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# A Privacy-Preserving Machine Learning Tactic to Hydroponic Agriculture

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#### Abstract

Full Spectral Imaging (FSI) is a type of imaging spectroscopy that succeeds hyper spectral imaging. It also includes experiential reflectance retrieval and independent remote sensing, which are components of new remote sensing systems that succeed the Lands at series of satellites. Land Cover Land Use is a Full Spectral Image that is based on two issues: dimensionality reduction and the elimination of redundant data. Land Cover Land Use is a Full Spectral Image that is based on two issues: dimensionality reduction by removing redundant and noisy bands, and the number of spectral bands, which has a negative impact on the accuracy of supervised classifiers. Using the variable bands elimination feature selection approach, see the effect of reducing dimensionality by picking pertinent bands and deleting unnecessary and superfluous ones. We give a comprehensive review of studies on machine learning applications in hydroponic agriculture production systems in this study. Crop management applications on yield prediction using Lasso Regression, disease detection, and crop quality were investigated in this study of this paper. The sieve and classification are shown to demonstrate how machine-learning technology might benefit hydroponic gardening. Machine learning is being applied to full spectral based hydroponic data using Time Series Classification and farm management system to create a real-time artificial intelligence empowerment tool that delivers sarcastic cues and insights into farmer decision support and action.

Keywords: Hydroponic Agriculture, Privacy Preserving Machine Learning, Lasso Regression

## **1. INTRODUCTION**

Hydroponics is a type of horticulture and a subculture of hydro culture in which plants, typically crops, and soil are cultivated without the use of mineral fertilizer solutions in aqueous solution. Earthly plants can only expose their roots with nutrient fluid, or an inert medium such as per light, gravel, or other surfaces can support the roots bodily. Despite the inert medium, root exudates affect rhizo sphere life and produce pH variations in the rhizosphere. Experts can choose from a wide range of settings to get the right combination of spatial clarity and wavelength range for a hydroponic farming application. Drones are frequently employed in this application, which covers medium distances (acres). Multispectral and hyper spectral cameras that are small and light have been designed expressly for use on unmanned aerial vehicles (UAVs). Hydroponic agriculture is one of the more accessible forms of contemporary agriculture for dealing with both water scarcity and farmland scarcity. Pests and soil-borne diseases are reduced. The major purpose is to ensure that consumers may get fresh, pesticide-free produce within three hours of harvest. Agriculture has always been an interest of mine. Cooking aromatic plants, oil extraction, nutrient extraction, alternative medicinal

UGC CARE Group-1,



Industrial Engineering Journal ISSN: 0970-2555

Volume : 52, Issue 4, April : 2023

medicine, and scent are all interesting possibilities. Before the hydroponic method became popular, it was used to cultivate crops. Hydroponics is a system that blends stability with Internet technologies.

## 1.1Related Work

The recent advancements in machine learning (ML) led to new, innovative, and functional approaches. Moreover, they have enabled the development of intelligent models that try to assess the likelihood of companies' default by looking for relationships among different types of financial data, and the financial status of a firm in the future. Different ML algorithms and techniques such as Support Vector Machine, boosting techniques, discriminate analysis, and Neural Networks have been used in the literature for this task. Moreover, different architectures have been evaluated to identify effective decision boundaries for this binary classification problem, such as the least absolute shrinkage and selection operator, dynamic slacks-based model, and two-stage classification. However, although default prediction models have been studied for decades, several issues remain. Interestingly, some new issues have even been introduced with the recently increased exploitation of machine-learning models. Indeed, since the Z-Score model was proposed by Altman, research mainly focused on accounting-based ratios as markers to detect and understand if a firm is likely to face financial difficulties, such as bankruptcy. Scoring-based models use discriminate analysis to provide ordinal rankings of default risk but are often computed from small datasets using statistical and probabilistic models that focus more on explainability and explicability but miss generalization over time and across different sectors

## **REVIEW OF LITERATURE**

Samuel., [1] Two machine-learning procedures have been investigated in some detail using the game of checkers. Enough work has been done to verify the fact that a computer can be programmed so that it will learn to play a better game of checkers than can be played by the person who wrote the program.

Mackowiak., [2] There is increasing evidence that transcripts or transcript regions annotated as noncoding can harbor functional short open reading frames (SORFs). Loss-of-function experiments have identified essential developmental or physiological roles for a few of the encoded peptides (micro peptides), but genome-wide experimental or computational identification of functional SORFs remains challenging.

Richardson., [3] Big Data is having an impact on many areas of research, not the least of which is biomedical science. In this review paper, big data and machine learning are defined in terms accessible to the clinical chemistry community. Seven myths associated with machine learning and big data are then presented, with the aim of managing expectation of machine learning amongst clinical chemists.

Wildenhain, J., [4] The structure of genetic interaction networks predicts that, analogous to synthetic lethal interactions between non-essential genes, combinations of compounds with latent activities may exhibit potent synergism.

Schwartz, R., [5]. Radiation oncology has always been deeply rooted in modeling, from the early days of isoeffect curves to the contemporary Quantitative Analysis of Normal Tissue Effects in the Clinic (QUANTEC) initiative. In recent years, medical modeling for both prognostic and therapeutic purposes has exploded thanks to increasing availability of electronic data and genomics. One promising direction that medical modeling is moving toward is adopting the same machine learning methods used by companies such as Google and Face book to combat disease.

Dowling, R., [6] Stroke is a major cause of death and disability. Accurately predicting stroke outcome from a set of predictive variables may identify high-risk patients and guide treatment approaches, UGC CARE Group-1, 2471



Industrial Engineering Journal ISSN: 0970-2555

Volume : 52, Issue 4, April : 2023

leading to decreased morbidity. Logistic regression models allow for the identification and validation of predictive variables.

Kampouridis, M.,[7]. Regression problems provide some of the most challenging research opportunities in the area of machine learning. Not only is the difficulty of a problem determined by how effective a given machine learning or data mining technique is, but is linked to the difficulties faced within the structure of the data set. There exist several chaotic data structures in the real world that exhibit unique behavior, whereby few trends or patterns are apparent.

Rhee, J., [8] Droughts have caused significant losses and damages. Defining the types of drought helps to monitor droughts and to build strategies for the preparation and response to droughts (Ward et al., 2006, Harou et al., 2010). Wilhite and Glantz (1985) addressed the conceptual definition of drought as well as the operational definition of drought.

Jiménez-Fernández, S., [9] Solar energy is an important source of renewable and clean energy, currently under expansion in different countries of the world, and with a huge potential to contribute significantly to the energy mix and nations' economies of these countries.

Barboza, F., [10] Financial institutions, fund managers, lenders, governments, and financial market players seek to develop models to efficiently assess the likelihood of counterparty default. Although default events behave stochastically, capital market information can be used to develop bankruptcy prediction models.

S.NO	TITLE	TECHNIQUE			
1	Some Studies in Machine Learning Using the Game of Checkers	Basic checker-playing program			
2	Extensive identification and analysis of conserved small ORFs in animals	Short Open Reading Frames			
3	Clinical chemistry in higher dimensions: Machine- learning and enhanced prediction from routine clinical chemistry data	Predictive modeling			
4	Prediction of Synergism from Chemical-Genetic Interactions by Machine Learning.	unbiased chemical-genetic interaction data			
5	Machine Learning Approaches for Predicting Radiation Therapy Outcomes: A Clinician's Perspective	Logistic regression (LR), support vector machine (SVM), and artificial neural network (ANN)			

## Table 1: Summary of Literature survey



Industrial Engineering Journal ISSN: 0970-2555

Volume : 52, Issue 4, April : 2023

6	Machine learning for outcome prediction of acute ischemic stroke post intra-arterial therapy	Endovascular Intervention
7	An extensive evaluation of seven machine learning methods for rainfall prediction in weather derivatives	Sliding window accumulation
8	Meteorological drought forecasting for ungauged areas based on machine learning: Using long-range climate forecast and remote sensing data	Standardized Precipitation Index
9	A novel Grouping Genetic Algorithm–Extreme Learning Machine approach for global solar radiation prediction from numerical weather models inputs	Grouping Genetic Algorithm–Extreme Learning Machine (GGA–ELM)
10	Machine learning models and bankruptcy prediction	Standard Mac Book Air

## **PROPOSED METHOD**

#### Time Series Classification for Hydroponic Agriculture

The act of measuring is, in reality, a crucial machine learning activity. It is difficult to overestimate the extent to which this behavior is widespread. Furthermore, measuring is frequently a continuous process rather than a one-time event. This signifies that there is a significant amount of data in the form of time-series. Hypothetically, a time-series consists of a set of pairs{ $< t_1, v_1 >, < t_2, v_2 >, <$  $t_3, v_3 >, ..., < t_n, v_n >$ }, where each  $t_i$  indicates a time instant and  $v_i$  indicates the values of some measurement. Usually, the instants in time when measurements made are well defined, at regular intervals. In such a case, it is passable to represent the time-series as just an ordered list of values<  $v_1, v_2, v_3, ..., v_n >$ . A set of measurements gathered at different times in time is referred to as a timeseries of data utilizing a machine learning system. This includes determining the Hydroponic Agriculture parameters of a machine learning system, such as loading hidden and/or normal data, executing the feature extraction procedure, reducing noise, and producing the output. Lasso Regression

When choosing the tuning parameter for prediction, the Lasso Regression incorporates much too many variables. However, the true model is almost certainly a subset of these variables. This suggests utilizing a secondary estimating stage. The adaptive Lasso Regression is capable of achieving and controlling the LASSO estimate's bias. The prediction-optimal tuning parameter leads to consistent selection using either technique. To calculate weights with adaptive LASSO, we require an initial estimate, least squares, or even LASSO estimates.

#### **Ordinary Least Square estimation**

$$\mathcal{L}_{\text{OLS}} = ||\mathbf{Y} - \mathbf{X}^{\text{T}}\boldsymbol{\beta}||^2$$



Industrial Engineering Journal

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As long as >0, Lasso Regression is biased. Furthermore, bias words with various functional forms exist in Machine Learning algorithms. However, if biased estimators are biased, why do they perform better than OLS? Yes, just because they are well-informed. It's worth noting, though, that bias can also result in a poor outcome. Furthermore, this crucial feature elucidates why hyper parameter adjustment is necessary for Machine Learning algorithms. Finding the best bias term is what we mean by this. With the help of cross validation, the lambda value can be chosen from a list of various options. Changing this value will aid in choosing the right lambda value for predicting the best-fit line.

## Privacy Preservation Approach for Hydroponic Agriculture

The knowledge gap between machine learning and privacy, which exists in today's machine learning systems, should be bridged. Prioritize approaches used to safeguard data in order to introduce the intersection of the two fields. We present machine learning tasks and dangers connected with current methods of gathering Hydroponic agriculture data and smart farmer crop yield data, as well as creating a machine learning system. We designate the proposed technique as a means of ensuring information confidentiality.

Our goal is to bridge the gap between machine learning and privacy and security technologies, as well as to enable machine-learning practitioners become more aware of potential privacy issues.

Computers provide the ability to learn without explicit programming in the field of hydroponic agricultural information and machine learning. By simplifying farm information data, machine-learning ways to understanding how to accomplish particular obligations are developed. Making accurate estimates or locating structures in attribute data are examples of such obligations. Crop yield data is a type of input data for a machine-learning algorithm. Each model has a set of distinguishing characteristics.

Consider one indicator, where agricultural yield data is used to represent each one. Crop yield can be generated using these property values. A label could be assigned to each of the attributes above. The training set and their associated labels are used to design the machine-learning model in the machine learning approach. The training or learning phase is the name given to this procedure. This machine-learning model should be labeled as Hydroponic agriculture at crop yield when presented with the new test model.

The efficiency of such machine learning is a measure of how easy it is for invisible data to appropriately assess the label using this machine-learning model. The quality and amount of data used to train the model, the machine learning methodology used to create the model, the choice of machine learning strategy employing cross validation, and the topographical method are all factors that influence test error.

## Hydroponic Agriculture Using Machine Learning

Machine Learning duties are often divided into several broad groups based on the type of learning, such as (UN) supervised learning models such as classification, regression, clustering, and dimensionality reduction, or learning models that work to complete a specific goal.



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## **BLOCK DIAGRAM**



Either labeled or unlabeled data can be trained by any machine learning procedure supervised or unsupervised methods to implement the classification of hydroponic agriculture data by predicting the learning results, and the enhancement of privacy preservation can be guided to maintain the data by hiding related data from unrelated prediction analysis and their results. Proper regression or classification analysis using machine-learning methods can generate the prediction output.

## 2. EXPERIMENTAL RESULTS

Table 2's data is examined in depth, one by one, for each variable. Calculate the average for each cluster, including the nutrient-receiving cluster and the nutrient-deficient cluster. Table 2: Table to store the data about the growth of plant

Hydroponic growth data (Length of leaves in mm)										
		Receive Nutrient-			Receive Plain					
		Rich Water				Water				
Date	N1	N2	N3	Average	W1	W2	W3	Average		
				8-				6		
1/3/2021	2	0	1	1	0	0	0	0		
3/3/2021	5	3	4	4	1	1	1	1		

Plot the average number of leaves below. The x-axis should be labeled 'Date,' and the y-axis should be labeled 'Average Number of Leaves.' In a single color, plot the average of plants that receive nutrient-rich water. Plot the average of plants that receive plain water in a different hue.



Industrial Engineering Journal ISSN: 0970-2555 Volume : 52, Issue 4, April : 2023



Figure 1: Plot the average of the other growth variable we studied

(Length, width, or area of the largest leaf)

## 3. CONCLUSION AND FUTURE WORK

Agriculture is the study of plants and their humanization. This is a significant advancement in passive human development, allowing individuals to dwell in urban environments. Plants that are grown in well-kept hydroponic systems have a long and happy life. Plants will grow longer and look for food with vast root systems that boost short time and energy since the roots are drenched in all the nutrients they require. Growth rates vary based on the type of system and the level of care provided, but hydro plants mature 25 percent faster than soil-grown plants, resulting in higher agricultural yields.

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UGC CARE Group-1,



Industrial Engineering Journal

ISSN: 0970-2555

Volume : 52, Issue 4, April : 2023

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