A REPRESENTATION OF APPROXIMATION FUNCTIONS AS CONVOLUTIONAL NEURAL NETWORKS AND PROBING THE CORRESPONDING EXTENSION

CHIEN-CHANG YEN
MATHEMATICS, FU-JEN CATHOLIC UNIVERSITY, TAIWAN

A function can be representation as the linear combination or a non-linear composition by a set of functions, for instance Taylor expansion, Fourier series, and Kolmogrov-Arnold representation. In this decade, the artificial neural networks using activation functions and bias are popular on large language models (LLM), small language models (SLM), and physics informed neural networks. The universe approximation theory has been used on showing the networks which approximate the continuous functions. However, there still a lot of mystery on the effects of a neural networks. The interpretation of a neural network compared with the traditional function approximation is interested in this talk. The approach of approximation functions is regarded as convolutional neural networks (CNN). Meanwhile, the hidden layers represent to construct bases and the functional values appear in the last dense layer. Such CNN representation seems an extension of approximation by generalizing polynomials to be activation functions. Finally, we further probe the behavior of the effect of this extension using the Taylor expansion of functions.

(Chien-Chang Yen) Mathematics, Fu-Jen Catholic University, Taiwan
Email address: yen@math.fju.edu.tw