The Profile of Market Analyst Emily

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<name>Emily</name>
<description>You are Emily, a Market Analyst dedicated to conducting thorough
    research on markets, industries, and companies. Your work involves gathering
     and analyzing vast amounts of data to produce detailed reports that inform
    investment decisions. Your insights into market trends, sector performance,
    and company fundamentals are critical for identifying potential investment
    opportunities and risks. You also provide timely updates and recommendations
     to ensure that the investment team is well-informed about the latest market
     developments.</description>
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<teamBackground>
    <description>Emily, as the Market Analyst within the QuantAgents framework,
        is responsible for providing the team with in-depth market intelligence.
         Her research supports the decision-making process by delivering
        accurate and actionable insights, making her a key contributor to the
        success of the overall investment strategy.</description>
</teamBackground>
</profile>
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Table 4: Summary of evaluation measures for the PRUDEX-Compass framework.

Axes	Measures	Descriptions
Profitability	Profit	Assesses the capability of FinRL methods to accumulate market capital.
	Alpha Decay	Indicates the decline in investment strategy effectiveness over time due to market changes.
	Equity Curve	Represents the portfolio value's progression over time.
Risk-Control	Risk	Evaluates the level of risk assumed by FinRL methods.
	Risk-adjusted Profit	Normalizes profit against the risk factors, including volatility and downside risk.
	Extreme Market	Measures the performance of FinRL methods during unpredictable market events.
Universality	Country	Covers performance across a spectrum of financial markets globally.
	Asset Type	Includes a variety of asset classes in the evaluation.
	Time-Scale	Accounts for different trading frequencies in the analysis.
Diversity	t-SNE	Utilizes statistical methods to visualize the diversity of data points.
	Entropy	Applies information theory to measure the diversity of trading behaviors.
	Correlation	Examines the interrelation between assets to assess strategy diversity.
	Diversity Heatmap	Graphically displays investment decision diversity across assets.
Reliability	Performance Profile	Provides a visual summary of the empirical score distribution of FinRL methods.
	Variability	Analyzes the consistency of performance across varying conditions.
	Rolling Window	Evaluates the adaptability of FinRL methods over sequential time periods.
	Rank Comparison	Offers a comparative ranking of methods based on performance metrics.
Explainability	-	This axis is reserved for future discussions on the interpretability of FinRL models.

financial applications. This axis focuses on the reliability of RL methods within the quantitative trading domain.

Explainability. Trust in a model is paramount for its adoption. Explainability encompasses techniques that clarify a model's behavior, aiding users in understanding model effectiveness under different market conditions and in rectifying erroneous actions. In the regulated financial sector, this is particularly important for model accountability, oversight, and auditing.

In our study, the QuantAgents method has undergone evaluation using the PRUDEX-Compass and has achieved superior scores across all dimensions, showcasing its robustness and effectiveness in financial market simulations.

G Details of Dataset Setup

This appendix provides a detailed explanation of the technical indicators created in the dataset for this paper, along with their calculation methods and significance. The technical indicators are as follows, a total of 60 indicators.

Delta: Delta is a term from options trading that measures the rate of change of an option's price relative to the underlying asset's price. In the context of stock technical analysis, it might be adapted to reflect sensitivity to market factors.

Permutation (Zero-based): In stock analysis, permutation could be used to analyze sequences of price movements or market conditions, though its application is not standard.

Log Return: Log return is calculated using the natural logarithm and is given by:

$$\text{Log Return} = \ln\left(\frac{\text{Price at time } t}{\text{Price at time } t-1}\right)$$

Max in Range: This is the highest stock price within a specified range.

Min in Range: This is the lowest stock price within the same range.

Middle: The middle value is the average of the close, high, and low prices:

$$\text{Middle} = \frac{\text{Close} + \text{High} + \text{Low}}{3}$$

Comparison Operators: These operators are used to establish conditions based on the relationship between data points:

- $\leq$ (less than or equal to)

- $\geq$ (greater than or equal to)

- $<$ (less than)

- $>$ (greater than)

- $=$ (equal to)

- $\neq$ (not equal to)

Count (Both Backward c and Forward fc): This refers to the tally of occurrences of a condition

or event in a dataset, observed both retrospectively and prospectively.

Cross: Crosses indicate when one moving average crosses another, signifying potential trend changes:

- *Upward Cross* - bullish signal when a short-term average crosses above a long-term average.

- *Downward Cross* - bearish signal when a short-term average crosses below a long-term average.

SMA (Simple Moving Average): The SMA is the average of a selected number of time periods and is calculated as follows:

$$\text{SMA} = \frac{1}{n}\sum_{i=1}^{n}\text{Price}_i$$

where n is the number of periods and Price_i is the price in period i.

EMA (Exponential Moving Average): The EMA gives more weight to recent prices, and it is calculated using the formula:

$$\text{EMA} = \left(\frac{\text{Price}_t - \text{EMA}_y}{1+y}\right) + \text{EMA}_y$$

where Price_t is the current price, EMA_y is the EMA of the previous period, and y is the number of periods.

MSTD (Moving Standard Deviation): The moving standard deviation measures the average amount by which prices deviate from the SMA over a period and is calculated as:

$$\text{MSTD} = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(\text{Price}_i - \text{SMA})^2}$$

MVAR (Moving Variance): The moving variance is similar to the moving standard deviation but represents the squared deviations:

$$\text{MVAR} = \frac{1}{n-1}\sum_{i=1}^{n}(\text{Price}_i - \text{SMA})^2$$

RSV (Raw Stochastic Value): The RSV is used in the calculation of the Stochastic Oscillator and is given by:

$$\text{RSV} = \frac{\text{Close}_t - \text{Low}_n}{\text{High}_n - \text{Low}_n}\times 100$$

where Close_t is the closing price of the current period, Low_n is the lowest price in the last n periods, and High_n is the highest price in the same period.

RSI (Relative Strength Index): The RSI is a momentum oscillator that measures the speed and change of price movements:

$$\text{RSI} = 100 - \left(100 \div \left(1 + \frac{\text{Average Gains}}{\text{Average Losses}}\right)\right)$$

KDJ (Stochastic Oscillator): The KDJ is a combination of three lines: K, D, and J, which are derived from the RSV and smoothed to identify trends:

$$\text{K} = \text{SMA}(\text{RSV}, 3)$$
$$\text{D} = \text{SMA}(\text{K}, 3)$$
$$\text{J} = 3 \times \text{K} - 2 \times \text{D}$$

Bolling (Bollinger Band): Bollinger Bands consist of a simple moving average plus and minus a standard deviation, providing a measure of volatility:

$$\text{Upper Band} = \text{SMA} + k \times \text{MSTD}$$
$$\text{Lower Band} = \text{SMA} - k \times \text{MSTD}$$

where k is a constant that determines the width of the bands.

MACD (Moving Average Convergence Divergence): The MACD is a trend-following momentum indicator that shows the relationship between two EMAs:

$$\text{MACD} = \text{EMA}(12) - \text{EMA}(26)$$

with a signal line, usually a 9-day EMA of the MACD line.

CR (Energy Index): The CR is a volume-based indicator that measures the difference between high and low prices to assess market strength:

$$\text{CR} = \frac{\text{Sum of middle values}}{\text{Sum of high-low ranges}}$$

WR (Williams Overbought/Oversold index): The WR is a momentum indicator that compares the closing price to the high and low range over a period:

$$\text{WR} = \frac{\text{Highest High} - \text{Close}}{\text{Highest High} - \text{Lowest Low}} \times -100$$

CCI (Commodity Channel Index): The CCI is designed to measure the difference between an