A COMPARATIVE STUDY OF ACTIVATION FUNCTIONS IN THE CONTEXT OF A FEEDFORWARD NEURAL NETWORK FOR RICE GRAINS CLASSIFICATION

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Rice has been a significant crop in economics, culture, and human life for centuries. Naturally, its market value is dependent on consumer-defined quality criteria for individual grains. As a result, this research focuses on the rice grains classification. A multiclass classification approach and a feedforward neural network model were utilized to study the classification of rice grains. This study utilized a dataset of 75,000 rice grains, from which features were extracted from rice grain images and categorized into three groups: morphological (12 features), shape (4 features), and color (90 features). A stochastic gradient descent optimization method was employed. An optimal performance was determined by comparing five activation functions, including sigmoid, rectified linear unit (ReLU), exponential linear unit (ELU), Mish, and Swish functions. Based on a 70:30 training-to-testing dataset split, the results indicated that the sigmoid activation function achieved the highest testing accuracy of 99.91%. With a 75:25 training-to-testing dataset split, ELU reached the highest testing accuracy of 99.89%. For an 80:20 training-to-testing dataset split, both the sigmoid and Swish activation functions performed similarly well, achieving the highest testing accuracy of 99.91%. When considering macro-average performance, the Swish activation function outperforms the sigmoid activation function.

CLASSIFYING FIVE VARIETIES OF RICE USING IMAGE PROCESSING AND MACHINE LEARNING TECHNIQUES

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This research aims to apply image processing techniques in conjunction with Machine Learning methods to classify various rice varieties from images of milled rice grains. The dataset comprises 15,000 color JPEG images, each with a resolution of 250x250 pixels, representing five types of rice: Karacadag, Jasmine, Ipsala, Basmati, and Arborio, totaling 75,000 images. These images were obtained from https://www.muratkoklu.com. The images of rice grains are subjected to image processing to eliminate noise, followed by image processing to perform edge detection using the Canny method, Sobel method, ridge detection, and texture detection. Subsequently, the effectiveness of classifying processed images using three Machine Learning techniques: Na?ve Bayes, k-Nearest Neighbors, and Support Vector Machines (SVMs) is compared under the condition of K-fold cross-validation with K=10 for all methods. The research findings indicate that employing Sobel edge detection in image processing combined with SVM classification yielded the highest effectiveness. The classification accuracies achieved were 98.68%, with precision, recall, and F1-score all at 98.67%, and a Cohen's kappa coefficient of 98.35%.