

Fuzzy-Embedded Long Short-Term Memory (FE-LSTM) System and its Applications in Forex Trading

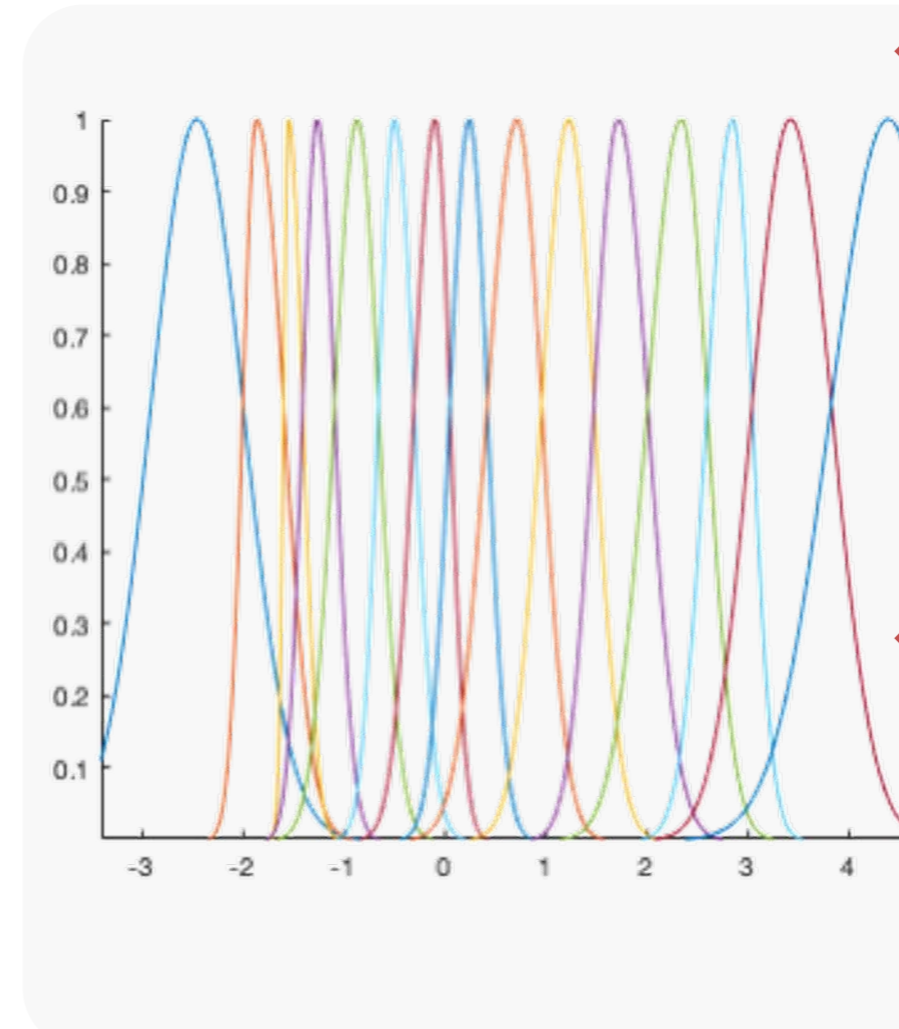
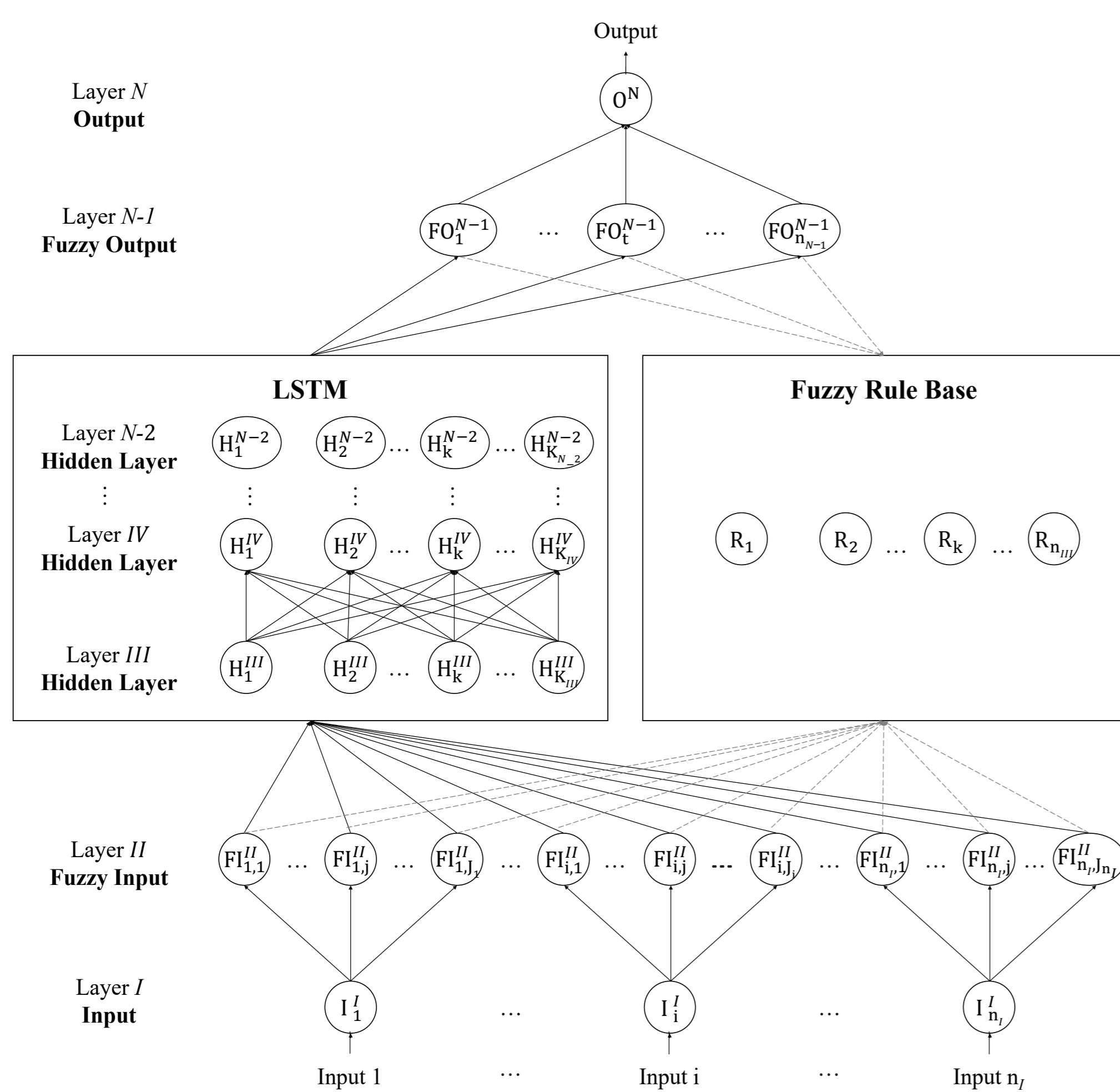
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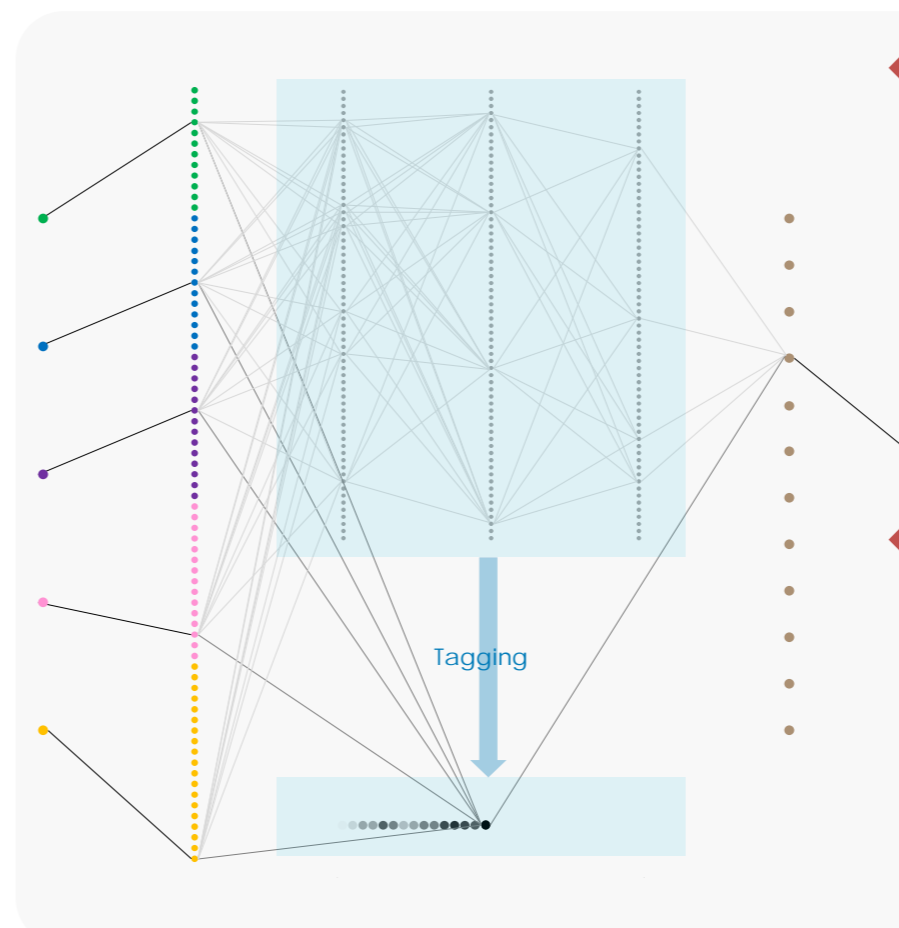
Overview

- ◆ **Mamdani neuro-fuzzy system** combining 1) the strong learning capabilities of deep LSTM neural networks and 2) the high interpretability of fuzzy frameworks
- ◆ Achieved **state-of-the-art** predictive accuracy with high adaptability
- ◆ Successfully applied in forex forecasting and trading with exceptional performance uplifts

Design & Implementation



- ◆ **2-Stage Incremental Clustering** adapted from eMFIS imitating psycho-physiological processes in categorical learning
- ◆ Uses cluster age, stability, and reducibility to facilitate cluster creation, update and merging



- ◆ **Hebbian pseudo-weights** tagged to the fuzzy rule nodes in parallel to the deep LSTM structure
- ◆ Mimics the repeated firing activities of the synaptic transmissions in between neurons during learning

Applications & Results

- ◆ Attained an average **R² of >99.18%** across 1- to 7-day lookahead forecasts for 12 forex pairs
- ◆ Implemented an **MACD-based long/short** trading strategy with lookahead EMA computed using FE-LSTM forex forecasts, achieving a **62.4% performance uplift** in cumulative PnL



	MACD Lookahead	MACD Vanilla	Buy & Hold
Std (x10⁻⁴)	7.9	8.0	12.0
Skewness	1.8	1.4	0.6
Kurtosis	12.2	8.1	3.5
PnL (9 Year)	754.7%	464.8%	56.2%
Sharpe Ratio	1.1	0.9	0.1