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Configuration of the Deep Neural Network Hyperparameters for the Hypsometric Modeling of the *Guazuma crinita* Mart. in the Peruvian Amazon

Gianmarco Goycochea Casas [1,*], Duberlí Geomar Elera Gonzáles [2], Juan Rodrigo Baselly Villanueva [3], Leonardo Pereira Fardin [1] and Hélio Garcia Leite [1]

[1] Department of Forest Engineering, Federal University of Viçosa, Viçosa 36570-900, MG, Brazil; leopfard@gmail.com (L.P.F.); hgleite@ufv.br (H.G.L.)
[2] Departamento de Ciencias Forestales, Escuela de Ingeniería Forestal y Ambiental, Universidad Nacional Autónoma de Chota, Jr. José Osores Nro. 418, Chota, Cajamarca 06121, Peru; dgelerag@unach.edu.pe
[3] Baños del Inca Agrarian Experimental Station, National Institute of Agrarian Innovation, Jr. Wiracocha s/n, Baños del Inca, Cajamarca 06004, Peru; jrbasellyv@gmail.com
* Correspondence: gianmarco.casas@ufv.br

Abstract: The *Guazuma crinita* Mart. is a dominant species of great economic importance for the inhabitants of the Peruvian Amazon, standing out for its rapid growth and being harvested at an early age. Understanding its vertical growth is a challenge that researchers have continued to study using different hypsometric modeling techniques. Currently, machine learning techniques, especially artificial neural networks, have revolutionized modeling for forest management, obtaining more accurate predictions; it is because we understand that it is of the utmost importance to adapt, evaluate and apply these methods in this species for large areas. The objective of this study was to build and evaluate the efficiency of the use of a deep neural network for the prediction of the total height of *Guazuma crinita* Mart. from a large-scale continuous forest inventory. To do this, we explore different configurations of the hidden layer hyperparameters and define the variables according to the function HT = f(x) where HT is the total height as the output variable and x is the input variable(s). Under this criterion, we established three HT relationships: based on the diameter at breast height (DBH), (i) HT = f(DBH); based on DBH and Age, (ii) HT = f(DBH, Age) and based on DBH, Age and Agroclimatic variables, (iii) HT = f(DBH, Age, Agroclimatology), respectively. In total, 24 different configuration models were established for each function, concluding that the deep artificial neural network technique presents a satisfactory performance for the predictions of the total height of *Guazuma crinita* Mart. for modeling large areas, being the function based on DBH, Age and agroclimatic variables, with a performance validation of RMSE = 0.70, MAE = 0.50, bias% = −0.09 and VAR = 0.49, showed better accuracy than the others.

Keywords: deep learning; artificial neural network; total height; forest management

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1. Introduction

The *Guazuma crinita* Mart. (Bolaina Blanca) is characterized as a fast-growing forest species established in plantations in which it reaches growth maturity by the eighth or ninth year, being ready for harvesting [1,2]. The wood has a high commercial value and is used to obtain round and sawn wood for the manufacture of stretchers, boxes, laminates, toys, matches, handicrafts, plywood, construction and coating of houses and the obtaining of cellulose for paper, contributing to the livelihood of local farmers [3,4]. According to the Servicio Nacional Forestal y de Fauna Silvestre [5], there is 8530.76 ha of Bolaina Blanca plantations in Peru, which represents 503,839.71 m^3 of standing trees.

A hypsometric model is generally expressed between the height and diameter relationship of a tree; however, it has also been shown that the variables of age, basal area, site