EvoTradeX

Solution Overview:

Our solution integrates hundreds of information sources with a deep learning algorithm to simplify retail investing. First, it predicts prices, then automatically creates portfolios using RL. Specialized feature engineering & a long-short module make us adaptable and scalable across any Stock

Hybrid Deep Learning Models

TFT : Captures long-term trends.
GRU : Learns short-term price trends.

Reinforcement Learning for Portfolio Management

Uses dynamic investment adjustments. with our reward mechanism to maximise Sharpe Ratio

02

04

01

03

05

Intelligent Feature Engineering

Extract Important sentiments and technical Indicators using ensemble clustering

Long Term & Short Term Analysis Module

Generates multi-horizon forecasts (T+1 to T+14) and compares it to similar past and near events

Explanable Fuzzy Decision-Making

Builds self-evolving trading rules, avoiding rigid, fixed strategies.

Architecture Layers

1 **Data Layer**

Extract Data from API and Process them

2 **Feature Extract**

Extract important sentiments & technical Indicators

3 **Clustering**

Help grouping similar trends and features together

4 **Fuzzification**

Uses Gaussian Membership to convert crisp to fuzzy for better interpretability

8 **RL Agent**

RL agent that from the insights gained Buys,Sells or Holds stock and trains itself

7 **Converting Back**

Convert Fuzzy sets back to crisp sets to get insights as to the market trends

6 **Inference**

Continuous learning & inference of the output from transformer model and rule layer

5 **Transformer + Rule-Based**

(Predicting T+14 days) Fuzzy Rule Based Layer (TSK 1) Helping in inference
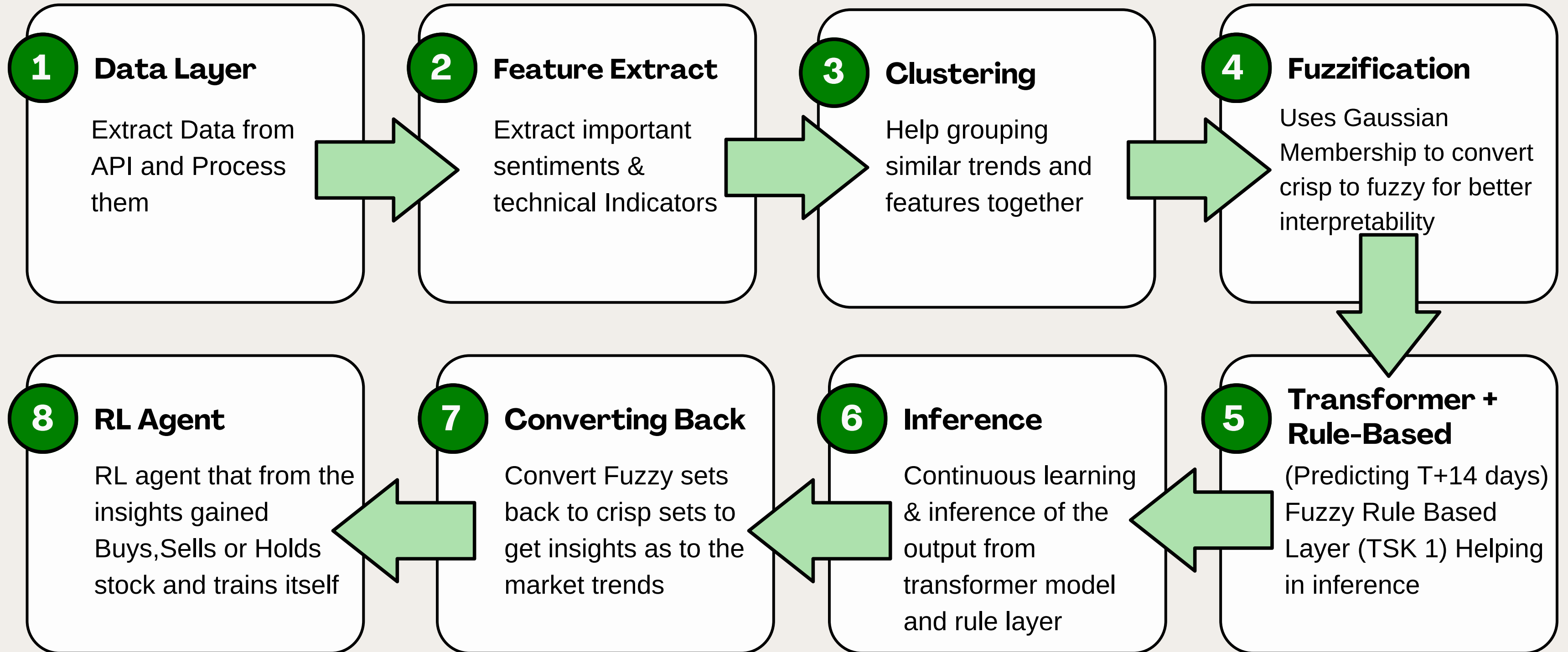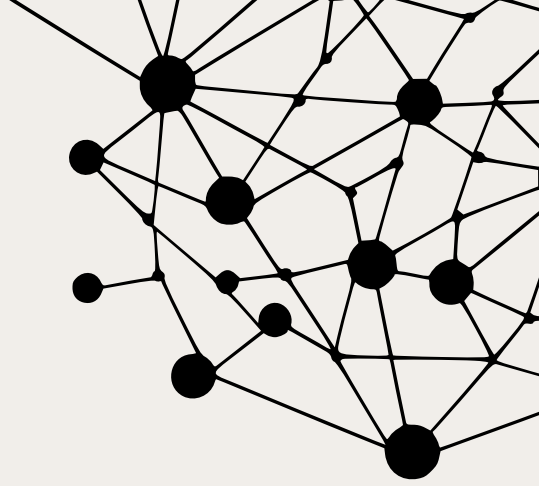
Neuro-Inference Fuzzy Architecture

Stock data · News data — Layer 1

Feature n1 · Feature n80 — Layer 2

Topo Art · EFCM · Fuzzy ART · DIC · Efficient FCKN — Layer 3

M1 1 · M1 2 · M1 m · Mn 2 · Mn 1 · Mn m — Layer 4

Transformer Layer · Self - Organizing Rule Based Layer — Layer 5

14 Layers

Inference Layer — Layer 6

Defuzzification — Layer 7

Portfolio Management - Reinforcement Learning — Layer 8
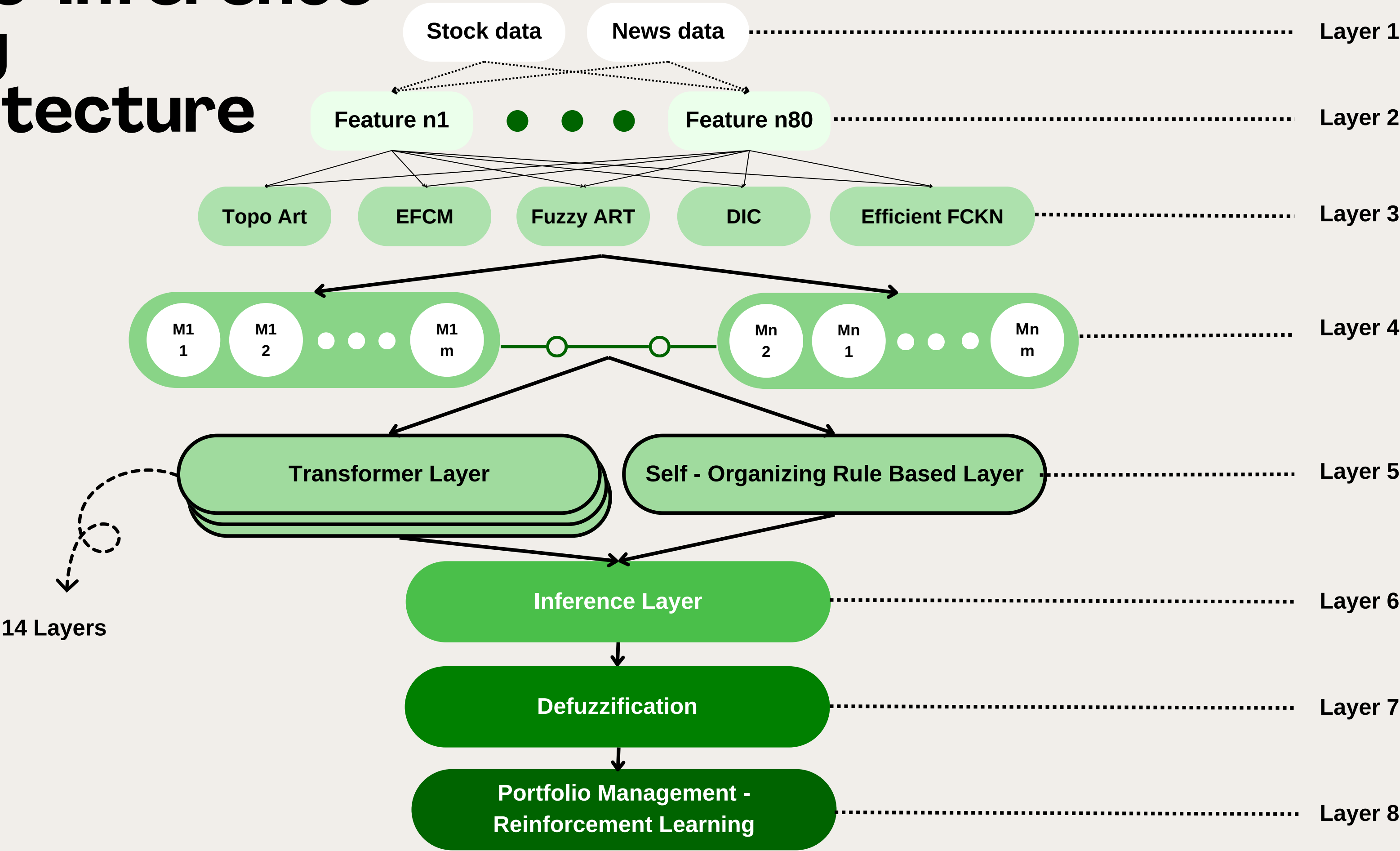
Prediction Model Architecture
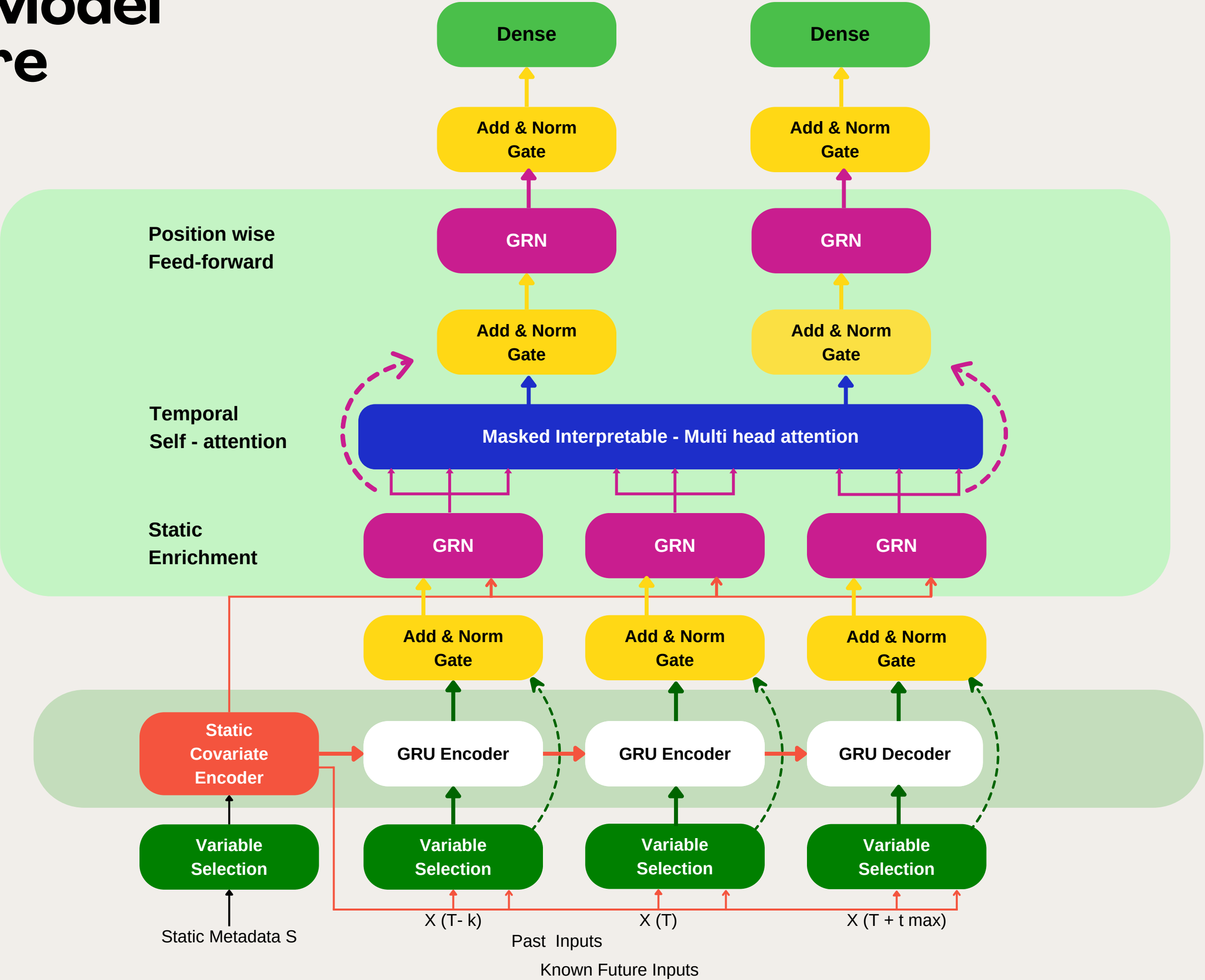
Data Processing & Feature Engineering in EvoTradeX

1) Data Extraction

- Yahoo Finance API → Price, volume, volatility, financial ratios
- News API → Extracts sentiment

2) Data Cleaning and preprocessing

- Adjust for Corporate Actions, Fill Missing Data, Normalize & Scale Features
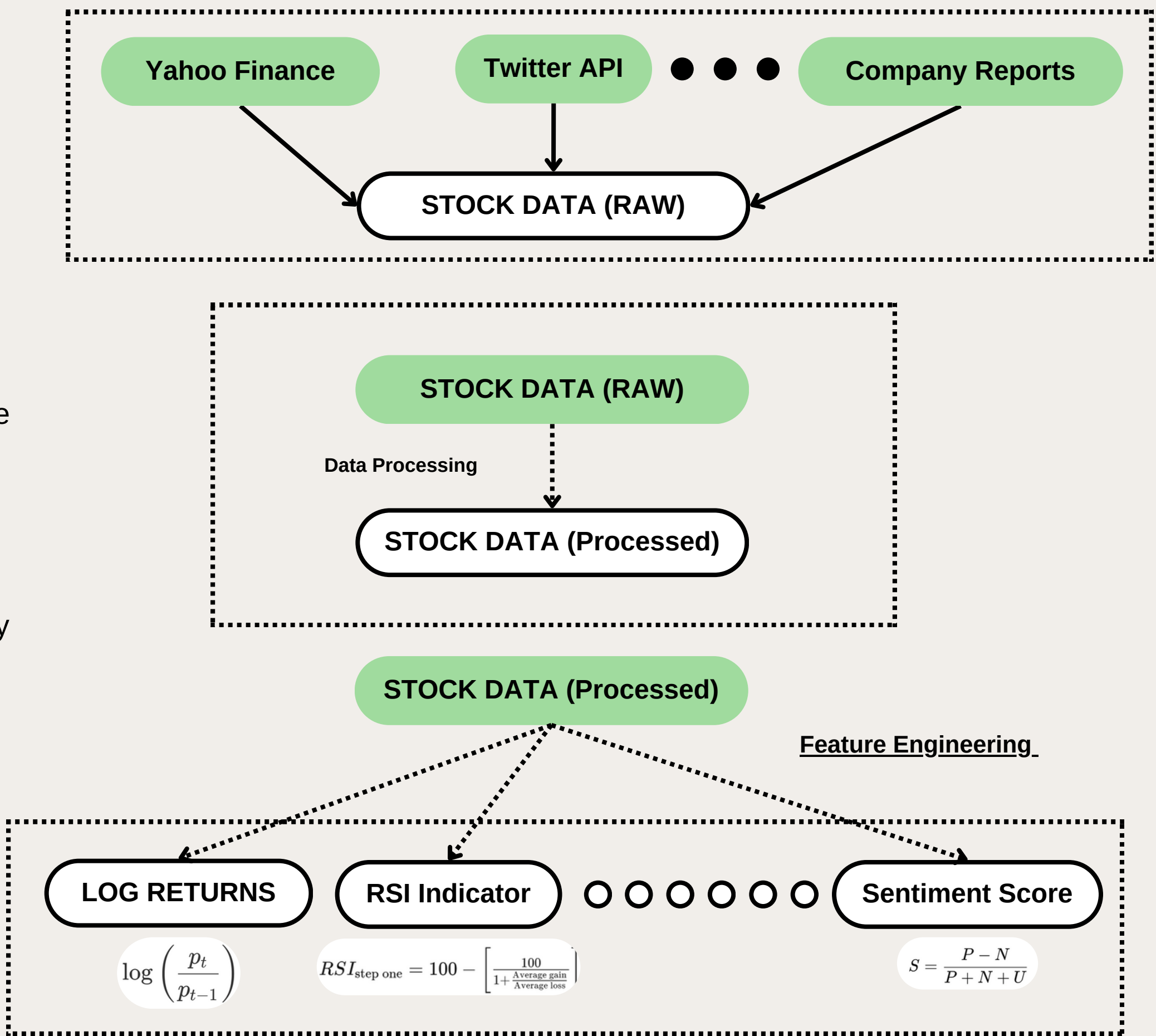
3) Feature Engineering

Statistical Features
- Log Returns, Rolling Volatility, Momentum Indicators, Liquidity & Volume Spikes

Sentiment Features
- News Sentiment Score, Volatility-Sentiment Correlation Twitter/Reddit Market Sentiment

Yahoo Finance · Twitter API · • • • · Company Reports → STOCK DATA (RAW)

STOCK DATA (RAW) — Data Processing → STOCK DATA (Processed)

STOCK DATA (Processed) — Feature Engineering → LOG RETURNS · RSI Indicator · ○○○○○○ · Sentiment Score

$$\log \left(\frac{p_t}{p_{t-1}} \right)$$

$$RSI_{\text{step one}} = 100 - \left[\frac{100}{1 + \frac{\text{Average gain}}{\text{Average loss}}} \right]$$

$$S = \frac{P - N}{P + N + U}$$

Clustering & Fuzzification in EvoTrade**X**

Why Clustering and fuzzification ?

- Clustering : Groups similar market conditions together.
- Fuzzification : Converts crisp values into fuzzy membership values.

Clustering

- Groups similar data conditions together.
- Detects Concept Drift.

Fuzzification

- Removes hard thresholds
- Makes trading decisions more adaptive & flexible.
- Handles uncertainty by allowing gradual transitions.

Each feature uses a different clustering algorithm for better adaptability.
During training, the best-performing algorithm is selected based on accuracy.
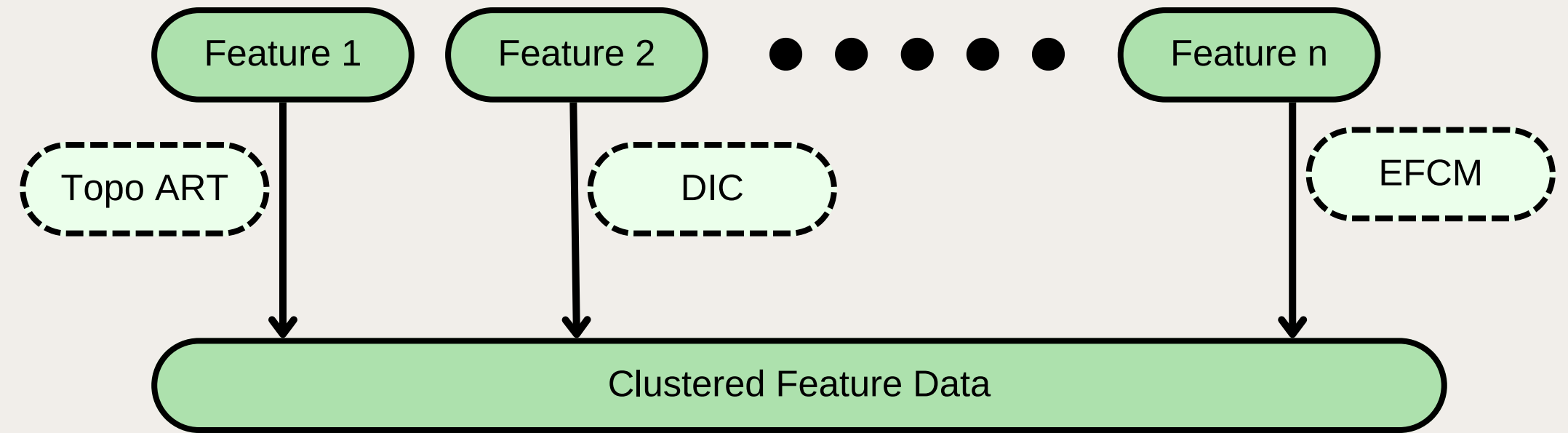
Each Cluster will be fuzzified using a gaussian membership function

Gaussian Membership

$$f(x; \sigma, c) = e^{\frac{-(x-c)^2}{2\sigma^2}}$$
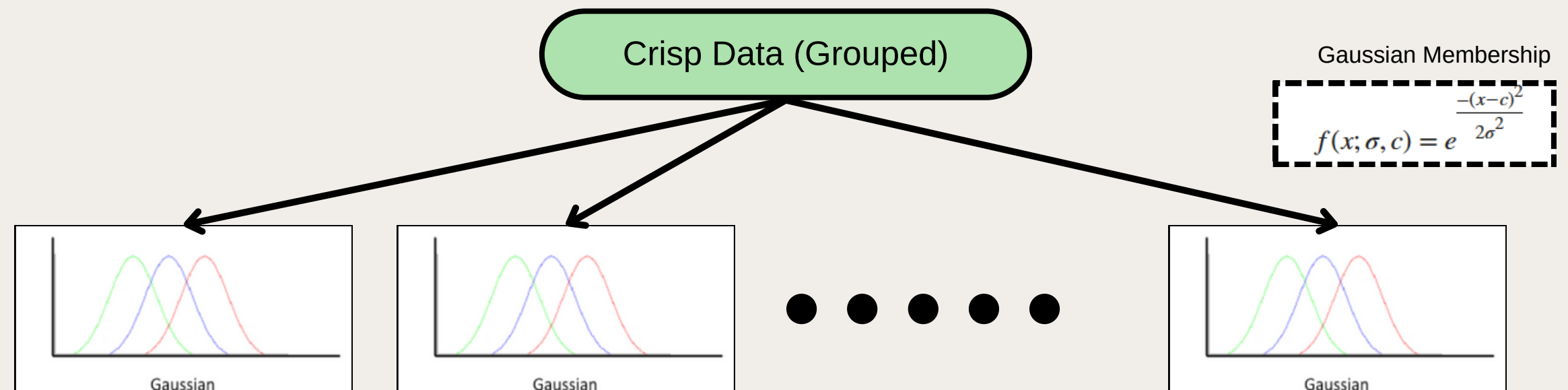
Transformer + Rule Layer

GRU (Gated Recurrent Unit) : Encoder Decoder

- Detects momentum shifts, volume spikes, and trend reversals.
- Filters noise with gated memory for critical insights.
- Faster training & better short-term trend analysis than LSTM.

TFT (Temporal Fusion Transformer)

- Processes static & dynamic features for market trends.
- Multi-head attention focuses on key time steps.
- Forecasts T+1 to T+14 for trading signals.

Serofam (Self-Reorganizing Rule Management)

- Dynamically refines fuzzy rules to handle market uncertainty.
- Uses meta-plasticity learning to continuously evolve decision logic.
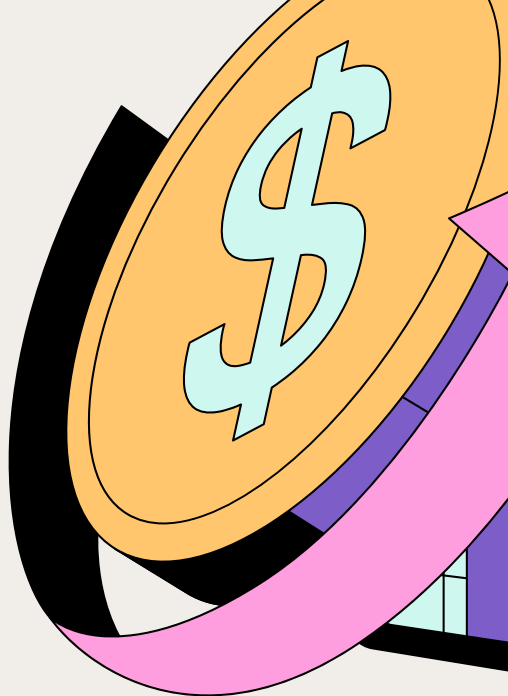- Prevents overfitting & ensures robust adaptive trading strategies.
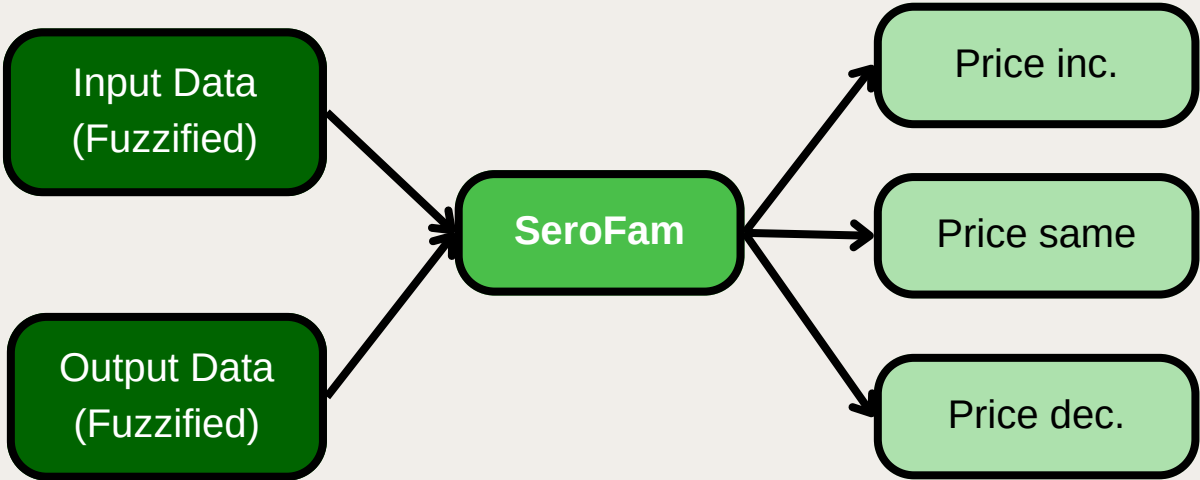
- *Uses a TSK 1 and Hebbian Learning approach to EXPLAIN why price will increase, decrease or remain same*
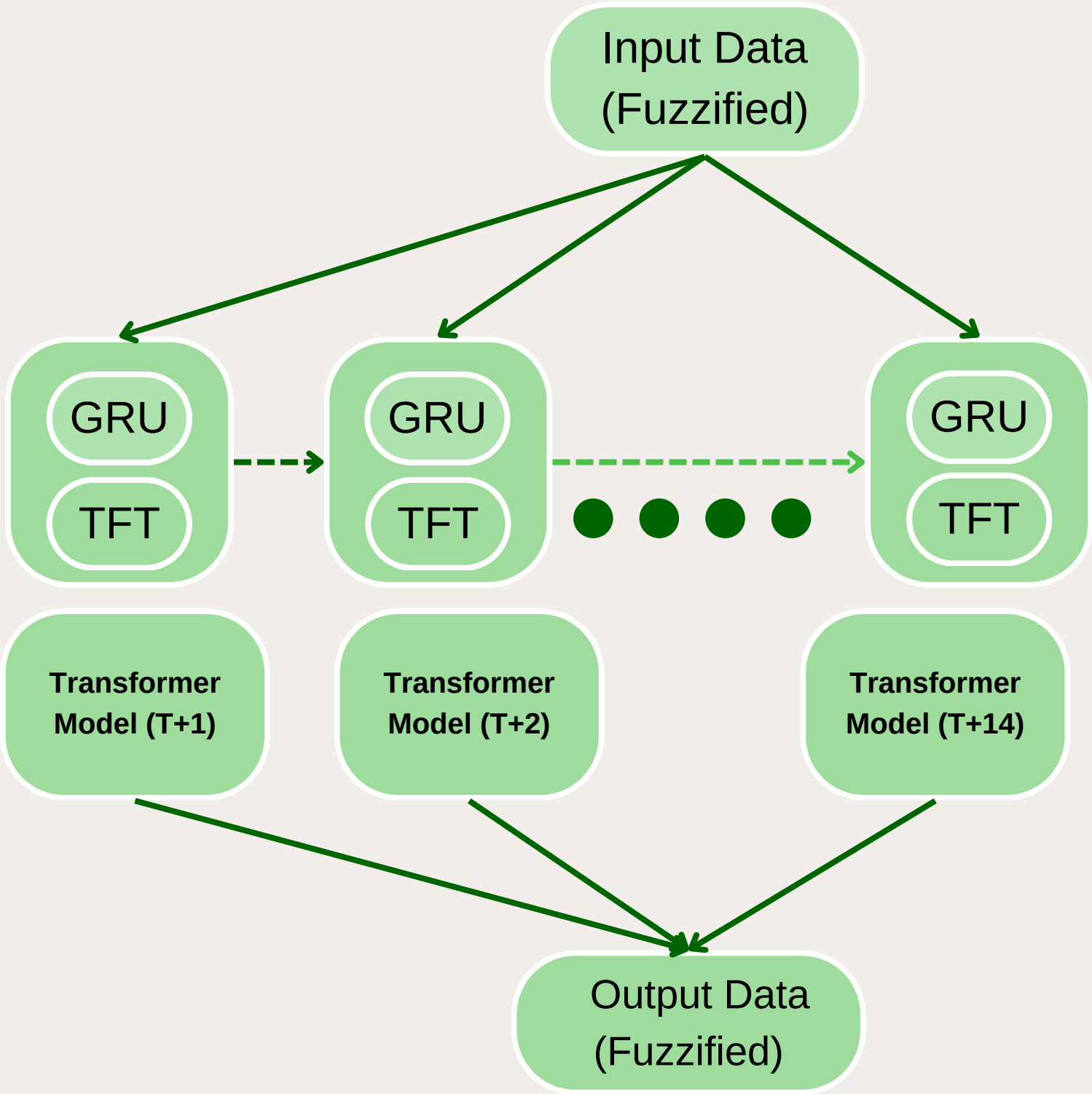
Use 14 different Transformer models to predict 14 days in ahead
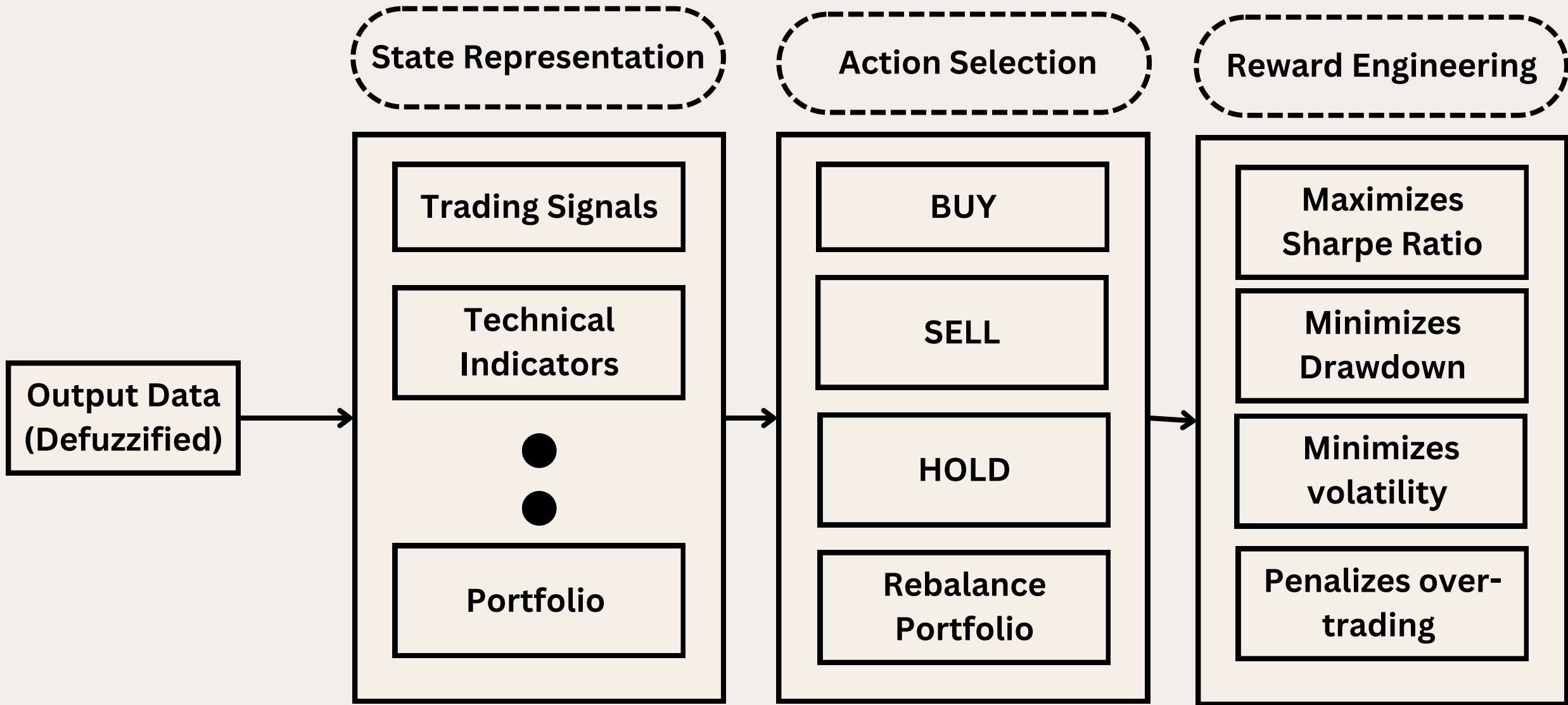
Portfolio Management

1. USES **REINFORCEMENT LEARNING** FOR DYNAMIC, AI-DRIVEN ASSET ALLOCATION.
2. IT LEARNS FROM **HISTORICAL TRADING SIGNALS** TO OPTIMIZE RISK-ADJUSTED RETURNS.
3. **PPO** ALGO ENSURES STABILITY, **DDPG** HANDLES ALLOCATION & **RARL** ADAPTS TO VOLATILITY

RL Logic

State(at t): Market Data, Portfolio Data, Risk Metrics

Action(at t): Discrete (Buy/Sell/Hold), Continuous (Allocation Adjustments);

Reward(at t): Immediate Return, Risk Adjustment, Transaction Cost Penalty

Output Data (Defuzzified)

State Representation

- Trading Signals
- Technical Indicators
- •
  •
- Portfolio

Action Selection

- BUY
- SELL
- HOLD
- Rebalance Portfolio

Reward Engineering

- Maximizes Sharpe Ratio
- Minimizes Drawdown
- Minimizes volatility
- Penalizes over-trading

Why Evo TradeX

Feature	Traditional	EvoTradeX
Market Adaptability	Fixed rules & thresholds	Self-adaptive clustering & fuzzification
Decision Logic	Static ML models	TFT + GRU Hybrid Deep Learning
AI Model	Black-box predictions	SeroFAM-driven adaptive inference
Portfolio Management	Rule-based asset allocation	RL-powered portfolio optimization
Explainability	Low interpretability	Transparent fuzzy rule-based insights
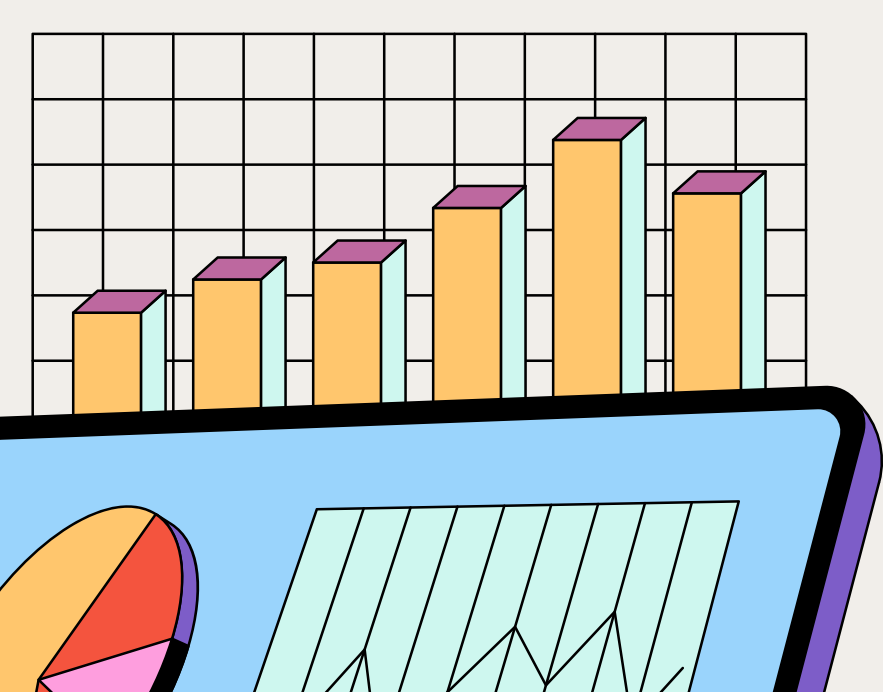
Models	AAPL	AMZN	GOOGL	MSFT	TSLA	ETHUSD
B&H	13.0	**42.33**	22.47	22.49	17.4	29.26
MACD	11.86	14.27	-18.0	15.23	-4.9	10.24
KDJ&RSI	2.17	19.38	24.39	18.84	2.14	8.87
ZMR	-3.91	18.73	32.51	9.86	-7.28	**29.35**
EvoTradeX	**31.9**	31.3	**41.9**	**65.1**	**21.9**	23.2

Table 1: Returns for Different Models in Q3 2024

Tesla, Inc. (TSLA)

Price History & Prediction

•◦ Historical Price ◦• Predicted Price

Explanation for Tesla Stock Trend

AI Model Decision & Prediction

- Buy Probability: 25%
- Sell Probability: 75%
- Final Decision: "High Sell Signal"
- Moderate Risk Observed
- Prediction: Overall Bearish Momentum in the Next Few Days

Key Factors Behind the Decline

- Fuzzification-Based Market State Analysis: Overbought conditions (RSI greater than 80) triggered a fuzzy-weighted mean reversion signal, increasing the probability of a downward correction.
- Gamma Exposure & Sentiment Deviation: Market makers were short gamma, forcing a sell-side delta hedge adjustment, accelerating Tesla's price decline.
- **Investor Sentiment:** The sentiment analysis revealed a sharp sentiment divergence—while retail traders remained bullish, institutional dark pool transactions signaled strong selling pressure due to the upcoming Earning Reports coming