The Fibonacci Network: A Simple Alternative for Positional Encoding

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Abstract : Coordinate-based Multi-Layer Perceptrons (MLPs) are known to have difficulty reconstructing high frequencies of the training data. A common solution to this problem is Positional Encoding (PE), which has become quite popular. However, PE has drawbacks. It has high-frequency artifacts and adds another hyper hyperparameter, just like batch normalization and dropout do. We believe that under certain circumstances, PE is not necessary, and a smarter construction of the network architecture together with a smart training method is sufficient to achieve similar results. In this paper, we show that very simple MLPs can quite easily output a frequency when given input of the half-frequency and quarter-frequency. Using this, we design a network architecture in blocks, where the input to each block is the output of the two previous blocks along with the original input. We call this a Fibonacci Network. By training each block on the corresponding frequencies of the signal, we show that Fibonacci Networks can reconstruct arbitrarily high frequencies.