

On the Trend Reversal Prediction and Its Robust Modification

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Giyeong Lee

Daily Stock Trading Strategies

Methodology	Article	Features	Limitations
Price Prediction	Jia et al. (2024)	Hybrid model combining ResNet and LSTM achieving at least a 20% improvement	<ul style="list-style-type: none"> Highly sensitive to data quality and preprocessing High computational cost
	Phuoc et al. (2024)	LSTM model combined with technical indicators achieving 93% short-term stock price accuracy	<ul style="list-style-type: none"> Model training time can be lengthy Dependent on data quality
Price Direction Prediction	Kim et al. (2020)	Combined ETE (Effective Transfer Entropy) and ML algorithms to improve directional prediction accuracy for S&P 500 index	<ul style="list-style-type: none"> Requires complex data processing Vulnerable to sudden market changes
Trend Reversal Prediction (Contrarian Trading)	Tsang et al. (2017)	Combined DC (Directional Change) paradigm and classification algorithms achieving a Sharpe ratio of 1.8 in FX markets	<ul style="list-style-type: none"> Complex model structure makes real-time application challenging
	Adegboye et al. (2021)	Developed trend reversal prediction model using genetic algorithms and DC framework, achieving high profitability across 20 currency pairs	<ul style="list-style-type: none"> High computational cost and challenges in integrating data sources
Momentum	Moskowitz et al. (2012)	Time-series momentum strategy achieving an annual excess return of 1.58%, validated across global asset classes	<ul style="list-style-type: none"> Increased risk of losses at market turning points Potential for reduced long-term returns

Trend Reversal Prediction

- **Advantages**

- Exploiting market inefficiencies
- Portfolio diversification
- Reduced transaction costs

- **Unsolved issues**

- Sensitive to the data quality and noise
- Difficult to distinguish between trend reversals and simple adjustments
- Other typical ML-related issues

Terminology Issues

- **Trend ... (up-)trend at time t if**

- Case 1. $r_{t-s+1} > 0$ for all $s = 1, \dots, H$ with window H
- Case 2. $\text{Smoothing}(p_{t-H+1}, \dots, p_{t-1}) < (1 + \eta)p_t$ with window H and threshold η
- Case 3. Gradient-based
- ...

- **Trend reversal**

- Once we define 'trend', the definition of 'trend reversal' is relatively clear
e.g. Denoting the uptrend and downtrend as $m_t = 1, -1$, respectively, trend reversal can be defined simply as $\mathbb{I}(m_{t-1} \cdot m_t = -1)$

⇒ **Main Issue: Difficulty in establishing a unified and robust definition of 'trend'**

Bypassing Trend (1)

▪ Mean-reversion

- Concrete theoretical background
e.g. Ornstein-Uhlenbeck process: $dx_t = \theta(\mu - x_t)dt + \sigma dW_t$
- Gaussian assumption is necessary to utilize the theory in most case

▪ Directional change framework

- Directional change (DC)
 - The first time at which the rate of change relative to the previous local extremum exceeds the threshold
 - Each DC event indicates a new trend
- Overshooting
 - The period from the moment that a DC event was observed to the next local extremum



Bypassing Trend (2)

- **Directional change framework (Cont.)**

- During the overshooting period, it is impossible to determine when the overshooting will end
→ Predict the duration of the current overshooting phase
- Other consideration is possible
 - Extension to the adaptive threshold to respond to changes in the magnitude of volatility
 - Predicting the probability that the next local extremum will be observed within a given period

- **Econophysics perspective ... *Price change pressure***

- *Price change pressure* decomposition
 - Long-term: due to changes in the intrinsic value of the asset
 - Short-term: the pressure to recover temporary discrepancies due to investors' cognitive errors or overreactions
- Expected to alleviate the problem of distinguishing between trend reversal and simple adjustment

Future Work

- **Research direction under the DC framework**
 - Adaptation to the temporal shift of input and covariate distributions
 - Probabilistic modification of DC framework

- **Further literature review looking for the concrete notion of *price change pressure***
 - Performance comparison with DC framework
 - Will establish the notion and compare it to existing research if there is no suitable notion in econophysics researches

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