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Classification of plant Species Using Neural Network

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***Abstract**: In this study, we explore the possibility of classifying the plant species. We collected the plant species from Kaggle website. This dataset encompasses 544 samples, encompassing 136 distinct plant species. Recent advancements in machine learning, particularly Artificial Neural Networks (ANNs), offer promise in enhancing plant Species classification accuracy and efficiency. This research explores plant Species classification, harnessing neural networks' power. Utilizing a rich dataset from Kaggle, containing 544 entries, we develop and evaluate a neural network model. Our neural network, featuring a single hidden layer, achieves remarkable results—a staggering 100% accuracy and a minute average error rate of 0.002. Beyond performance metrics, we delve into the intricacies of plant Species classification through feature importance analysis. The most influential features—Vegsout, durflow, semiros, pdias, begflow, wind, leafy, autopoll and insects— uncover the physiological traits underpinning accurate rice classification. This research contributes to advancing rice classification methods and highlights the potential of ANNs in optimizing agricultural practices, ensuring plant safety, and bolstering global trade.*

Keywords: Classification of plant Species Using Neural Network

Introduction

Classification of plant species using neural networks is an innovative and powerful approach that leverages the capabilities of artificial intelligence and machine learning to accurately categorize different types of plants based on their unique characteristics. This application of neural networks holds great promise in various fields, including botany, agriculture, environmental conservation, and even citizen science initiatives.

Plants are essential components of our ecosystem, and identifying and classifying them accurately is crucial for understanding biodiversity, ecosystem health, and making informed decisions in agriculture, forestry, and conservation efforts. Traditional methods of plant classification often rely on manual identification by experts, which can be time-consuming, labor-intensive, and prone to errors. Neural networks offer a modern and automated alternative to address these challenges
The process of classifying plant species using neural networks typically involves the following steps:

- Data Collection: Gathering a diverse and comprehensive dataset of plant images or information, including labeled examples of various species, is the first crucial step. This dataset serves as the training data for the neural network.
- Preprocessing: Cleaning and preparing the data by resizing, normalizing, and augmenting the features to make them suitable for neural network training.
- Model Architecture: Designing the neural network architecture is a critical task.
- Training: The neural network is trained on the prepared dataset, adjusting its parameters (weights and biases) through a process called backpropagation. During training, the network learns to map input data to the corresponding plant species labels.
- Validation and Testing: The model's performance is evaluated using a separate validation dataset to ensure it generalizes well to new, unseen data. Testing with a separate test dataset assesses the model's accuracy and robustness.

Classification of plant species using neural networks offers several advantages, including speed, scalability, and the ability to handle large volumes of data. It also enables non-experts to contribute to plant species identification efforts through user-friendly applications and platforms. Moreover, as neural networks continue to evolve and improve, their accuracy and reliability in plant classification tasks are likely to increase, further advancing our understanding of plant biodiversity and supporting various fields of research and conservation.

The Input and Output Variables

Table 1: Attributes and their description

Attribute Name	Attribute description	Attribute Name	Attribute description
Species	Output, string	leafy	Input, numeric
pdias	Input, numeric	suman	Input, numeric

longindex	Input, numeric	wi?n	Input, numeric
durflow	Input, numeric	monocarp	Input, numeric
height	Input, numeric	polycarp	Input, numeric
begflow	Input, numeric	seasaes	Input, numeric
mycor	Input, numeric	seashiv	Input, numeric
vegaer	Input, numeric	seasver	Input, numeric
vegsout	Input, numeric	everalw	Input, numeric
autopoll	Input, numeric	everparti	Input, numeric
insects	Input, numeric	elaio	Input, numeric
wind	Input, numeric	endozoo	Input, numeric
lign	Input, numeric	epizoo	Input, numeric
piq	Input, numeric	aquat	Input, numeric
ros	Input, numeric	windgl	Input, numeric
semiros	Input, numeric	unsp	Input, numeric

Building the ANN Model

We have used Just Neural Network (JNN) tool [24] to build a multilayer ANN model. The proposed model consists of 3 Layers: Input Layer with 31 nodes, a Hidden Layer with 5 nodes, and Output Layer with one node as can be seen in Figure 1.

We have sat the parameters of the proposed model as follows: Learning Rate 0.64 and the Momentum to be 0.77, and Average Error rate to be 0.01 (as shown in Figure 2).

Evaluating the ANN model

The plant Species dataset consists of 542 samples with 32 attributes as in Table 1. We imported the CSV file of the plant Species dataset into the JNN environment (as seen in Figure 3). We divided the imported dataset into two groups (Training and Validation) randomly using the JNN tool. The Training consists of approximately 80% and the validation set consists of 20% of the dataset. After making sure that the parameter control was sat properly (as in Figure 4), we started training the ANN model and kept eye on the learning curve, loss error and validation accuracy. We trained the ANN model for 3801 cycles. The best accuracy we got was 100% (as seen in Figure 5). We determined the most influential factors in the plant species dataset as in Figure 6.

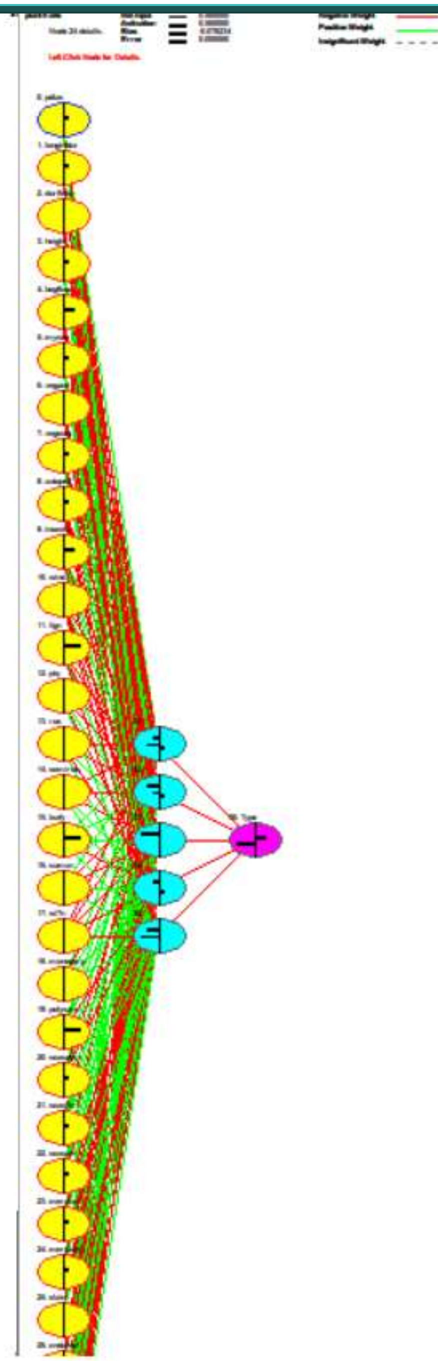

Figure 1: Proposed model architecture

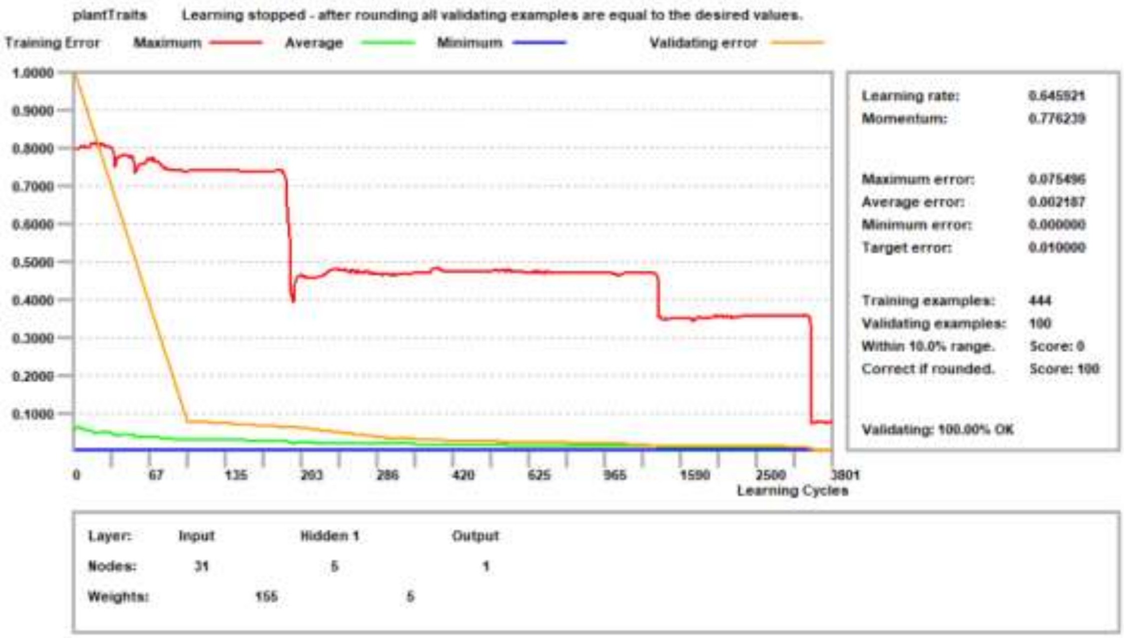

Figure 2: Training and validating the proposed ANN model

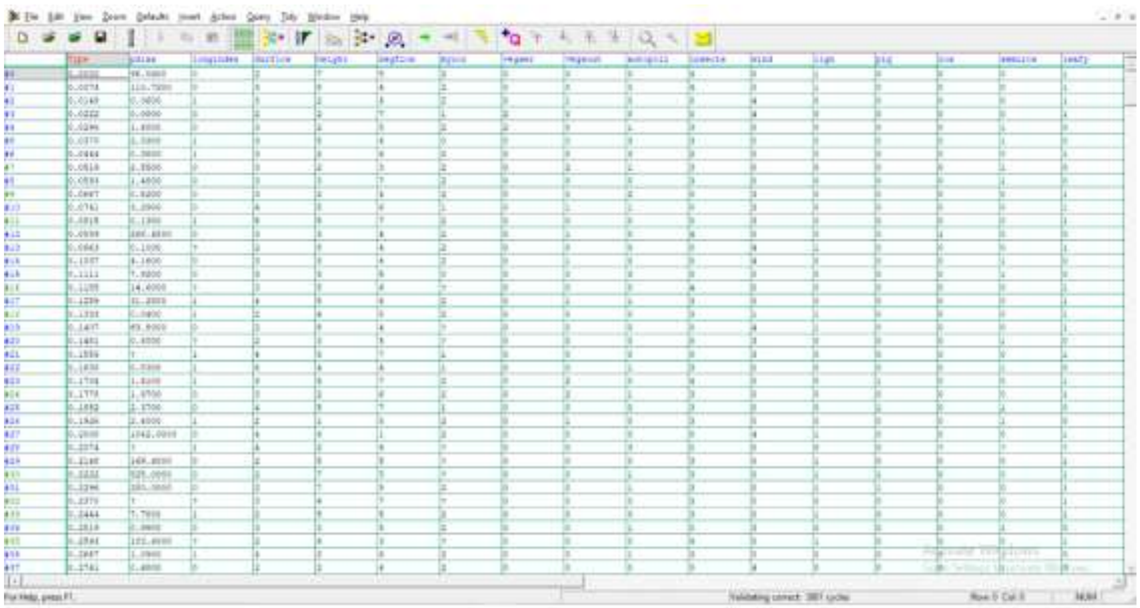

Figure 3: Imported csv dataset into JNN environment

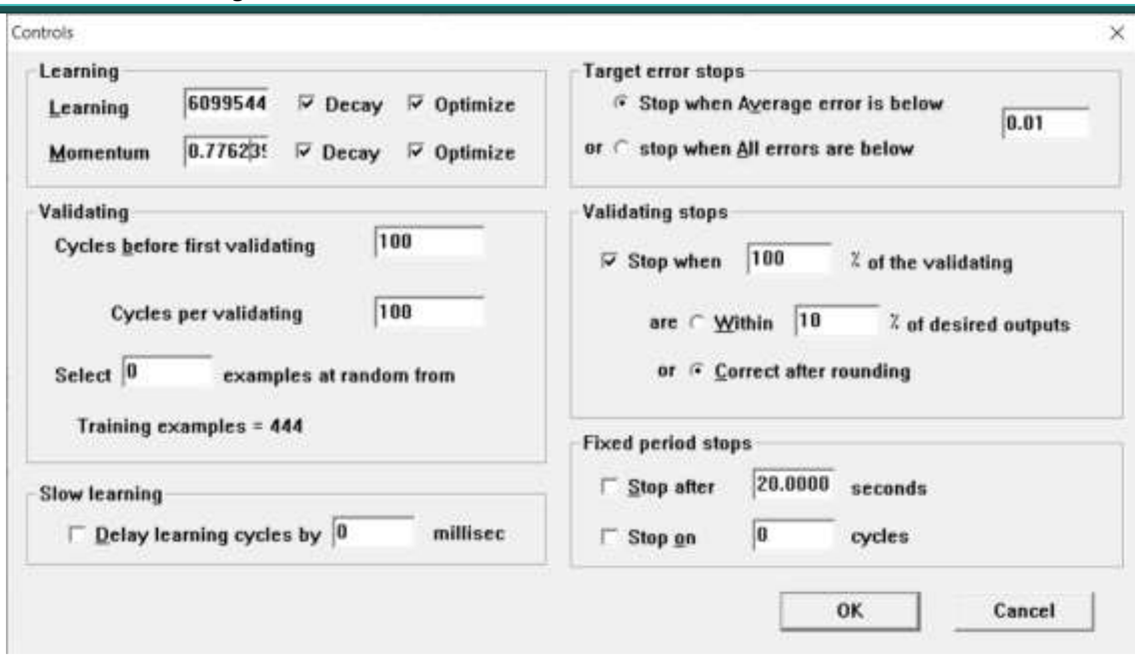

Figure 4: Control of the Proposed ANN model

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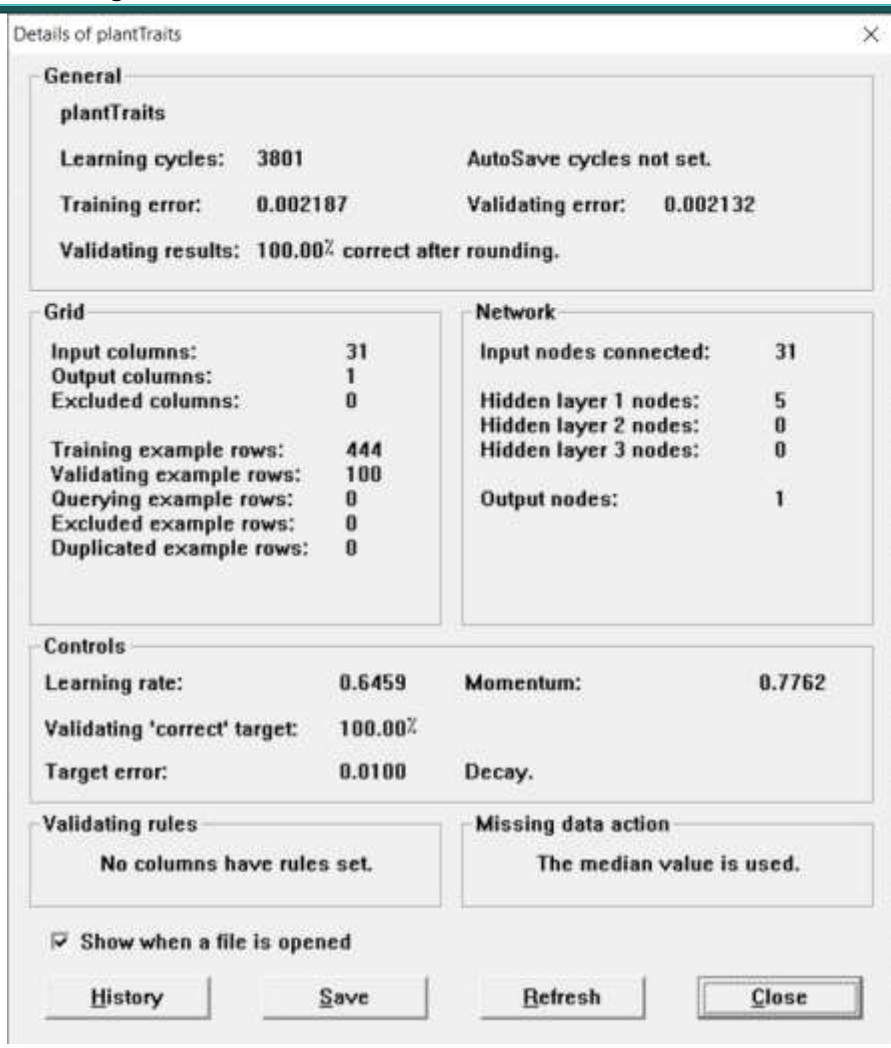
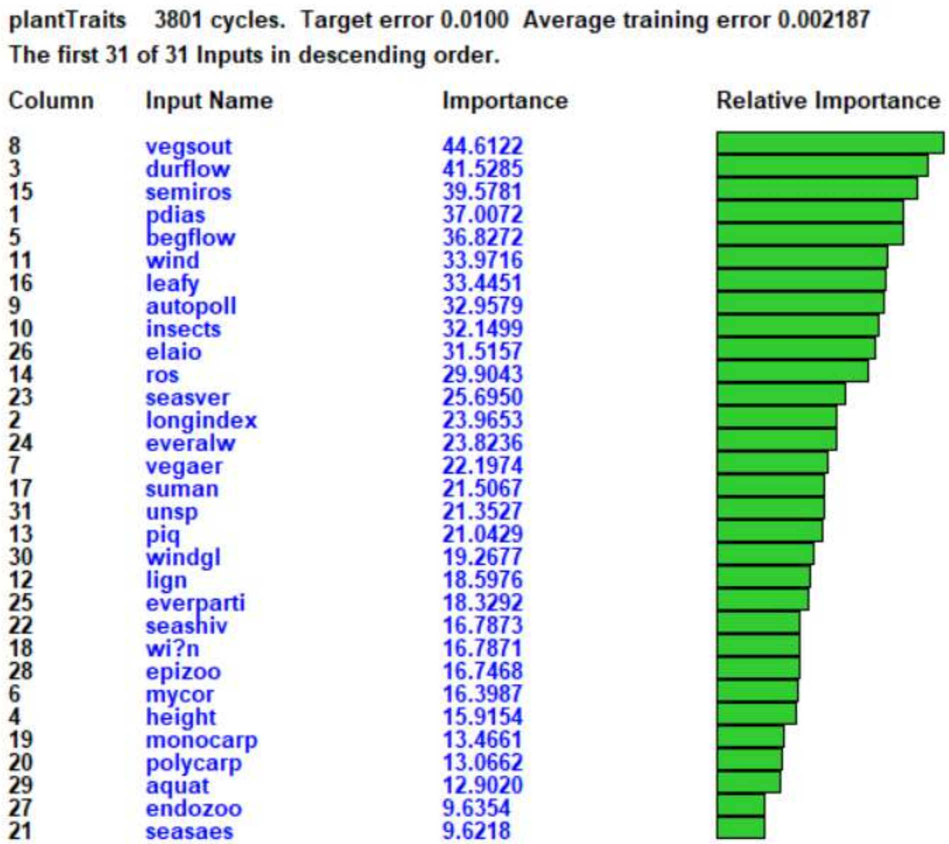


Figure 5: Details of the proposed models


plantTraits 3801 cycles. Target error 0.0100 Average training error 0.002187
The first 31 of 31 Inputs in descending order.

Column	Input Name	Importance	Relative Importance
8	vegsout	44.6122	
3	durflow	41.5285	
15	semiros	39.5781	
1	pdias	37.0072	
5	begflow	36.8272	
11	wind	33.9716	
16	leafy	33.4451	
9	autopoll	32.9579	
10	insects	32.1499	
26	elaio	31.5157	
14	ros	29.9043	
23	seasver	25.6950	
2	longindex	23.9653	
24	everalw	23.8236	
7	vegaer	22.1974	
17	suman	21.5067	
31	unsp	21.3527	
13	piq	21.0429	
30	windgl	19.2677	
12	lign	18.5976	
25	everparti	18.3292	
22	seashiv	16.7873	
18	wi?n	16.7871	
28	epizoo	16.7468	
6	mycor	16.3987	
4	height	15.9154	
19	monocarp	13.4661	
20	polycarp	13.0662	
29	aquat	12.9020	
27	endozoo	9.6354	
21	seasaes	9.6218	

Figure 6: Most influential Features of the dataset

Conclusion

In this study, we explored the possibility of classifying the plant species. We collected the plant species from Kaggle website. This dataset encompasses 544 samples, encompassing 136 distinct plant species. Recent advancements in machine learning, particularly Artificial Neural Networks (ANNs), offer promise in enhancing plant Species classification accuracy and efficiency. This research explores plant Species classification, harnessing neural networks' power. Utilizing a rich dataset from Kaggle, containing 544 entries, we develop and evaluate a neural network model. Our neural network, featuring a single hidden layer, achieves remarkable results—a staggering 100% accuracy and a minute average error rate of 0.002. Beyond performance metrics, we delve into the intricacies of plant Species classification through feature importance analysis. The most influential features— Vegsout, durflow, semiros, pdias, begflow, wind, leafy, autopoll and insects— uncover the physiological traits underpinning accurate rice classification. This research contributes to advancing rice classification methods and highlights the potential of ANNs in optimizing agricultural practices, ensuring plant safety, and bolstering global trade.

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