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Neural Network Operators of Multivariate of Bernstein-Type with the Integer Positive Parameter

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Abstract

This paper develops a neural network that depends on an integer positive parameter by using the type of Bernstein in multivariate for some sigmoidal functions. The theorems for uniform and pointwise approximation are established when applying such a network to a continuous function on [0,1]. Also, the order of approximation for functions in Lipschitz is studied, making use of the absolute moment. Next, from the graph of the test function in the examples, it seems that the new network's numerical findings are better than those of the classic one.

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1. Introduction

Costarelli and Spigler [1], introduced the neural networks in univariate and studied their behavior of it. Also, they studied the multivariate of the same neural network in the reprint [2] given by: For a bounded function $h: \mathcal{R} \to \mathbb{R}$,

$$F_n(h;\boldsymbol{\xi}) = \frac{\sum_{k_1=\lceil na_1 \rceil}^{\lfloor nb_1 \rfloor} \cdots \sum_{k_d=\lceil na_d \rceil}^{\lfloor nb_d \rfloor} h\left(\frac{\mathbf{k}}{n}\right) \Psi_\sigma(n\boldsymbol{\xi}-\mathbf{k})}{\sum_{k_1=\lceil na_1 \rceil}^{\lfloor nb_1 \rfloor} \cdots \sum_{k_d=\lceil na_d \rceil}^{\lfloor nb_d \rfloor} \Psi_\sigma(n\boldsymbol{\xi}-\mathbf{k})}, \boldsymbol{\xi} \in \mathcal{R} \quad (1)$$

where $\mathcal{R} := [a_1, b_1] \times \ldots \times [a_d, b_d]$, $\mathbf{k} = (k_1, \ldots, k_d) \in \mathbb{Z}^+$, the symbols used $\lceil . \rceil, \lfloor . \rfloor$ represent the ceiling and the floor respectively. The function Ψ_σ denotes the density function which is constructed by the sigmoidal function σ. Also introduced studies in [3],[4] by using some modifications for the Bernstein operator of this neural network in formal (1). Bajpeyi and Kumar [5] study a neural network of exponential type in one and multi-dimensional. Next, Costarelli and others [6] studied a neural network of max-product Kantorovich

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