Neural Basis Expansion Analysis for Time Series Forecasting

Introduction:

N-BEATS, short for Neural Basis Expansion Analysis for Time Series Forecasting, is a deep learning model designed specifically for time series forecasting. Introduced in a research paper by Boris Oreshkin, Dmitri Carpov, Nicolas Chapados, and Yoshua Bengio in 2019, N-BEATS represents a significant advancement in the field of time series analysis using neural networks. It is notable for its simplicity, interpretability, and effectiveness.

Model Architecture:

Generic Architecture: N-BEATS is a fully connected feed-forward neural network. Unlike many other time series forecasting models, it doesn't rely on recurrent or convolutional layers. This simplicity is one of its key strengths, making it both efficient and highly adaptable.

Stacking Blocks: The architecture consists of a series of blocks, each of which makes its own prediction for the output series. These blocks are stacked together, and their outputs are combined to produce the final forecast. Each block in the N-BEATS network is trained to forecast the time series' future values directly.

Basis Expansion: A unique aspect of N-BEATS is its use of basis expansion techniques. Each block in the model learns a set of basis expansion coefficients that are applied to a

predefined set of basis functions. This approach allows the model to learn complex temporal patterns from the data.

Interpretable Parameters: One of the notable features of N-BEATS is that its design allows for a degree of interpretability. The basis expansion coefficients can provide insights into the patterns the model has learned from the data.

Key Features:

Model Agnosticism: N-BEATS is agnostic to the underlying time series' nature, meaning it can be applied to a wide range of time series forecasting problems without specific tailoring to the domain.

High Performance: In empirical studies, N-BEATS has demonstrated superior performance in comparison to many traditional and machine learning-based time series forecasting methods.

Scalability and Efficiency: Due to its fully connected architecture, N-BEATS is computationally efficient and scales well with large datasets.

Flexibility in Inputs: The model can handle various inputs, including historical time series data, external covariates, or a combination of both.

Applications:

N-BEATS has broad applications across various domains, such as finance (for stock price prediction), retail (for demand forecasting), and climatology (for weather forecasting). Its ability to handle different types of time series data makes it a versatile tool for any problem involving forecasting future values from past data.