



Hybrid Algorithm-Based Prediction of Turmeric Growth and Disease: Enhancing Crop Yield and Disease Prevention in Agriculture

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ABSTRACT

Our nation's economic foundation is agriculture, which is also the general term for the production of human food. Turmeric plant production materials play a role in our daily lives, such as food preparation and health care. The most common turmeric plant diseases are Leaf Spot and Leaf Blotch, which are airborne diseases that can wipe out entire crops in a matter of days. In this paper, Hybrid algorithms such as Regression Tree, Kernel least square regression, Quadratic SVM, Ensemble boosted tree, optimized ensemble, square exponential GPR and Optimized neural network are proposed to predict the growth of turmeric and turmeric plant disease. The proposed hybrid algorithms are predicting the turmeric growth level from turmeric yield dataset. It is also used in the agricultural sector to increase crop yield by spotting disease affliction early and categorising the type of disease affected so that preventative measures can be taken to stop the disease from spreading to other plants in the field. Regression Tree, Kernel least square regression, Quadratic SVM, Ensemble boosted tree, optimized ensemble and square exponential GPR algorithms are performing less due to prediction of turmeric growth based on accuracy and time. These algorithms give huge difference in prediction such as accuracy level and speed. Turmeric yield data fed to the pre-trained for prediction of turmeric growth. The proposed Hybrid algorithm gives high accuracy prediction compared to other statistical algorithms. Optimized neural network gives high accuracy of about 96% compared to conventional methods.

KEYWORDS: Turmeric yield data; Regression Tree; Kernel least square regression; Quadratic SVM; Ensemble boosted tree; optimized neural network, optimized ensemble; square exponential GPR

1. INTRODUCTION

South East Asian monsoon forests are the natural habitat of turmeric. It is a perennial herb that can grow up to 1 m tall. If clumps are left alone for a year, it produces long, stunning white flower spikes. The flower is so beautiful that growing it is worthwhile for this reason

alone. It needs a climate without frost, well-drained soil, and between 1000 and 2000 mm of rain per year or additional irrigation. It is incapable of withstanding waterlogging and does best on fertile loamy or alluvial soils. While light shade is advantageous, heavy shadow will decrease the yield. 25% of curry powder is made up of ground turmeric, which gives the mixture its yellow hue. The gathered rhizomes can be utilised fresh or they can be boiled and sun-dried for 7-8 days. In place of tetrazine, it is also used as a yellow food colour. Fish is encased in leaves, which provide flavour while it cooks. The young shoots and rhizome tips are consumed uncooked in Indonesia. In warm soil, plant the turmeric in September or October. Rhizomes need to be buried 5-7 cm deep. It is frequently grown on hills, typically with plants spaced 15 to 30 cm apart and 30 to 45 cm apart. Setts (small rhizomes) with one or two buds are used to plant the crop. For one hectare, around 1,700 kg of setts are needed. Fresh turmeric will be expected to generate between 13 and 35 tonnes/ha. In glasshouses, turmeric can be cultivated in Australia's cooler regions. Turmeric clumps must be divided into new pieces and replanted every three to four years, just like all other herbaceous perennials. Rhizomes are harvested 9 to 10 months after planting; signs of maturity include lower leaves turning yellow or stems drying out and toppling over. Instead of harvesting the entire clump, the home gardener can simply carefully dig at the edge of a clump and pluck rhizomes as needed. Its rhizome, or underground stem, is used in traditional medicine and as a spice in food. Turmeric has historically been used in Eastern Asian medical systems like traditional Chinese medicine, as well as Ayurveda and other traditional Indian medical systems. It has historically been used in India to treat ailments of the skin, upper respiratory tract, joints, and digestive system. Today, turmeric is marketed as a dietary supplement for a wide range of ailments, such as depression, liver disease, allergies, respiratory infections, arthritis, digestive disorders, and many others. Dietary supplements made from dried turmeric rhizome typically include a blend of curcuminoids. Additionally, turmeric paste is prepared for use on skin issues. When consumed or applied topically in the recommended dosages, turmeric and conventionally formulated curcumin products are probably safe. Many modified curcumin products are already available on the market, and efforts have been made to create products with increased bioavailability. Enhancing bioavailability could result in an increase in both undesirable and beneficial effects. Use of turmeric during pregnancy may be dangerous in doses greater than those typically found in food. Little is known about whether using turmeric while breastfeeding in doses higher than those typically found in food is safe. Even though the turmeric plant's edible roots are well-known, all other parts of the plant, such as the leaves and flowers, are also edible. Some of the important states that cultivate turmeric include Andhra Pradesh, Tamil Nadu, Orissa, Karnataka, West Bengal, Gujarat, Meghalaya, Maharashtra, and Assam; Andhra Pradesh alone accounts for 35.0% of the state's land area and 47.0% of its production. Due to the seasonal nature of turmeric, it is best to purchase "fresh harvest during late December to January" from a farm or the market. Turmeric should ideally be planted in March or April for the highest quality harvest. "Just plant the roots in the soil and give it two to three days' worth of water. Turmeric is a significant cash crop that is primarily grown for the profits it is expected to bring, which is supported by sentiment. Despite the high cost of production, farmers are encouraged to cultivate on the smallest available plot of land because it is regarded as a good omen crop. Turmeric is primarily affected by four foliar diseases, including leaf blotch, *Colletotrichum* leaf spot, *Cercospora* leaf spot, and leaf blight, as well as three rhizome diseases, including rhizome and root rot, dry rot, and brown rot. Rhizomes, the primary source of infection during sowing, carry the fungus on their scales. Wind, water, and other physical and biological agents all contribute to the secondary spread. The same pathogen, which is spread through seed-borne infections, is also known to cause chilli fruit rot and leaf spotting. When chilli is grown nearby or rotated

with turmeric in a crop rotation, the pathogen easily multiplies, increasing the chance of epiphytotic outbreaks.

Problem statement

Our society's development and economy are greatly influenced by agriculture. Identification of the plant disease is essential for improving crop productivity. Plant development and product quality can be significantly impacted by changes in nutrient management and environmental factors. The turmeric plant can be grown in artificial environments as long as those conditions are met. Bacteria and viruses are the main disease-causing microbes, and they are invisible when they first affect a plant. In order to identify and stop the disease from spreading throughout the entire plant, the hybrid algorithm is used in this paper.

Contributions

The prediction of turmeric growth and disease plays a vital role. To solve the above problem hybrid algorithms are proposed

- (i) To determine the turmeric growth through proposed method hybrid algorithms such as Regression Tree, Kernel least square regression, Quadratic SVM, Ensemble boosted tree, optimized ensemble, square exponential GPR and Optimized neural network from turmeric yield dataset
- (ii) To detect the disease at earlier stage through proposed hybrid algorithms
- (iii) To prove the accuracy level of turmeric growth and avoid from turmeric disease

2. LITERATURE SURVEY

Our society's development and economy are greatly influenced by agriculture. Identification of the plant disease is essential for improving crop productivity. The rhizomatous crop turmeric is well-known for its therapeutic, culinary, and non-culinary uses. The rhizome rot is one of the diseases that turmeric is susceptible to, and it significantly reduces crop production while causing farmers great suffering. The use of artificial intelligence is growing across all industries to automate tasks and increase productivity. It is also used in the agricultural sector to increase crop yield by spotting disease affliction early and categorizing the type of disease affected so that preventative measures can be taken to stop the disease from spreading to other plants in the field [1-2]. In this paper, AgriTalk is proposed as a low-cost Internet of Things (IoT) platform for precision soil cultivation. Our research on the cultivation of turmeric shows that using AgriTalk significantly improves the quality of the spice [3]. The NiCo 2 O 4 @GP electrode was found to be extremely selective for MY despite interferences like sodium, potassium, zinc ions, and curcumin [4]. Finding the disease-affected areas in a cultivation of more than 20 acres can be very difficult for most farmers. To solve this issue, a dataset of the turmeric leaf is created using sample images. It is an approach to image processing. Analysing the image is done before conversion. Farming's primary focus is on identifying plant illnesses [5]. In India, turmeric is consumed by over 20 million people. Plant development and product quality can be significantly impacted by changes in nutrient management and environmental factors. Multiple sensors are part of the automated system to track the turmeric farm. The necessary sensors are connected using WSN technology [6]. Leaf blotch, leaf spot, and rhizome rot are the three main infections that have an impact on the plant. Rhizome rot, one of the diseases that have been reported, is dangerous and extremely destructive in the production of turmeric, causing more than 60% crop loss. The most common species of rhizome rot is Pythium [7]. The most common diseases that affect turmeric leaves are Leaf Spot and Leaf Blotch. The study produces high-quality crops by creating an algorithm for spotting diseases early and stopping them from spreading to the entire crop. The creation and processing of a database of various leaf image types used k-Means image segmentation, and textural analysis of leaf image types was completed using GLCM [8]. Artificial intelligence (AI) is a rapidly expanding field that can be used to

automate tasks and boost productivity across a wide range of industries. Additionally, it was used outside the agriculture industry to increase crop productivity by early detection and classification of disease affection [9]. Although there are harvesting machines that can be automated, small-scale farmers cannot afford them. A tractor-drawn turmeric harvester is created by lowering the cost of the device and making it compact to harvest in small farmlands in order to solve the problems those cultivators face [10]. Using a miniaturized spectrometer, Vis-NIR reflectance spectroscopy, and machine learning to determine the degree of adulteration. With less than 15% error in prediction, linear regression was found to be the best of the six different regression techniques used [11]. For the segmentation and classification of the diseased portion in the turmeric crop, four different architectures were chosen. All of the architectures use Quadrature Discriminant Feature Selection (QDFS) in one of the convolutional layers [12]. We discovered that increasing the frequency of soil analysis for turmeric growth is not practically useful because it takes 9 months for turmeric to grow with one soil sample per month. As a result, we can only gather a tiny dataset for AI training. This study suggests the AgriTalk method, which forecasts *Bacillus* amounts using cutting-edge IoT and machine learning technologies [13]. The main goal of this study was to create novel, high-quality dairy yoghurts with reduced glycaemic impact that were blended with spice oleoresin (*Cinnamomum zeylanicum*, *Curcuma longa*). In a randomised crossover study with 16 healthy volunteers, the developed yoghurt products were contrasted with standard dairy yoghurt as the control, primarily for the glycaemic impact after consumption [14]. Recent achievements in technology and research in the fields of Nano medicine and tissue engineering are covered in recent trends in these fields [15].

Inference from literature survey

There are different types of algorithms used to predict the turmeric growth and disease such as artificial intelligence, SVM, ensemble, WSN, IOT and regression tree. Compared to other decision predictors, regression trees are largely unstable. A minor change in the data can have a significant impact on the regression tree's structure. Kernel least squares regression requires a large data set in order to produce reliable results. The choice of the starting values can have a significant impact on it. Large datasets require long training times for quadratic SVM. The final model's variable weights and individual impacts make it challenging to comprehend and interpret. The fact that the user cannot understand the knowledge acquired by ensembles is a serious flaw in current ensemble methods. To solve the above problems hybrid algorithm are proposed. The proposed hybrid algorithms give high accuracy prediction, good performance, high speed and less time.

3. METHODOLOGY

In this paper, **Figure 1** shows the block diagram of hybrid algorithm for turmeric growth prediction and disease analysis

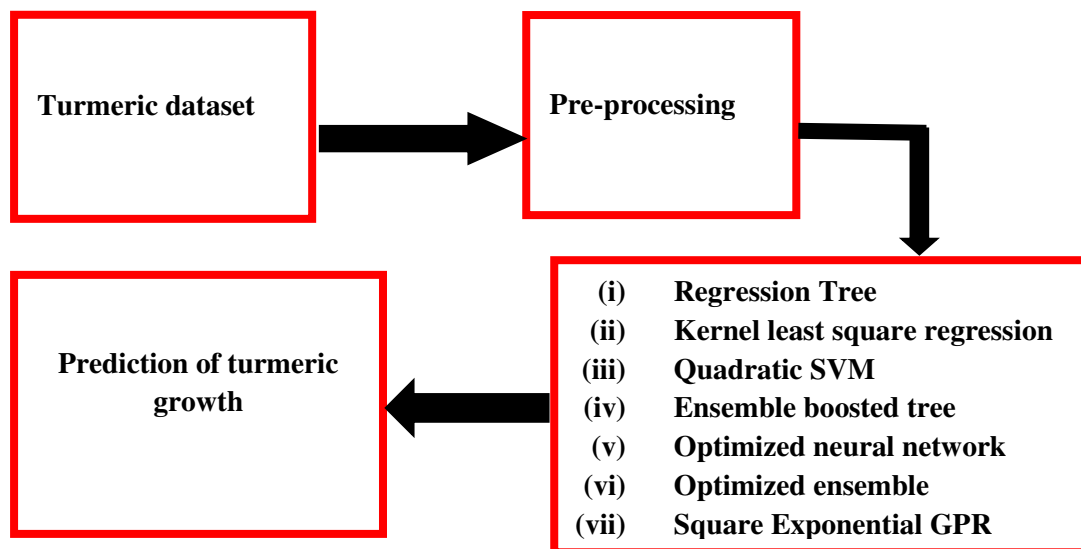


Fig 1 shows the Block diagram of Hybrid Algorithms for turmeric growth prediction and disease analysis

Figure 2 shows the difference between normal turmeric plant and disease turmeric plant.

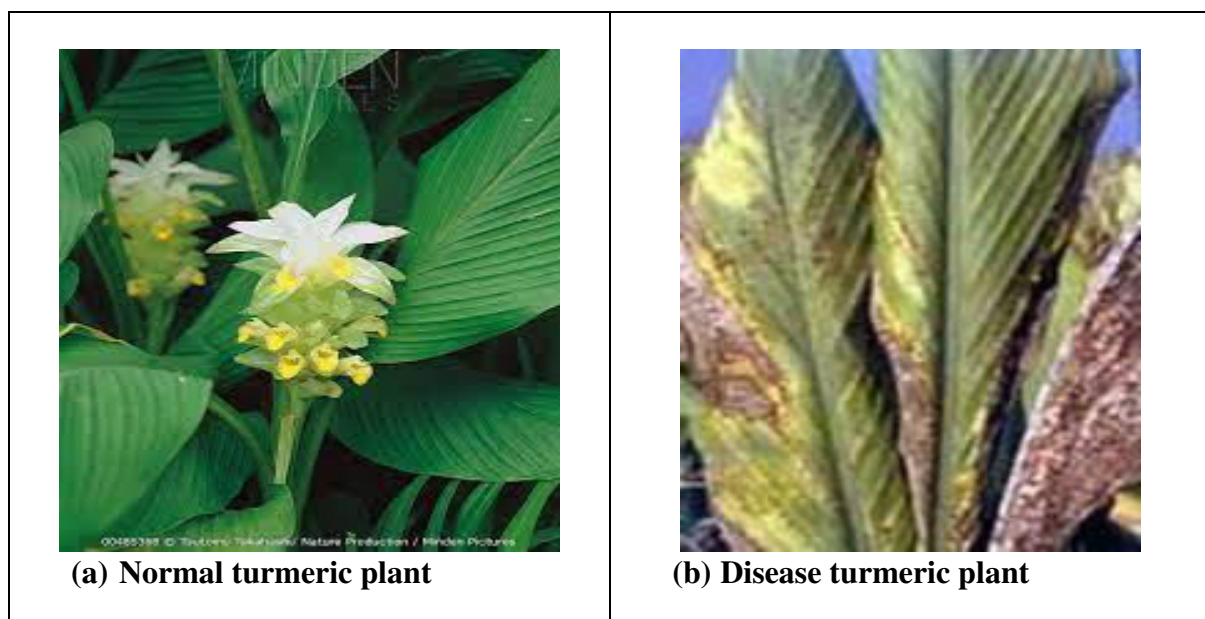


Fig 2 difference between normal turmeric plant and disease turmeric plant

On leaves, you can find oblong brown spots with grey centres. The spots are 2-3 cm wide and 4-5 cm in length. In later stages of the illness, concentric rings of black dots that represent fungal acervuli appear on the spot. The grey centres thinning and tearing. Affected leaves wilt and dry out severely. They have yellow haloes all around them. On a single leaf, an indefinite number of spots may be present. As the disease worsens, the spots grow larger and eventually take up a significant portion of the leaf blade.

3.1. Regression tree

Regression trees are decision trees with continuous target variables rather than class labels in the leaves. Modified split selection criteria and stopping criteria are used with regression trees. The decisions can be explained, potential outcomes can be seen, and potential events

can be identified using a regression tree. You can make the best choice with the aid of the analysis. Data are divided into subsets by branches, nodes, and leaves in regression trees. Regression trees choose splits to reduce the dispersion of target attribute values, much like decision trees do. As a result, the mean values of the target attribute in the leaves can be used to predict their values. Regression trees' ability to be read by humans is their main benefit. In addition to predicting the values of targets' attribute values, regression trees also describe which attributes are used and how they are used to arrive at the predictions. The stored procedures REGTREE, GROW REGTREE, PRUNE REGTREE, and PREDICT REGTREE all use the regression tree algorithm. Use the PRINT MODEL stored procedure to print regression trees. To find a model that produces accurate predictions for the fresh data, use the Regression Tree Algorithm. A supervised learning algorithm called a decision tree is employed in classification and regression modelling. These trees are used to categorise data or forecast future events because regression is a technique for predictive modelling.

3.2.Kernal-least square regression

Kernel regression in statistics is a non-parametric method for calculating the conditional expectation of a random variable. Finding a non-linear relationship between two random variables, X and Y, is the goal. Nonparametric regression models called kernel ridge models can simulate both linear and nonlinear relationships between predictor variables and results. Results may vary significantly depending on the model hyperparameters chosen. Kernel regression is non-parametric in and of itself because the quantity of data serves as our "parameters" in this context. This perfectly satisfies the requirement that a non-parametric model be one "that cannot be parametrized by a finite sample of parameters." To deal with the nonlinearity in the dataset, machine learning uses kernels. The dataset gains a new dimension through the addition of a user-specified kernel function (similarity function), which allows the dataset to be classified using a linear hyperplane. In addition to using kernels, SVMs also employ regularisation, which lessens the likelihood of overfitting. Process scheduling, resource distribution, device management, interrupt handling, memory management, and process management are just a few of the tasks that a kernel can perform. It is in charge of controlling the system's resources, such as memory, processors, and hardware. It gives users and applications access to crucial services like communications, multitasking, and security. When necessary, it handles crucial tasks like suspending or killing processes.

3.3.SVM – Quadratic SVM

A linear programme is an optimization problem where the objective function, inequality, and equality constraints are all linear. However, the optimization problem is known as a quadratic programme if the objective function is quadratic and all of the constraints are linear. The hard margin SVM optimization objective is finally defined as: We can now write code to solve the SVM optimization problem because the goal has been defined in a way that allows us to estimate it effectively (a quadratic objective and linear constraints). Factoring, using square roots, completing the square, and the quadratic formula are the four ways to solve a quadratic equation. As they prepare your brain to handle more complex sorting algorithms, bubble, selection, and insertion sort are good beginner algorithms to learn. Due to their Big O time complexity of $O(n^2)$, these three algorithms are referred to as quadratic algorithms. Quadratic functions occupy a special place in the academic curriculum. They are slight improvements over linear functions and offer a significant break from attachment to straight lines because their values can be readily calculated from input values. Squaring a number, also known as multiplying it by itself or raising it to the second power, is a quadratic process.

3.4. Ensemble- boosted tree ensemble

Using ensemble learning, which combines multiple models, is one way to lessen overfitting. Let's get started because both random forests and boosted trees (the former uses a technique called bagging, the latter boosting) are ensemble methods that utilise decision trees. In order

to reduce training errors, boosting is an ensemble learning technique that combines a number of weak learners into a strong learner. A random sample of data is chosen, fitted with a model, and then trained sequentially in boosting, where each model tries to make up for the shortcomings of the one that came before it. It can read and sound more complicated as an ensemble technique than sibling techniques like bootstrap aggregation (bagging) and stacked generalisation (stacking). The concepts underlying boosting ensembles are incredibly straightforward, despite the fact that implementations can be quite complex. By contrasting it to bagging, one can comprehend boosting. An ensemble is produced in bagging by taking numerous distinct samples from the same training dataset and fitting a decision tree to each one. Each decision tree is unique because each sample in the training dataset is unique, which results in slightly different predictions and prediction errors. Combining the predictions from each decision tree created reduces error compared to fitting a single tree. The way that boosting works is similar. To produce a better prediction than fitting a single decision tree, multiple trees are fitted on various versions of the training dataset, and the predictions from the trees are combined using simple voting for classification or averaging for regression. Each tree is constructed individually, and each tree's sum is calculated sequentially. Next tree tries to make up for the loss (difference between actual and predicted values). Benefits of the Gradient Boosting technique include: different loss functions are supported. When trees boost, they become reliant on older trees. By adjusting the residual of the trees that came before it, the algorithm learns. As a result, boosting tends to increase accuracy while carrying a slight risk of reduced coverage in a decision tree ensemble.

3.5. Neural network - optimized

One adaptable kind of machine learning is deep learning, also known as neural networks. They are node and layer models that drew inspiration from the structure and operation of the brain. A given input vector is propagated through one or more layers in a neural network model to produce a numerical output that can be used for classification or regression predictive modelling. In order to minimise the error of the model's output relative to the expected output, weights are adjusted while repeatedly exposing the model to examples of input and output. The stochastic gradient descent optimization algorithm is what this is. A specific calculus rule that allocates error proportionally to each weight in the network is used to change the model's weights. The backpropagation algorithm is what is used in this. The best method for training neural network models is stochastic gradient descent optimization with backpropagation weight updates. It is not the only method for training a neural network, though. Any arbitrary optimization algorithm can be used to train a neural network model. To put it another way, we can specify the architecture of a neural network model and then use an optimization algorithm to find a set of weights for the model that produces the lowest possible prediction error or the highest possible classification accuracy. It is anticipated that alternative optimization algorithms will generally be less effective than stochastic gradient descent with backpropagation. However, in some particular circumstances, such as non-standard network architectures or non-differential transfer functions, it might be more effective. Demonstrating the central role of optimization in the training of machine learning algorithms, and more specifically neural networks, can be a fascinating exercise.

3.6. Square exponential GPR

In the field of machine learning, Gaussian process regression (GPR) is a nonparametric, Bayesian approach to regression that is causing a stir. GPR has a number of advantages, including the ability to measure prediction uncertainty and performing well on small datasets. Gaussian processes are an effective algorithm for both classification and regression. Their ability to accurately estimate their own uncertainty is their greatest practical benefit. A radial basis function regression model with an infinite number of basis functions is expressed as

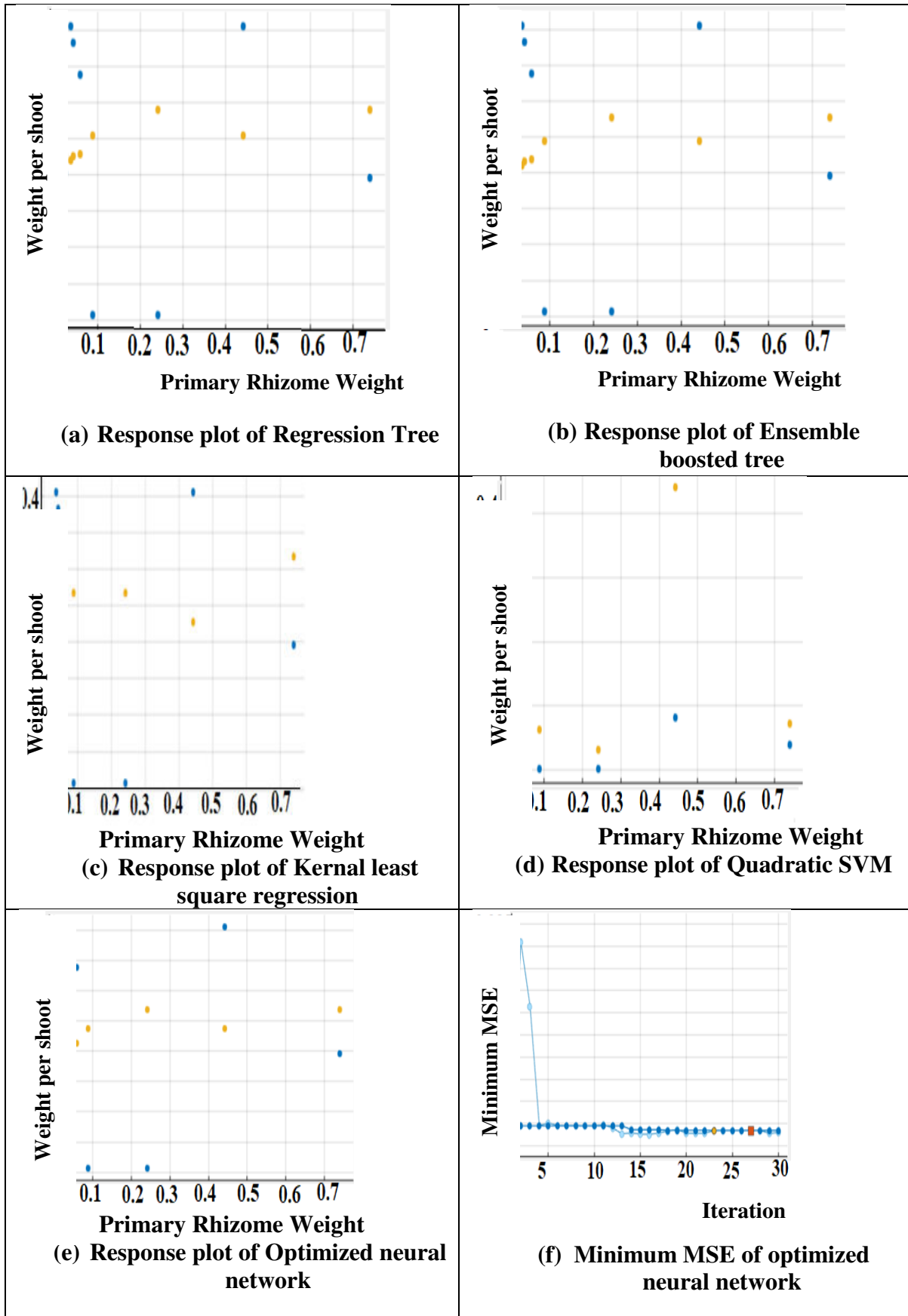
square exponential GPR in function space. The only difference between the Squared Exponential GPR and the Exponential GPR is that the Euclidean distance is squared.

3.7.Ensemble Optimized

A well-liked method for describing small-angle X-ray scattering (SAXS) data from highly disordered proteins is the ensemble optimization method (EOM). To fit the SAXS data, the EOM algorithm chooses subensembles of coexisting states from large pools of randomised conformations. The ensemble method has received extensive research and is frequently employed in machine learning communities. Its fundamental concept is exemplified by: It is possible to "boost" a "weak" learning algorithm into a "strong" learning algorithm that is arbitrarily accurate by outperforming random guessing.

4. RESULTS AND DISCUSSION

In this paper, turmeric growth is predict through hybrid algorithms such as Regression Tree, kernel least square regression, Quadratic SVM, Ensemble Boosted Trees, optimized ensemble, square exponential GPR and Optimizable Neural Network. The turmeric dataset has different types of attributes for hybrid algorithms such as primary rhizome weight, weight per shoot, rhizome colour, rhizome width, number of shoots, lamina length and lamina width. A tool called LAMINA is used to automatically analyse leaf image data. LAMINA was created to provide the traditional measurements of leaf shape (blade dimensions) and size (area) needed for correlation analysis to biomass productivity, as well as measurements that show leaf asymmetry, leaf serration traits, and indicators of herbivore damage (missing leaf area). To support multivariate analysis, such as principal component analysis, the location of a specified number of evenly spaced markers can optionally be returned. The entire flat and extended portion of the leaf is referred to as the lamina. The lamina, also known as the leaf blade, is a leaf's main structural component. The spice turmeric is a rhizome (root) that comes from an Indian-native plant in the ginger family (Zingiberaceae). The part of turmeric that has been most thoroughly researched for its anti-inflammatory properties is called curcumin. When the turmeric plant's aerial portion senesces and its rhizomes take on a bright yellow to orange yellow hue, turmeric is ready for harvest. The presence of the polyphenolic pigment curcuminoids, which makes up 2-5% of the rhizome mass, is what gives the characteristic yellowish colour. Rhizomes of all varieties had an average length of 58.11 mm, a breadth of 36.71 mm, and a thickness of 30.17 mm. Rhizome was found to weigh, on average, 34.87 gm. One of the acceptable measurements is the biomass of a specific plant, or the dry weight of the shoots. This technique is typically used to calculate the yield of a plant, but it is also a reliable indicator of plant biomass. The measurement of samples that have been dried in an oven is the traditional method for calculating shoot dry weight (SDW). The portion of a plant that grows above ground and contains flowering buds, lateral buds, and flowering stems is called a shoot. The axis of the plant, or stem, is made up of nodes and internodes. It is in charge of a plant's ability to produce food or engage in photosynthesis. **Figure 3** shows the response plot of hybrid algorithms and minimum MSE plot of optimizable neural network algorithm for turmeric dataset.



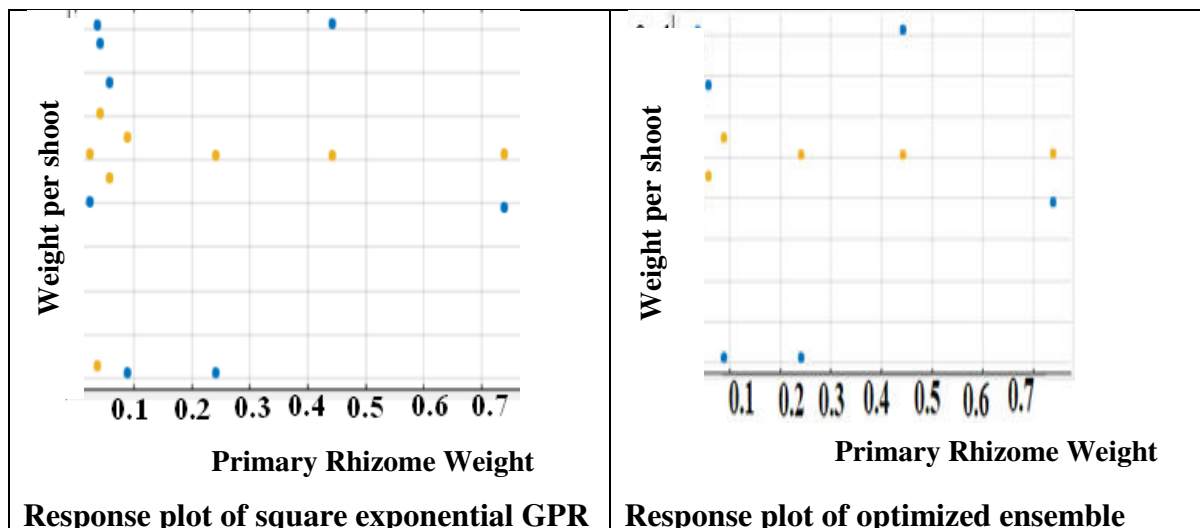


Fig 3 Response plot of hybrid algorithms and Minimum MSE of optimized neural network

In **Figure 3**, a response plot drawn between primary rhizome weight and weight per shoot for hybrid algorithms. X-axis contain primary rhizome weight and Y-axis contain weight per shoot. An indicator of how much variation in a dependent variable is explained by one or more independent variables in a regression model is the R-Squared statistic. The amount of error in statistical models is gauged by the mean squared error, or MSE. Between the observed and predicted values, it evaluates the average squared difference. The MSE is equal to zero when a model is error-free. One of a regression model's two primary performance indicators is the Root Mean Squared Error (RMSE). It calculates the typical difference between values that a model predicts and actual values. It gives an estimate of the model's predictive power for the desired value (accuracy). **Table 1** shows the training parameters of hybrid algorithms.

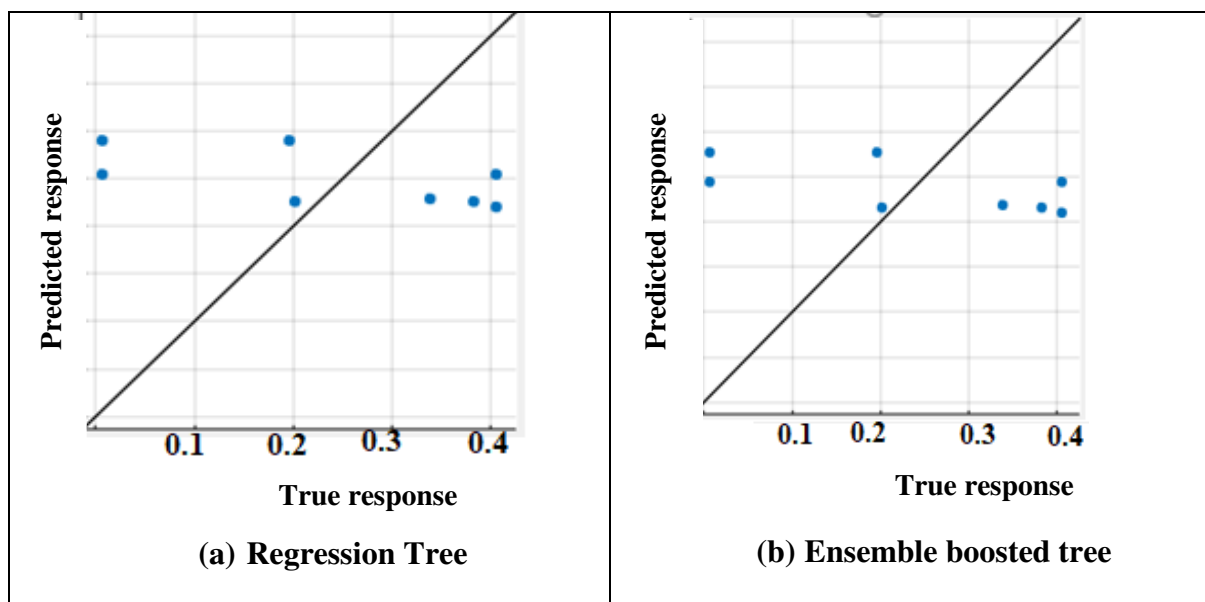
Tab 1 Training parameters of hybrid algorithms

Parameters/ Algorithms	Regression tree	Quadratic SVM	Kernel least square regression	Ensemble Boosted Trees	Optimizable Neural Network
RMSE	0.17525	0.66509	0.18735	0.17439	0.17418
R-Squared	0	-13.40	-0.14	0.01	0.01
MSE	0.030714	0.44235	0.035099	0.030413	0.030338
MAE	0.15666	0.37871	0.16958	0.15597	0.15549
Prediction speed	~760 obs/sec	~1100 obs/sec	~510 obs/sec	~360 obs/sec	~1100 obs/sec
Training Time	1.7974 sec	2.1566 sec	2.3005 sec	1.9563 sec	15.668 sec

Algorithms	RMSE	R-Squared	MSE	MAE	Prediction Speed	Training Time
Regression tree	0.17525	0	0.030714	0.15666	~760 obs/sec	1.7974 sec
Quadratic SVM	0.66509	-13.40	0.44235	0.37871	~1100 obs/sec	2.1566 sec

Kernel least square regression	0.1873 5	-0.14	0.035099	0.1695 8	~510 obs/sec	2.3005 sec
Ensemble Boosted Trees	0.1743 9	0.01	0.030413	0.1559 7	~360 obs/sec	1.9563 sec
Optimizable Neural Network	0.1741 8	0.01	0.030338	0.1554 9	~1100 obs/sec	15.668 sec
Square exponential GPR	0.2049 7	-0.30	0.042013	0.1708 1	~640 obs/sec	2.5423 sec
Optimized ensemble	0.1795 2	0	0.032227	0.1623 3	~440 obs/sec	40.245 sec

High RMSE value gives less accuracy value and Low RMSE value gives high accuracy value for hybrid algorithms. Quadratic SVM has high RMSE value (0.66509) and it gives less accuracy. Optimizable Neural network has low RMSE value (0.17418) and it gives high accuracy level for turmeric dataset. High MSE and MAE values give low accuracy for hybrid algorithms. Low MSE and MAE values give high accuracy for hybrid algorithms. Quadratic SVM has high MSE (0.44235) and MAE values (0.37871). Optimizable Neural network has low MSE value (0.030338) and MAE value (0.15549). Optimizable Neural network gives high accuracy level (96%) compared to other algorithms for turmeric data. **Figure 4** shows the Validation predicted Vs actual plot of Hybrid algorithms.



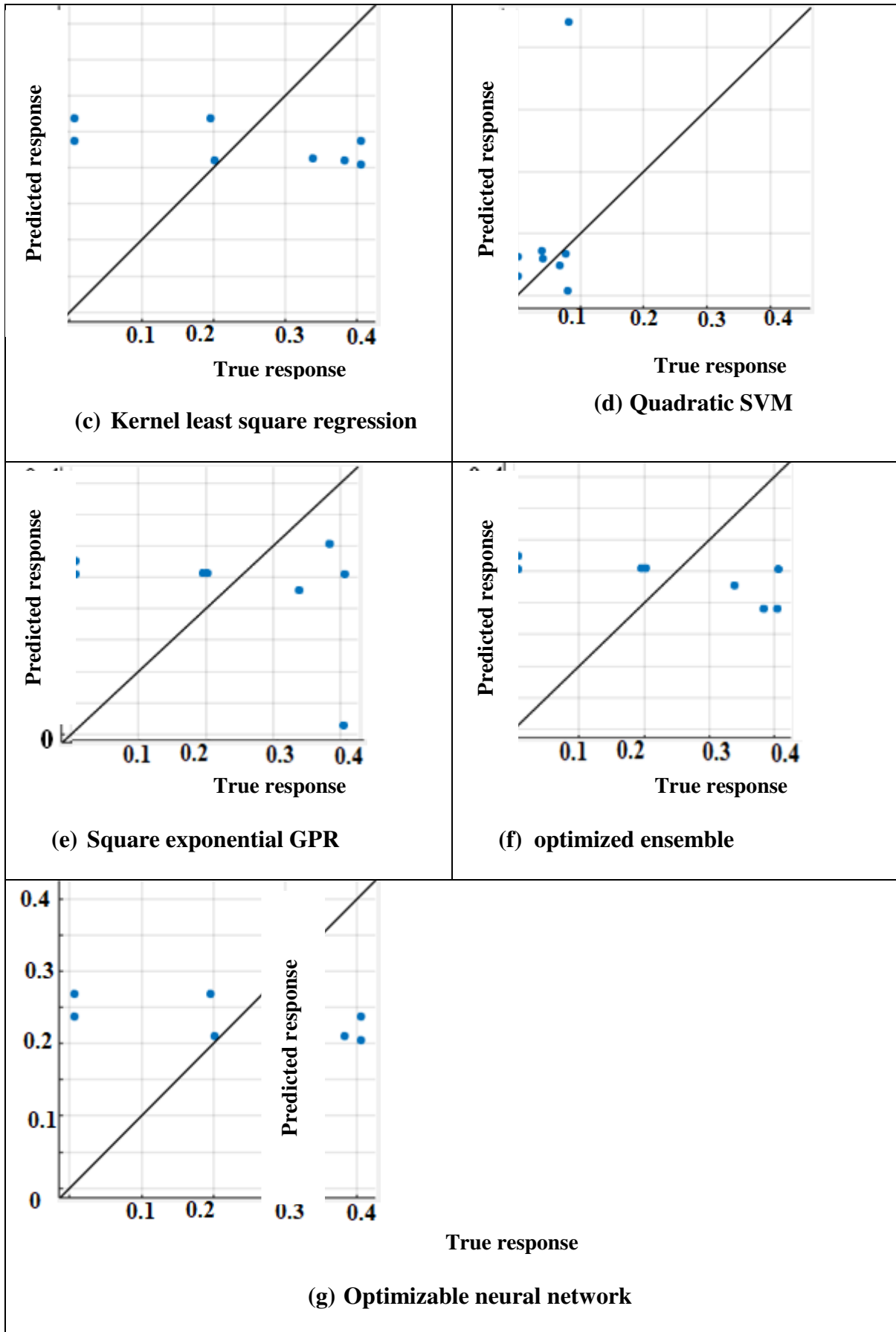
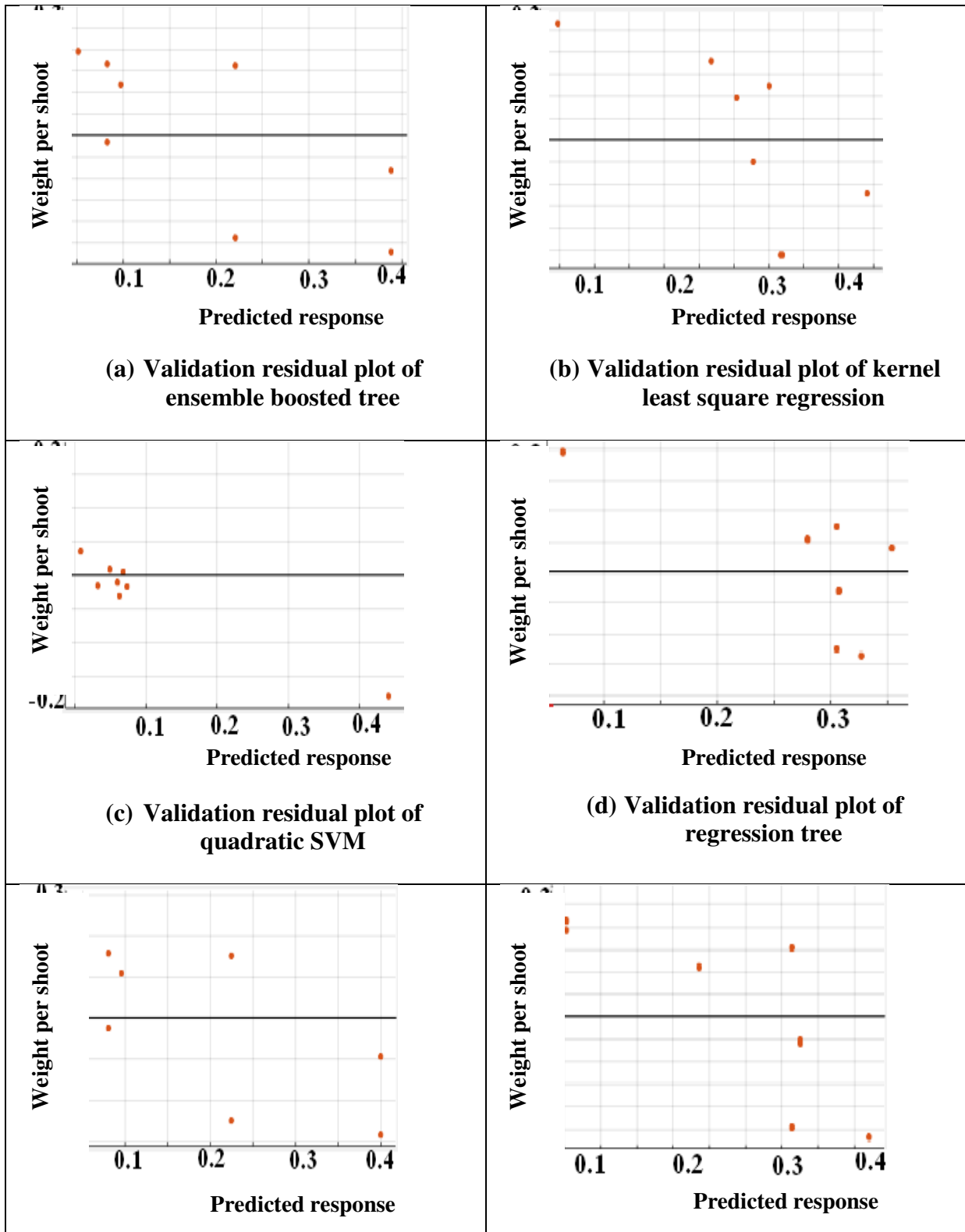


Fig 4 Validation predicted Vs actual plot of Hybrid algorithms

The actual values are depicted along the X-axis of the scatter plot, while the predicted values are shown along the Y-axis. In a plot that compares the predicted value to the actual value, an effect of the model is shown and compared to the null model. In order to achieve a good fit, the points should have narrow confidence bands and should be located relatively close to the fitted line. **Figure 5** shows the validation response plot of hybrid algorithms for turmeric dataset.



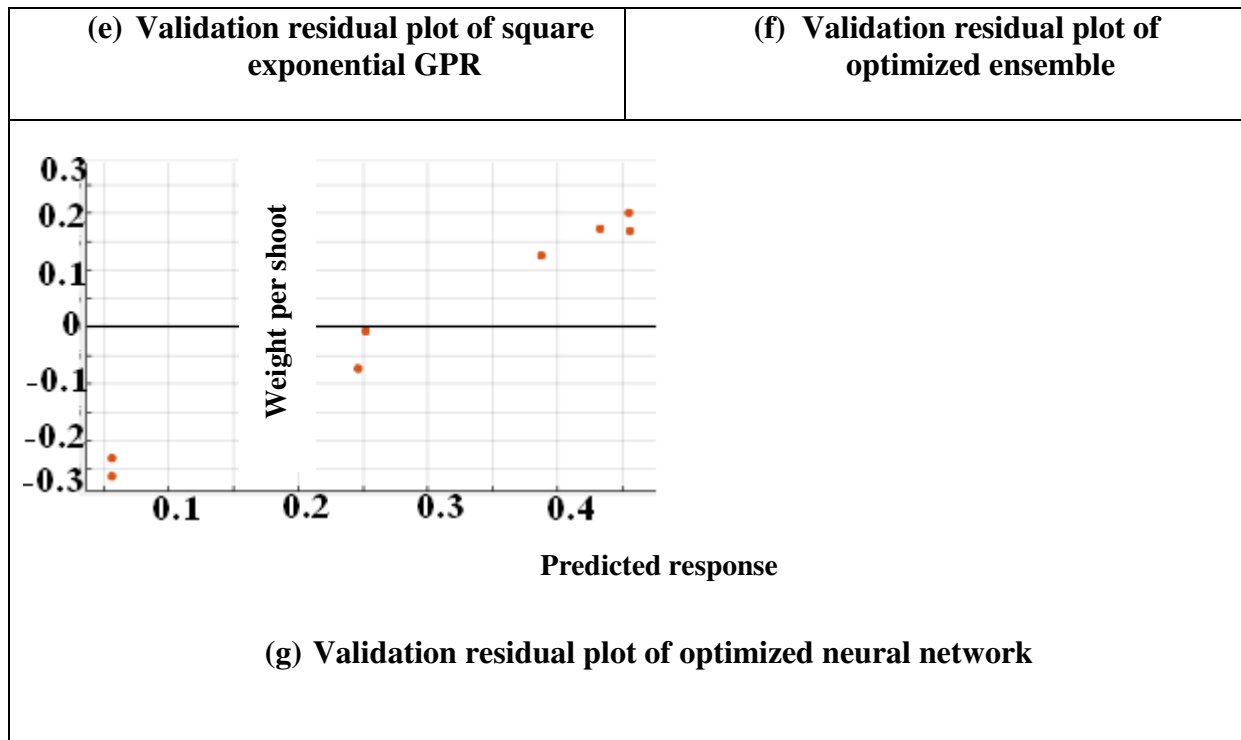


Fig 5 shows the validation response plot of hybrid algorithms for turmeric dataset

The discrepancy between the values of the fitted response and the observed response is displayed on a residual plot. The null residual plot, which represents the ideal residual plot, exhibits a random distribution of points that form a band around the identity line that is roughly constant in width. A linear regression model is appropriate for the data if the residual plot's points are randomly distributed around the horizontal axis; otherwise, a nonlinear model is preferable. There are a lot of points close to the origin and not as many points farther away.

5. CONCLUSION

In this paper the proposed hybrid algorithms such as regression tree, quadratic SVM, Gaussian least square regression, Ensemble Boosted Trees, optimizable ensemble, square exponential GPR and Optimizable Neural Network predicts turmeric growth and disease from turmeric dataset. Compare to other algorithms optimizable neural network algorithm produces enhanced output for turmeric dataset. Optimizable Neural Network give satisfactory performance, response, regression, and clear plots of turmeric dataset compared to other methods. Optimizable Neural Network gives high accuracy about 96%, less time and speed for turmeric dataset. This prediction used to detect the plant growth and avoid the disease in turmeric plant.

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