation, and makes strides family efficiency. The government has taken steps to boost agricultural production through the usage of technology. Drone, commonly referred to as an unmanned aerial vehicle (UAV), is one of the breakthroughs that was first used by the military for battlefield monitoring. Unmanned aerial vehicles, or UAVs, are a sort of unmanned aircraft that can carry a range of equipment, carry out several missions, and can be recycled. It can carry a fatal or nonlethal charge, drift autonomously or be remotely controlled, be comprehensive or rectifiable. With the support of precision agriculture, drones can scan the soil, observe plant health, help prepare irrigation schedules, fertilize, evaluate yield information, and implement relevant info for climate analysis. Drones have altered agriculture by contributing farmers with dominant cost savings, increased productivity, and extra profitability. It can proclaim crop health, boost spraying accuracy, trail livestock and irrigation schemes and more. In recent years, UAV has emerged as a low-cost option in sensing technologies and data processing techniques. UAV can capture images of the farmer's crop using a range of camera filters, contributing multiple spectral imaging, enabling image processing and analysis, and identifying areas of the crop that need special forms of care. The small UAV is simple to drift and manage, generating it a good choice for farmers who wants to develop their farming by combining agriculture and remote sensing technology.

The idea of blockchain in agriculture has recently attracted a lot of attention. This lessens economic takeover and manipulation caused by false branding and fraud on the part of some unethical actors. A "digital ledger" is a term that is frequently used to describe the peer-to-peer network of nodes that stores transactional records known as blocks, including their public versions in numerous databases. This system protects data in a way that makes it difficult or impossible to alter, hack, or cheat it. Blockchain technology can increase shared trust, make data transmission easier throughout the supply chain, and significantly reduce the cost of agricultural transaction. By enabling data to be recognized throughout the food supply chain, the blockchain invention helps to improve food safety. By giving users a safe means to store and manage data, it promotes the development and adoption of data-driven solutions for smart farming and smart index-based crop insurance. Blockchain may have a significant impact on how horticultural commerce is conducted. Using blockchain technology, businesses, the government, and consumers will be able to gather information on the growing of foodstuffs, from the farm where they were grown to the factory where they were produced to the marketplace where the customer would place their orders. A decentralized, permanent, and traceable blockchain technology records the entire process. Blockchain provides information on the integrity, security, and viability of the agricultural goods and maintains every aspect of their transaction. Blockchain can help government organizations identify people who don't adhere to international standards and improve their capacity to control animal and plant diseases and guarantee a healthy environment. In a nutshell, it is undeniable that blockchain has fundamentally changed how the agriculture industry functions. Now is the time for all stakeholders, notably farmers, to educate themselves and fully own these contemporary phenomena.

2. LITERATURE REVIEW

Rokhmana [4] displayed information about cadaster boundaries, plant health, and land preparation. They also demonstrated how to handle local personnel in a cost-effective, quick, and simple manner. They use the digital camera that is mounted on the UAV to view the state of the crops. IoT has a lot of potential for Smart Farming and Precision Agriculture applications since it makes it possible to collect environmental data in real-time. However, due to difficulties in choosing and implementing the appropriate technology, such as data collecting and image processing techniques, the actual proliferation and exploitation of UAVs in Smart Farming has not been as strong as anticipated. Here, the most popular applications, the several types of UAVs employed, and the data collecting techniques and technologies were covered, along with each advantage and disadvantage.

Maddikunta and Saqib Hakak [5] discussed that UAVs are used to monitor animal activity and crop conditions. Farmers and stack holders can use apps on their devices to access and collect data from a cloud-based platform. They employ a range of agricultural sensors. They made use of Bluetooth low energy, or BLE. since the equipment is inexpensive, the technology is user-friendly, and the communication range is better. In this paper they described about several types of agriculture sensors. Such as: Location Based sensors, Electrochemical sensor, Temperature and Humidity Sensors, Optical Sensors, RGB sensor, Multi Spectral sensor, Hyper-spectral sensor, Thermal Infrared sensor. With a bird's eye view of the entire crop region, farmers can monitor their crops from the air. Observations made from the sky stage reveal irrigation issues, soil variations, and insect infestations. This UAV operated using an Arduino board, Bluetooth, and GPS. The UAV operated with Bluetooth is used for monitoring cattle. The ability to defend their crops from animals is a huge benefit for farmers. They also stated that this is a cost-effective method for smart farming in their research.

Tsouros, Triantafyllou, Stamatia and Panagiotis [6] talked about utilizing a UAV to capture photographs and sending the data to a server for precision farming. In the study discussed here, satellite imaging techniques have become a more useful tool for collecting imagery data for precision agriculture. The authors discuss these circumstances' usage of hyperspectral imaging and the techniques that were employed. In addition, they conducted a survey on the use of deep learning with agricultural data. They utilized four different types of sensors for UAV data acquisition. They are thermal sensors, multispectral sensors, hyperspectral sensors, and visible light sensors (RGB).

Yuan and Choi [7] proposed a method for determining the amount of heating needed to prevent frost in an apple orchard using thermal and RGB cameras mounted on an unmanned aerial vehicle. The findings proved the viability of the suggested method for calculating orchard heating requirements, which has the potential to be a crucial part of an autonomous, accurate frost management system in subsequent research.

N. Islam, Mamunur, Faezeh, Biplop, Steven and Rajan [8] listed out some major features related to IoT and UAV in Smart farming such as Field Monitoring, Livestock Monitoring and Tracking, Application in Green house, Compost Management and Offspring care. The authors discussed about different types of UAVs each of which are designated for jobs like: Harvesting UAV, Spraying UAV, Sensing UAV. This paper outlines some major applications of IoT and UAV in smart farming, explores the communication technologies, network functionalities and connectivity requirements for Smart farming.

Guo and Huang [9] described how the yellow rust disease, which is contagious everywhere, seriously jeopardizes the security of wheat output. The following stage is to monitor the illness at a field level, which is crucial for disease management. To collect photos, researchers employed an unmanned aerial vehicle (UAV) with a hyperspectral sensor. In the middle of the infection period, they discovered that the VI-based model had the highest monitoring accuracy (R2 = 0.75).

Kawcher, Tasmia, Irfanul and Sifat [10] mentioned three of the most prevalent diseases of rice plants—leaf smut, bacterial leaf blight, and brown spot. As the input, crisp pictures of damaged rice leaves on a white background were employed. The dataset was trained using a variety of machine learning methods, including KNN (K-Nearest Neighbor), J48 (Decision Tree), Naive Bayes, and Logistic Regression, after the appropriate pre-processing. After 10-fold cross-validation, the decision tree algorithm has an accuracy of over 97% when used on the test dataset.

Ram, Mamoon, Kamlesh and Shibi [11] approached to fusing an image processing technology with a pattern recognition method. The method enables a farmer to cultivate crops in a specific way so that risks can be identified earlier. The writers can automate the procedure without the need of human resources by combining this with the capabilities of the Internet of Things. Farmers will be able to cultivate more in a shorter length of time.

Kamilaris, Agusti and Francesc [12] discussed about the advantage of Blockchain in the Food supply chain management. Increased traceability can aid in enhancing the integrity and safety of food. Blockchain technology can help food companies stop food fraud by quickly identifying and tracking outbreaks to their source. This is a critical component of agriculture and food supply chains, which include a large number of participants from the point of raw production to the supermarket shelf .

Sethy, Nalini, Amiya and Santi [13] reviewed state-of-the-art works based on image segmentation, feature extraction, feature selection, and classification, the related studies are contrasted. This research also discusses recent developments, restrictions, and recommendations for upcoming investigations pertaining to the identification of diseases affecting rice plants.

Sadia, Masuduzzaman, Rajib and Anik [14] characterized blockchain as an open, distributed ledger that employs cryptography and digital signatures to store historical data. Each transaction or activity within the blockchain is validated by the consensus of the participants (i.e., no activity is permissible without the permission of the majority network). Thus, blockchain is considered to be a secure technology for data management.

Based on a transfer learning methodology, Jadhav, Vishwanath and Sanjay [15] proposed a successful method for diagnosing soybean illnesses using pretrained convolutional neural networks from AlexNet and GoogleNet (CNNs). Using 649 and 550 images of diseased and healthy soybean leaves, respectively, the suggested AlexNet and GoogleNet CNNs were trained to identify three different soybean diseases. The approach of five-fold cross-validation was used. The suggested CNN-based AlexNet and GoogleNet models had respective accuracy rates of 98.75 and 96.25 percent. Compared to what was accomplished using conventional pattern recognition techniques, this accuracy was substantially higher. According to test results for the diagnosis of infections in soybeans, the suggested model seemed to have the highest level of effectiveness.

Aravind, Aniirudh, Mukesh, Ashiwin and Vikas [16] used the Plant Village dataset's healthy leaf images of grapefruit plants together with the classification of three ailments using Alexnet CNN. Using a transfer learning-based method, 4063 images from the categories are fed to the pretrained AlexNet. The classification accuracy of the model was 97.62 percent. The Multiclass Support Vector Machine (MSVM) is fed the feature values of the same network from its various layers in order to assess its performance. When features from AlexNet's Rectified Linear unit (ReLu) layer were combined with the MSVM, they achieved the highest classification accuracy, scoring 99.23% .

Albashish, Malik and Sulieman [17] put forth a technique based on image processing that involves four main components. First, they created a color transformation structure for the RGB leaf image, which they then transformed using device-independent color space transformation. The second stage involves segmenting the current pictures using the K-means clustering technique. In the third phase, they calculated the texture features for the segmented infected items. Finally, in the fourth phase, a trained neural network is applied to the obtained features. As a test, they used a collection of images of leaves. According to the results of the trials, the recommended method can significantly support the accurate and automatic detection and recognition of leaf diseases. The developed Neural Network classifier, which is based on statistical classification, performs well with all types of sampling leaf diseases and has a 93 percent accuracy rate for correctly identifying and classifying the diseases under study. In conclusion, the suggested detection models based on neural networks are excellent at detecting leaf diseases, while K-means clustering technique produces successful results in the segmentation of RGB photos.

3. PROPOSED METHOD

This paper attempts to detect crop health using the AlexNet prediction model by UAV surveillance across the fields to provide earlier damage detection and recovery. The results are made public through broadcasting on blockchain to ensure data transparency that is communication across multiple farmers and continuous upgradation of prediction of food supply chain. This helps in reducing the number of crops being damaged in every season, reduces the effort of the farmers in monitoring and maintaining crop fields. In addition, provides enough data to the Department of Agriculture to predict crop pricing and maintenance of balance across the supply chain. Through all these positive approaches, the ultimate result is the positive impact on the country's economy. The following figure shows the breakdown of the overall process and discusses below in details.

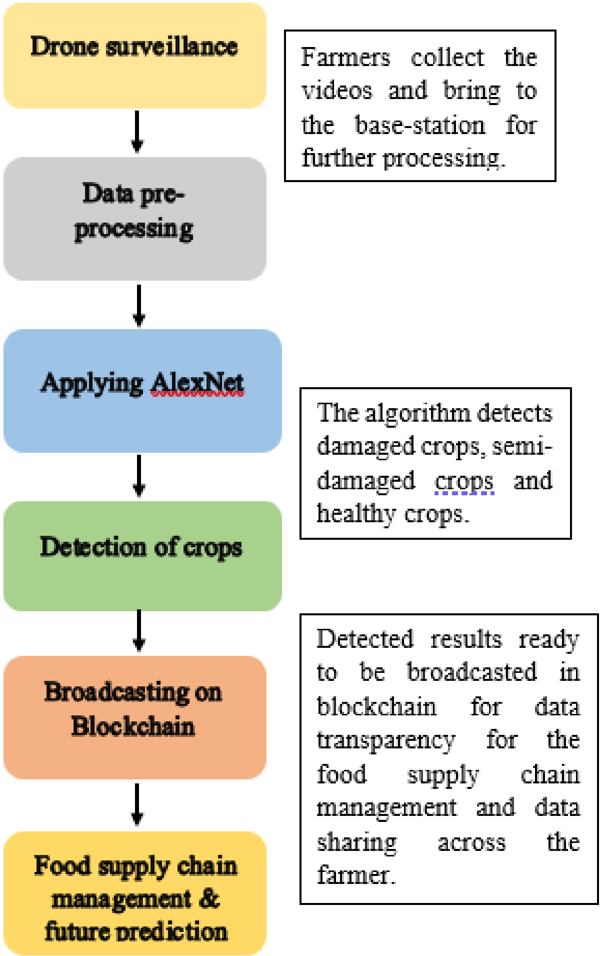

Fig. 1. Representation of the overall process

3.1 Drone Surveillance

Traditional approach of crop monitoring is to visit the field physically and look onto each crop, one to one. This whole process is very time consuming and requires huge effort. The paper suggests upon using UAV for surveillance of the crop field and a deep learning algorithm for detection that will save farmer's effort and time as well. These days agriculture using digitalized processes are of great need to reduce the sufferings of the farmer and ensure that they have profitable output. After UAV surveillance of the crop field under the presence of the farmer, the farmer is responsible to bring back the video to the base station for further processing to achieve results. The UAV is operated or driven by the farmer itself.

3.2 Data Pre-processing

The base station is where the videos are processed to get the required output. A base station may cover an area of multiple fields as one base station for each field is not feasible in terms of cost, useability by farmers and availability of the machine. The machine must have the configuration to run the algorithm so high availability for every field is difficult. Whereas we cannot ensure that the farmers will be able to operate the machine by themselves or have enough money to pay for the machine. Therefore, each base station is under the responsibility of an operator who is in charge of the base station and the operator only operates the machine for detection of the crop health. The processed result is broadcasted in the blockchain after the computation to enable transparency with the network of farmers and the supply chain management board. Broadcasting at the time of computation helps in reducing the collection of data later for the storage in blockchain. The video is fed to the machine, processed, and analysed; this whole process is carried out automatically to preserve the decentralization. The data sharing in blocks gives instant update to the supply chain management community. Once the video is processed, data analysed and broadcasted, the farmer can reuse the same storage for further field surveillance to minimize storage cost of the farmer. As the current data is thought to be broadcasted on the blockchain, it does not require any further storage for future analysis as blockchain itself is a public ledger.

3.3 Applying AlexNet Algorithm

The base station is where the videos are processed to get the results such as detection of unhealthy and healthy crops. The videos that are retrieved using UAV surveillance are fed to the machine, resided on the base station, that runs the Deep learning algorithm for the detection of crops. The datasets that were chosen for the implementation purpose and training of the classification model is corn dataset.

DL approaches take construction of prediction models to a different level because ML techniques still require expert human support to carefully examine the dataset, extract features, and choose the features for training the model. ML techniques are highly beneficial when it comes to building models to anticipate software faults. This is where DL is helpful because it has the capacity to automatically extract features from a data repository, it does away with the need for human interaction in ML techniques, and it also offers best-in-class performance. There are numerous different deep learning (DL) methods; a few of them are ANN, CNN, RNN, LSTMN, MLPs, etc., and these models are continually improved over time as needed [2]. CNN (Convolutional Neural Network) has been chosen as the model to use in this research from among these models. The processes that are involved in are shown below.

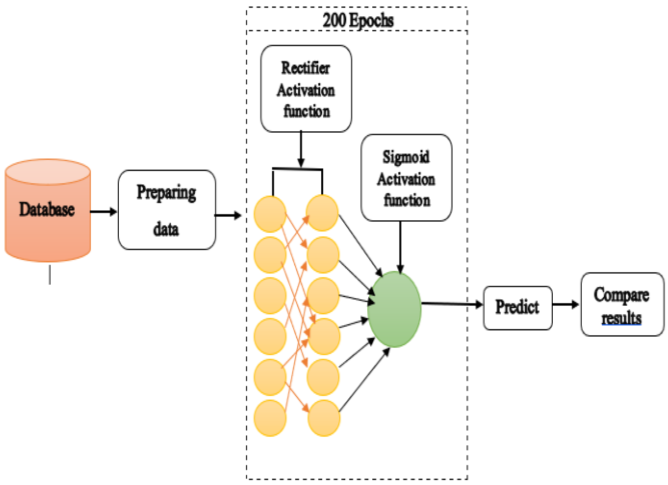

Fig. 2. Model Construction Diagram Using DL

One type of neural network that uses convolutional, pooling, fully connected, and normalizing layers as hidden layers is the convolutional neural network. An image or signal is modified via the process of convolution, which involves applying a filter to it. The discretization method known as pooling uses samples. The input's dimensionality should be decreased as the primary reason. Thus, enabling assumption about the characteristics present in the binned sub-regions [18].

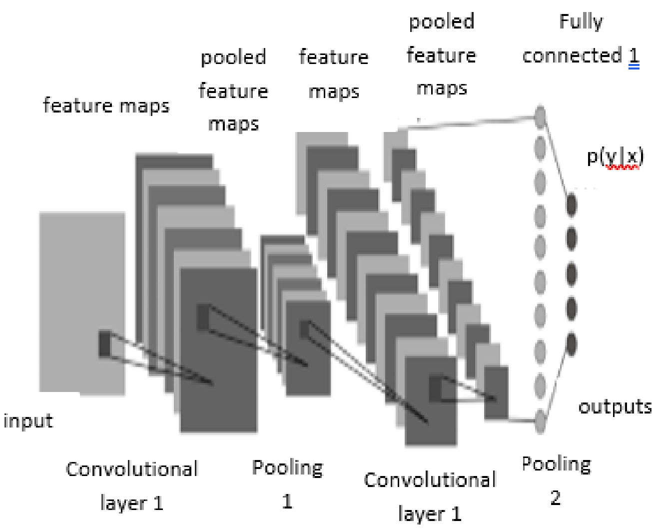

Fig. 3. Functionality of CNN

AlexNet is a type of CNN which has 8 layers to it. The layers are:

- 5 Convolutional Layers
- 2 Fully Connected Hidden Layers
- 1 Fully Connected Output Layer

It uses a special kind of activation function called the ReLU function. The first two layers of AlexNet have a convolution window shape of 11 x 11. Items in ImageNet data occupy more pixels and have more visual information since ImageNet images are eight times higher and wider than MNIST images. As a result, a larger convolution window is needed to capture the object. The convolution window shape is reduced to 3x3 in the third layer. After the first, second, and fifth convolutional layers, the network adds max-pooling layers with a window shape of and a stride of 2. Additionally, LeNet has 10 times less convolution channels than AlexNet does [19].

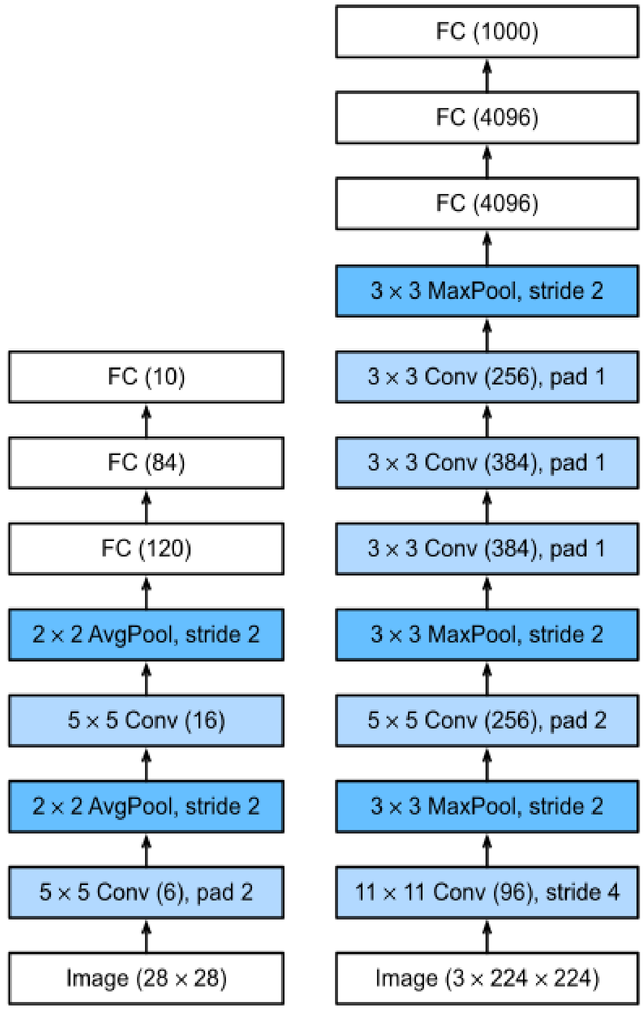

Fig. 4. Architecture Flowchart of AlexNet CNN

AlexNet changed its activation algorithm from sigmoid to the less complex ReLU. On the one hand, it is simpler to calculate the ReLU activation function. For instance, it does not use the exponentiation method used in the sigmoid activation function. The ReLU activation function, however, facilitates model training when using alternate parameter initialization strategies. When the output of the sigmoid activation function is very near 0 or 1, backpropagation cannot continue to update certain of the model parameters since the gradient of these areas is almost zero. However, the gradient of the ReLU activation function is always 1 in the positive interval. The sigmoid function may therefore generate a gradient of virtually 0 in the positive interval if the model parameters are improperly initialized, rendering the model ineffectively trained [9].

Table. 1. Architecture of AlexNet Model

Layer	Function	Filter Size	Stride
Conv 1	Convolution	11 × 11 × 96	4
Pool 1	Max Pooling	2 × 2	2
Conv 2	Convolution	11 × 11 × 256	1
Pool 2	Max Pooling	2 × 2	2
Conv 3	Convolution	3 × 3 × 384	1
Conv 4	Convolution	3 × 3 × 384	1
Conv 5	Convolution	3 × 3 × 256	1
Pool 5	Max Pooling	2 × 2	2

3.4 Blockchain

Data can be securely stored on a distributed network using the blockchain protocol and encryption technology [21]. There is an endless amount of these blocks in the Blockchain, and they are all connected to one another in chronological order by links in a chain. Each block has a hash value that is based on the block before it. They are all connected, so if one is changed, it will undoubtedly affect the other blocks that are connected to it. This research utilizes the advantages of blockchain to make the agriculture process go transparent to reduce wastage (due to sudden spread of crop virus through early detection) and enhance information sharing among farmers and supply chain management officials. In addition, when the whole of the process is transparent to all, there is no loophole for any sort of fraudulent activities such as sudden rise in prices, stock-out, less profit of farmers etc. This paper assumes that the data that are to be stored in the blockchain can further be analysed by the Agriculturists for prediction of required crops that needs to be cultivated every year or the upcoming year. This helps in wastage of crops or vegetables that are cultivated without prior calculation, as a result, farmers are in great loss and the products are as well wasted in good number. Each block in the blockchain contains some information that is stored and is important. In this research, each field must be registered with a unique identifier in the national database to help for identification when it comes to broadcasting. The block in the blockchain will contain field identification number, linkage to previous block, percentage of healthy and unhealthy crops, percentage of semi-damaged crops, field owner/ farmer public key and base station number. Depending on the number of cultivation fields in a country, the number of base stations may vary, it is totally dependent on the size of cultivation areas. The below figure shows that representation of each block from the perspective of this research.

A. F_I
B. $Hash_{previous\text{-}block}$
C. $P_{healthy\ crops}$, $P_{semi\text{-}damaged\ crops}$, $P_{damaged\ crops}$
D. $Owner/Farmer_{public\ key}$
E. BS_{number}

Fig. 5. Block representation in Blockchain

4. Result and Analysis

4.1 Dataset

For analysis purpose, a real Bangladeshi dataset was acquired from Kaggle, which contains images of different classes of diseases among different crops. These crops are Corn, Potato, Rice, Wheat. The origin of this dataset is Plant Village [20]. The amount of pictures are as follows,

- Corn (3852 Images)
- Potato (2152 Images)
- Rice (4078 Images)
- Wheat (2942 Images)

Amongst these pictures, the corn dataset was chosen in order to train the classification model. The dataset was split into three sections: Training, Valid and Testing. This research has used the Valid data to verify whether the data which are being trained are overfitting or not; meaning, it is used as feature selection. It tests data in the initial stage and checks which part of the images should not be included and it solidifies the training process. Otherwise, the machine will overtrain and result in lesser accuracy. The table below shows the distribution:

Table. 2. Training & Testing Dataset Of AlexNet CNN

Disease Type	Training Sample	Valid Sample	Testing Sample
Common Rust	832	240	120
Gray Leaf Spot	360	103	52
Northern Leaf Blight	690	200	100
Healthy	815	233	117
y	2697	776	389

Common Rust

Grey Leaf Spot

Healthy

Northern leaf blight

Fig. 6. Types of Diseases

4.2 Analysis

Jupyter Notebook was used to create the prediction model of the crop dataset. Since local resources were used, the computer specifications are stated below in order to get a clear perspective of the whole process about how and why it performed the way it did using these resources.

- RAM:16-Gigabytes ~ 2 8-Gigabytes Sticks
- PROCESSOR: AMD Ryzen 5 2400G (8 CPUs), ~ 3.6 GHz
- GRAPHICS: Radeon RX Vega 11 Graphics ~ 7 GB Shared + 2 GB VRAM
- STORAGE: 1 Terabytes HDD + 256 Gigabytes SSD

As only chosen dataset was the Crop dataset, the dataset was split into 3 parts and were used to train the model.

Table. 3. Training Performance of AlexNet CNN

Epoch	Elapsed Time	Batch Accuracy	Batch Loss
1	00:05:17	72.01%	1.1882
5	00:25:02	85.95%	0.3874
10	00:50:15	91.69%	0.2394
15	01:15:57	93.21%	0.1942
20	01:41:15	93.66%	0.1951

From the table 3 above, it can be inferred that the model gradually increases its training accuracy with each epoch. Initially, during epoch 1 the batch accuracy was at 72.01%, which is very low. However, with each epoch the accuracy increases and by the 10th epoch, the accuracy of the batch flew up to 91.69%. Further in the 20th epoch, the accuracy hit a bit higher at 93.66%. The time cost in constructing this model was huge and the computer specifications were at fault for this poor performance regarding time.

Table. 4. Testing Performance Of AlexNet CNN

Epoch	Elapsed Time	Batch Accuracy	Batch Loss
1	00:00:11	95.37%	0.1981

From the table 4 above, it is clear that the testing process is much faster than the training process as it takes only 11 seconds to classify images with 95.37% accuracy, which is better than the testing performance.

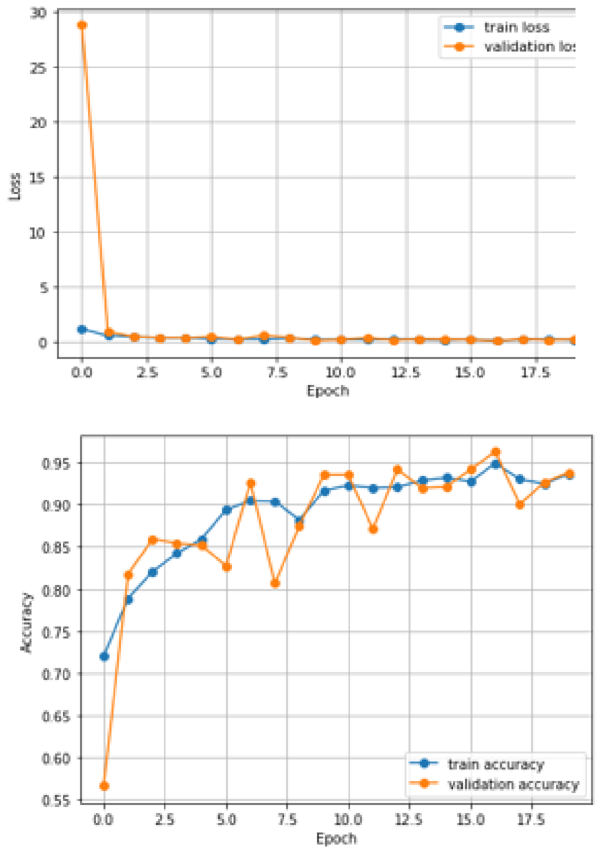

Fig. 7. Training and Validation Accuracy/Loss Graph

In the above figure 7, the training accuracy over the epochs are visualized in the shape of a graph. It can be observed that the train accuracy has been increasing since the first epoch and without any big fluctuations it went higher through every epoch. On the other hand, the validation accuracy fluctuated a lot throughout the epochs. The rise of train accuracy per epoch gives quite an idea of how the process would end up if epochs were increased in amount.

4.3 Discussion

Unmanned aerial vehicles (UAVs) are now the most well-liked innovation. It conserves human energy, money, and time. Smart farming is now incredibly effective for farmers. Utilizing UAVs in the agricultural sector is smart farming [28]. But one must keep in mind about the cost that is used in smart farming. Several researchers come up with high computational power UAVs to process data, or very high image resolution that increases UAV cost [22]. These requirements increase the cost of the whole farming process as the users are basically farmers. In this research, the capability of the UAVs is kept as minimal as possible to reduce the cost. Only recording videos are the jobs for the UAVs therefore there is a reduction in cost for each UAVs required for the process [23]. Videos are processed in the ground base station using the algorithm so one base station can be used for multiple fields. The computation power is resided on to the base machine for processing data retrieved from the multiple fields under it. The data after processing are broadcasted to the blockchain to share among different stakeholders those who are linked with the supply chain management system. The algorithm AlexNet is applied on the crop dataset of corn and on the testing phase an accuracy of 95.37% is achieved in 11s which is considered to be good enough for crop health identification. These data give the stakeholders an idea about current cultivation amount, needed in future and for the upcoming year as well. Such data reduces the frequency of crop wastage or sudden rise in crop prices that harasses normal citizens. In addition, the agriculturists can use such data for mining and processing to generate patterns and deal with viruses and diseases that spread out in very short time. Information such as attack of sudden virus or bacteria is also transferred by broadcasting data to the blockchain enabling peer networks, farmers being informed about sudden attack.

The broadcasting of crop health, farming ingredients helps nearby field's farmer to have an idea about problematic cases and helps to deal with it [24]. Through blockchain, it can form a community of farmers to help each other with techniques and methods to improve farming methods and deal together in critical conditions as well. The officials of supply chain management will maintain the blockchain to store distribution of data to track out asset passage easily. This helps in reduction of scenarios where crop prices increase suddenly due to unavailability. While everything is being transparent, there remains no central authority to shift data such as crop or alter any of these to have own profit [25].

This research plays a vital role in contributing to the Sustainable Development Goals such as:

a) *No poverty:* Early detection of damage can help farmers to apply proper necessities to overcome the damage. The overall loss of the process is reduced that helps farmers to fight poverty. In addition, the transparency of the whole process helps to verify the passage of goods enabling farmers to ensure that are correctly paid off.
b) *Economic Growth:* The characteristics of transparency and the smooth running of the whole process leads to economic growth as a country's economy is highly dependent on its agricultural growth. Therefore, agriculture is a key aspect of economic growth [25].
c) *Sustainable communities:* The utilization of technology in agriculture helps to build sustainable communities. The participants of the process are trained to carry out the process in achieving a sustainable community [29].
d) *Responsible consumption and production*: The early prediction of the goods helps to reduce wastage and as well as reduce sudden price rise due to shortage. With proper analysis and investigation of data retrieved from the proposed model, an approximate number of consumption and production required every year can be predicted.

Several other goals of the sustainable development are indirectly linked to the scope and aspect of this research such as zero hunger, innovation and infrastructure, life on land and affordable and clean energy.

There are several characteristics of Blockchain that enhances the whole process such as Transparency, Decentralization, Security, Distributed and Consensus Networking [26].

a) *Transparency*: In contrast, the data is made available within the system for everyone to read. There is no information being hidden throughout the whole process starting from cultivation to distribution. The stakeholders responsible for the whole cultivation can themselves verify whether the distribution and management are on track or not.
b) *Decentralized:* Since the network is decentralized, there is no central authority [27]. Since there is no need for a regulatory authority, anyone involved in the process can access the system directly from the web and access the data. These reduces the scenarios of sudden unavailability and price rise.
c) *Security:* There is no centralized authority, so it is impossible for anyone to change any aspect of the network easily for their own benefit. The system now has an additional layer of security thanks to encryption. Identity is protected by blockchain services using strong, impenetrable encryption. This prevents people from being linked to specific public blockchain addresses. This ensures that your transactions remain entirely confidential and makes it more difficult for hackers to access your data.
d) *Distributed:* The network ledger is updated by every other system user. The systems' processing power was distributed among them to produce a better outcome. Distribution enhances the transparency of the process.
e) *Consensus:* Every blockchain has a consensus algorithm in place to assist the peer-to-peer network in making decisions.

5. CONCLUSION

From the result analysis, it can be deduced that AlexNet CNN prediction model with the given Dataset can provide about 95% accuracy when it comes to detect crop disease, which is not bad at all. If better computers are employed and adjustments are made to the model's construction, the accuracy can most likely be raised above 95%. Additionally, better refined datasets might prove that it is the sampling that is giving out comparatively lower results. If better computers are controlled, the full model can be built considerably more quickly than what was stated in this work. Since AlexNet CNN performed significantly better on crops than GoogleNet, it was decided to use in this study. This paper explains why it utilizes blockchain for UAV in agriculture, and how it works to create a reliable ecosystem for bringing together key parties to create a more secure and effective food supply chain Governments spend more money on education, training, and research in order to develop and demonstrate the technology's potential benefits. This research and its implications can lead to serving as a goal of Sustainable Development in the agriculture sector. Several policy actions could be implemented, such as promoting the development of blockchain-based ecosystems in agri-food chains, supporting the technology as part of broader objectives of improving competitive advantage, as well as supporting the requirements of the agri-food supply chain and putting in place a clear regulatory framework.

The overall attempt is to step forward towards Sustainable developments. This research implementation can help to reduce poverty, develop decent growth in economic work and help to build sustainable communities. In addition, the scope of this research contributes to achieving the other goals of sustainable development as well. Agriculture is a key factor of a country's growth and development; implication of technology and its advancements can help in agriculture to reduce loss and increase profit. Moreover, a good number of populations of a country is responsible for the agricultural process, so a little contribution towards efficiency can have a good impact on the overall process.

REFERENCES

[1] M.S. Akhter, A.M. Akanda, K. Kobayashi, R.K. Jain, Bikash Mandal. (2019). "Plant virus diseases and their management in Bangladesh". https://doi.org/10.1016/j.cropro.2018.11.023.

[2] Alqasem, Osama & Akour, Mohammed. (2019). Software Fault Prediction Using Deep Learning Algorithms. International Journal of Open Source Software and Processes. 10. 1-19. 10.4018/IJOSSP.2019100101.

[3] D. Gershgorn, "The data that transformed AI research—and possibly the world".(2017). Available: https://qz.com/1034972/the-data-that-change d- the- direction- of- ai-research-and-possibly-the-world/.

[4] Rokhmana, "The Potential of UAV-based Remote Sensing for Supporting Precision Agriculture in Indonesia". (2015). Procedia Environmental Sciences. 24. 10.1016/j.proenv.2015.03.032.

[5] P. K. R. Maddikunta , "Unmanned Aerial Vehicles in Smart Agriculture: Applications, Requirements, and Challenges," in IEEE Sensors Journal, doi: 10.1109/JSEN.2021.3049471.

[6] D. C. Tsouros, A. Triantafyllou, S. Bibi and P. G. Sarigannidis. (2019) "Data Acquisition and Analysis Methods in UAV- based Applications for Precision Agriculture," 15th International Conference on Distributed Computing in Sensor Systems (DCOSS), pp. 377-384, doi: 10.1109/DCOSS.2019.00080.

[7] W. Yuan and Choi. (2021). "UAV-Based Heating Requirement Determination for Frost Management in Apple Orchard," Remote Sensing, vol. 13, no. 2, p. 273. Available: http://dx.doi.org/10.3390 /rs13020273

[8] N. Islam,Mamunur, Faezeh, Biplop, Steven and Rajan. (2021). "A Review of Applications and Communication Technologies for Internet of Things (IoT) and Unmanned Aerial Vehicle (UAV) Based Sustainable Smart Farming," Sustainability, vol. 13, no. 4, p. 1821 Available: http://dx.doi.org/10.3390/su13041821

[9] A. Guo. (2021)."Wheat Yellow Rust Detection Using UAV-Based Hyperspectral Technology," Remote Sensing, vol. 13, no. 1, p. 123. Available: http://dx.doi.org/10.3390/rs13010123

[10] Kawcher Ahmed, Tasmia Rahman Shahidi, Syed Md. Irfanul Alamand Sifat Momen. (2019). "Rice Leaf Disease Detection Using Machine Learning Techniques. pp. 1-5, doi: 10.1109/STI47673.2019.9068096.

[11] Balwant Ram, Mamoon Rashid, Kamlesh Lakhwani and Shibi S. Kumar. (2019). "Health Detection of Wheat Crop Using Pattern Recognition and Image Processing". International Journal Of Healthcare Information Systems And Informatics. 15. 50-60. 10.4018/IJHISI.2020 040104.

[12] Andreas Kamilaris, Agusti Fonts, Francesc X. Prenafeta-Boldώ. (2018). "The Rise of the Blockchain Technology in Agriculture and Food Supply Chain". https://doi.org/10.1016/j.tifs.2019.07.034.

[13] Prabira Kumar Sethy, Nalini Kanta Barpanda, Amiya Kumar Rath and Santi Kumari Behera. (2020). "Image Processing Techniques for Diagnosing Rice Plant Disease: A Survey". Procedia Computer Science. 167. 516-530. 10.1016/j.procs.2020.03.308.

[14] Sadia, K., Md Masuduzzaman, Rajib and Anik Islam. (2019). "Blockchain-Based Secure E-Voting with the Assistance of Smart Contract". https://doi.org/10.1007/978-981-15-4542-9_14G.

[15] Sachin B. Jadhav, Vishwanath R. Udupi and Sanjay B. Patil. (2020). "Identification of plant diseases using convolutional neural networks", International Journal of Information Technology, vol. 13, no. 6, pp. 2461-2470. Available: 10.1007/s41870-020-00437-5.

[16] K. R. Aravind, P. Raja, R. Aniirudh, K. V. Mukesh, R. Ashiwin and G. Vikas. (2019). "Grape Crop Disease Classification Using Transfer Learning Approach". Lecture Notes in Computational Vision and Biomechanics. 1623–1633. doi:10.1007/978-3-030-00665-5_150

[17] D. Al Bashish, Malik Braik and Sulieman Bani-Ahmad. (2011). "Detection and Classification of Leaf Diseases using K-means-based Segmentation and Neural-networks-based Classification", Information Technology Journal, vol. 10, no. 2, pp. 267-275. Available: 10.3923/itj.2011.267.275.

[18] V. Nigam, "AlexNet: The First CNN to win Image Net", My Great Learning, 2020. [Online]. Available: https://www.mygreatlearning.com/ blog/alexnet-the-first-cnn-to-win-image-net/.

[19] D. P. Hughes and Marcel Salathe. (2015). "An open access repository of images on plant health to enable the development of mobile disease diagnostics". Available: http://arxiv.org/abs/1511.08060.

[20] E. Honkavaara ans Saari. (2013). "Processing and Assessment of Spectrometric, Stereoscopic Imagery Collected Using a Lightweight UAV Spectral Camera for Precision Agriculture," Remote Sensing, vol. 5, no. 10, pp. 5006–5039. Available: http://dx.doi.org/10.3390/rs510 5006

[21] H. Xiong, Tobias, Wang and Huang. (2020). "Blockchain Technology for Agriculture: Applications and Rationale", Frontiers in Blockchain, vol. 3. Available: 10.3389/fbloc.2020.00007

[22] Ting-Chu Hsieh , Ming-Chien Hung , Mai-Lun Chiu and Pay-Jiing Wu. (2020). "Challenges of UAVs Adoption for Agricultural Pesticide Spraying: A Social Cognitive Perspective". (doi: 10.20944/preprints202001.0121.v1).

[23] M. Ayamga, Bedir Tekinerdogan and Ayalew Kassahun. (2021). "Exploring the Challenges Posed by Regulations for the Use of Drones in Agriculture in the African Context," Land, vol. 10, no. 2, p. 164. Available: http://dx.doi.org/10.3390/land10020164

[24] "How the agricultural industry can harvest the benefits of blockchain technology", Nortonrosefulbright.com, 2021. [Online]. Available: https://www.nortonrosefulbright.com/en/knowledge/publications/53901 082/how-the-agricultural-industry-can-harvest-the-benefits-of-blockchain-technology.

[25] "Blockchain in Agriculture — Rise of New Techniques, Apps & Solutions", PixelPlex, 2021. [Online].Available: https://pixelplex.io /blog/ blockchain-in-agriculture/

[26] "6 Key Blockchain Features You Need to Know Now", 101 Blockchains, 2021. [Online]. Available:https://101blockchains.com /introduction-to-blockchain-features/#prettyPhoto.

[27] Anik Islam and Soo Young Shin. (2020). "A blockchain-based secure healthcare scheme with the assistance of unmanned aerial vehicle in internet of things. http://dx.doi. org/10.1016/j.compeleceng.2020.10662 7.

[28] Ahmed Alioua, Houssem-eddine Djeghri, Mohammed Elyazid Tayeb Cherif, Sidi-Mohammed Senouci and Hichem Sedjelmaci. (2020).

"Uavs for traffic monitoring: A sequential gamebased computation offloading/sharing approach".

[29] Fatma Outay, Hanan Abdullah Mengash and Muhammad Adnan. (2020). " Applications of unmanned aerial vehicle (uav) in road safety, traffic and highway infrastructure management: Recent advances and challenges".