Financial forecasting using ANFIS networks with Quantum-behaved Particle Swarm Optimization [1]

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[1] [Bagheri et al 2014] Ahmad Bagheri, Hamed Mohammadi Peyhani, and Mohsen Akbari (2014). Financial forecasting using ANFIS networks with quantum-behaved particle swarm optimization. *Expert Systems with Applications, 41(14):6235–6250.*

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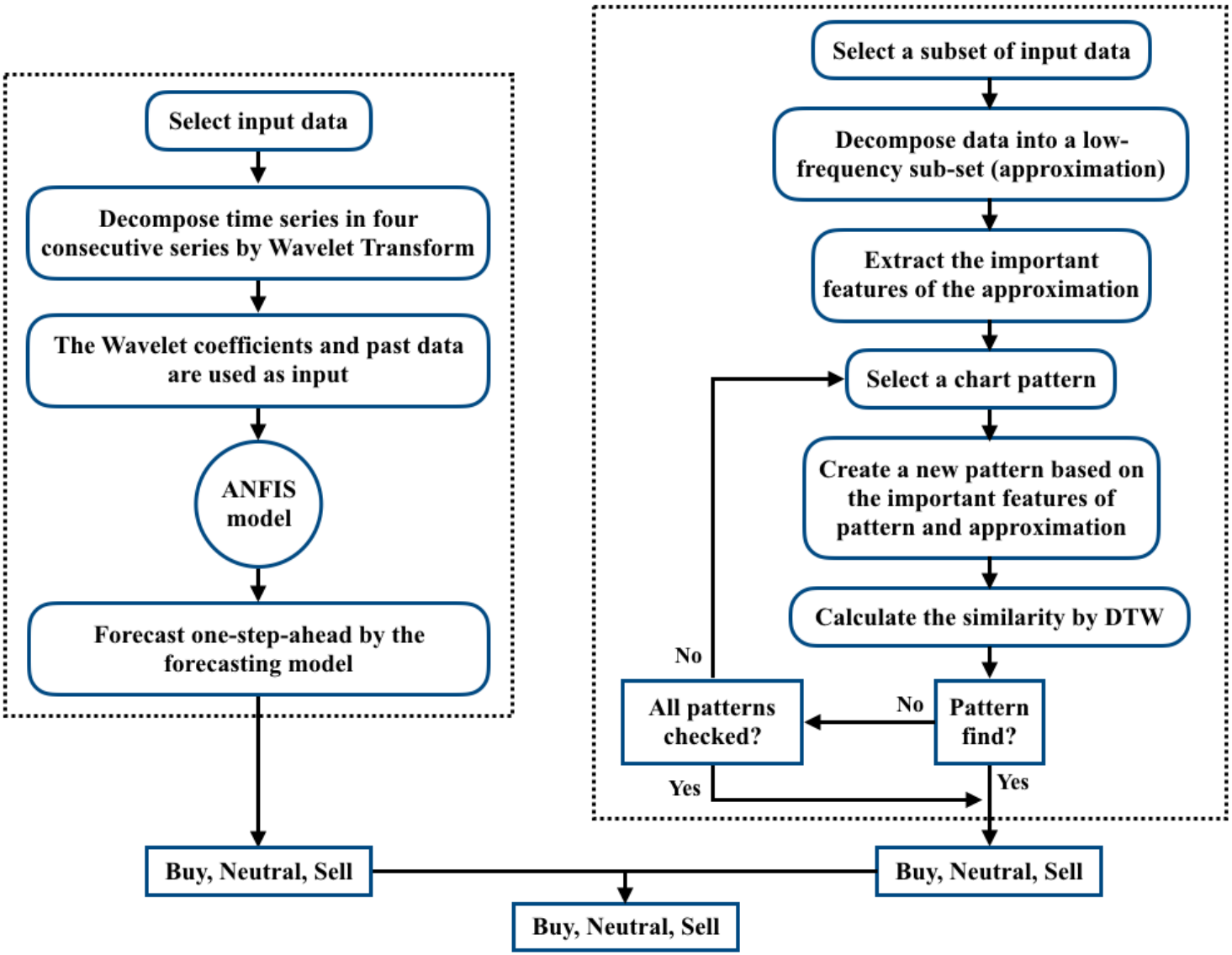
Problem Definition

- To be successful in **financial market trading** it is necessary to correctly forecast future market values
  - > From historical data and chart patterns
- *Efficient market history*: Impossible to make long-term predictions, however there are hidden patterns in short-term predictions
- **Goal:** Provide a trading advisory signal (buy, neutral, sell) over the **Foreign Exchange Market** (FX)

Architecture of the IDSS



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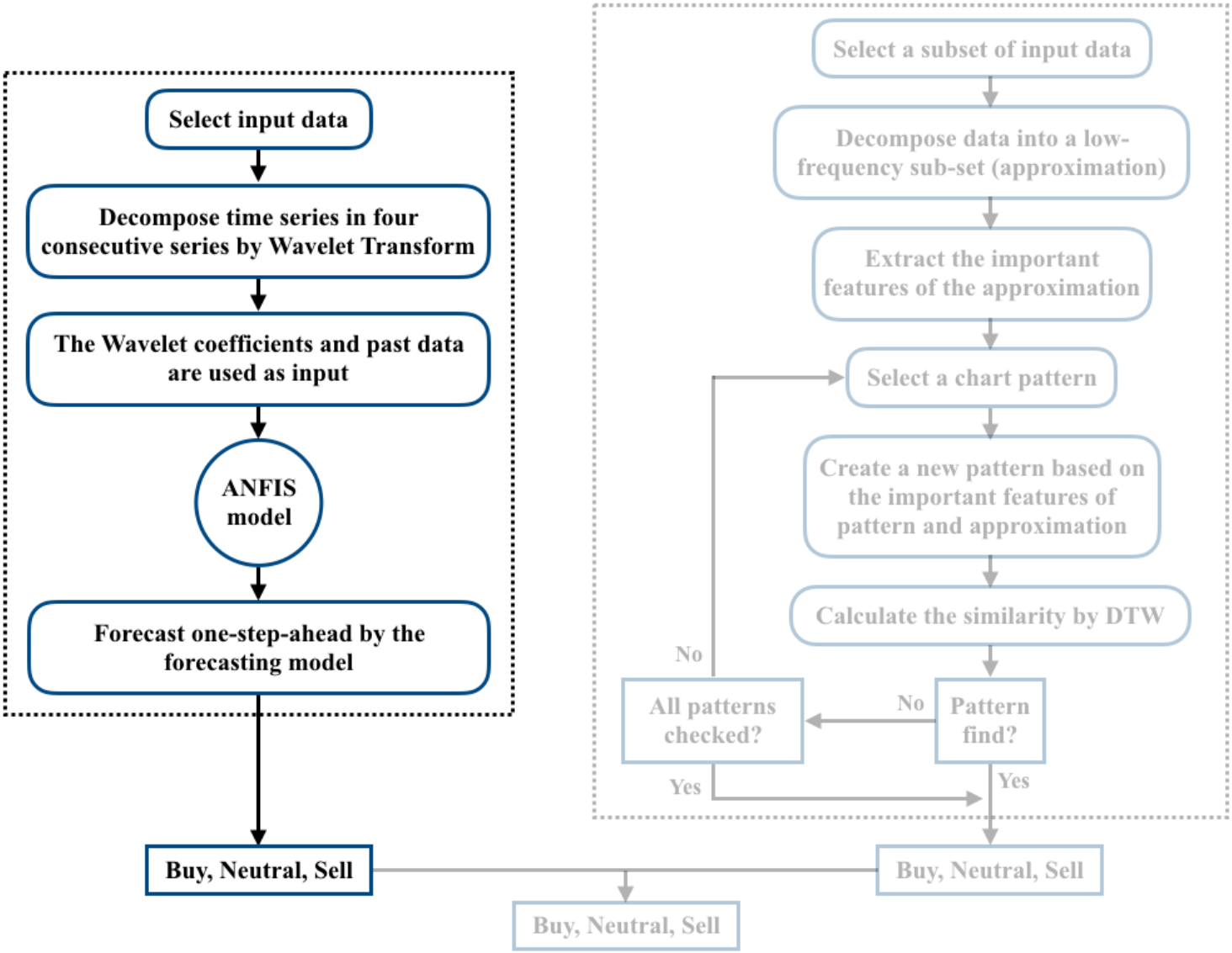

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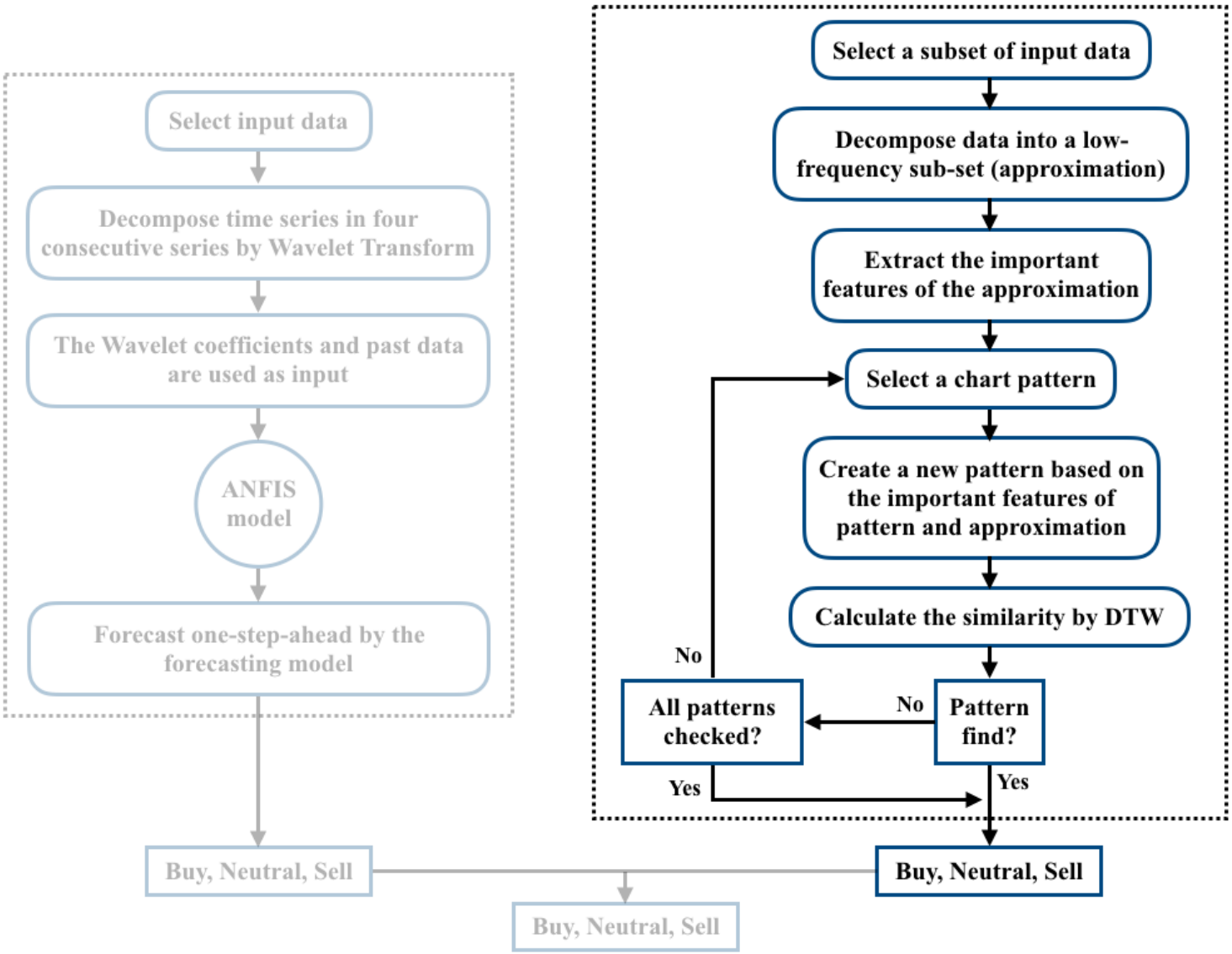
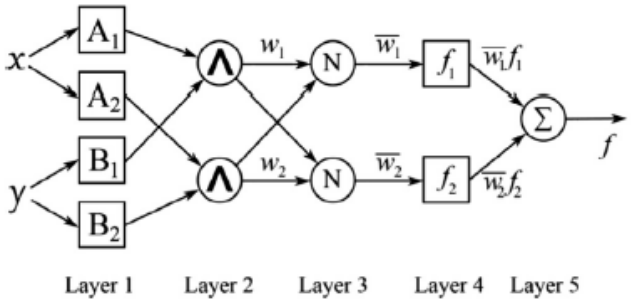


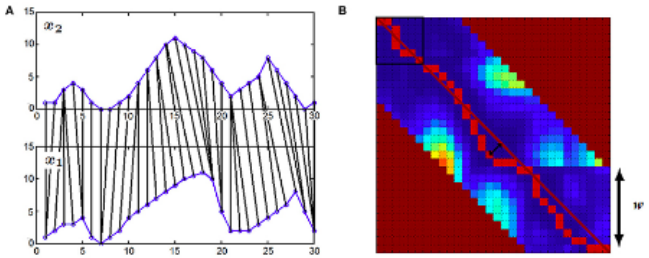
Intelligent and optimization methods

- Adaptive Network-based Fuzzy Inference System (**ANFIS**)
  - > Uses a Takagi–Sugeno type fuzzy system
  - > **If** x is A_1 and y is B_1 **then** $f_1 = p_1 x + q_1 y + r_1$



- Quantum-behaved Particle Swarm Optimization (**QPSO**)
  - > Stochastic search technique based on a population of particles

- Dynamic Time Warping (**DTW**)



Evaluation of the IDSS

- **Training data:** 735 days (January 3-2011 to October 31-2013)
- **Testing data:** 84 days (November 1-2013 to February 28-2014)

- Evaluation of the ANFIS model
  - RMSE $= \sqrt{\frac{1}{N}\sum_{i=1}^{N}(\text{Actual}_i - \text{Forecast}_i)^2}$
  - MAPE $= \left(\frac{1}{N}\sum_{i=1}^{N}\left|\frac{\text{Actual}_i - \text{Forecast}_i}{\text{Actual}_i}\right|\right) * 100$
  - MAE $= \frac{1}{N}\sum_{i=1}^{N}|\text{Actual}_i - \text{Forecast}_i|$

- Evaluation of the IDSS
  - Hit Rate (%) $= \frac{\text{Correct Predictions}}{\text{Number of Test Data}} * 100$
  - EUR/USD $\rightarrow$ 68.68%; GBP/USD $\rightarrow$ 74.70%