Project Proposals

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1 Volume-based models

Tick-by-tick data is a type of financial data that records every individual transaction or trade (tick) that occurs in a financial market. It provides the most granular and detailed information about price changes and trading activity in real-time. Each tick in tick-by-tick data represents a single trade, including the exact time it occurred, the price at which the trade was executed, and the volume of the trade.

1.1 Trade Management and Optimization

Consider a tick-by-tick timeseries of prices and a series of predictions. Every prediction p contains the following data:

- Timestamp: the time at which we are willing either to buy or sell at the corresponding price level;
- Direction: +1 if the trader decided to buy, 1 if the trader decided to sell at the corresponding timestamp;
- Upper bound (maximum price level) employed by the model;
- Lower bound (minimum price level) employed by the model;

The upper and lower bounds are employed by a ML model during the training and define an initial corridor within we accept price moves. It is reasonable to modify such corridor during the life of a trade.

Finally, for every trade we take a position at the entry price p_e and close the trade at the closing price p_c, the reward is usually referred as *return*, in formula:

$$r = \frac{(p_c - p_e) * direction}{p_e}. \tag{1}$$

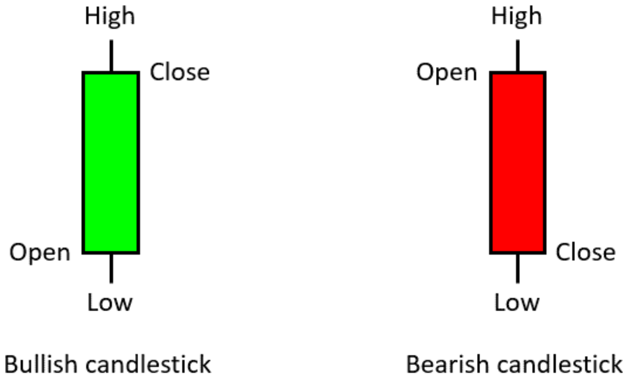
Our goal is to find a proper management strategy to maximize the cumulative return. In particular, you should study how to manage each trade effectively. This involves:

- Setting stop loss and take profit levels to control losses and secure gains, considering the trade's risk-reward ratio.
- Implementing a trailing stop to lock in profits as the trade moves favorably.
- Determining the appropriate position size for each trade based on your account balance, risk tolerance, and trade-specific parameters.
- Employing risk management strategies to maintain trade exposure within acceptable limits.

2 Prices

Similar to a bar chart, a daily candlestick chart displays the market's opening, highest, lowest, and closing prices for a given day. The candlestick comprises a broader section known as the "real body."

This real body signifies the price range between the day's opening and closing prices. If the real body is filled or colored black (or red), it signifies that the closing price was lower than the opening price. Conversely, when the real body is white (or green), it indicates that the closing price exceeded the opening price. See for instance the following figure:



2.1 Pattern quality

In the context of financial markets a price is a recognizable formation or arrangement of price movements on a chart. These patterns are often used by traders and technical analysts to make predictions about future price movements. In particular, price patterns allow us to identify the prevailing trend in the market. For instance, a series of higher highs and higher lows might suggest an uptrend, while lower highs and lower lows could indicate a downtrend.

The project consists in the design of a series of patterns and in the evaluation of the quality of each patter. As a basic guide line, you could follow the following steps:

1. Define a series of patterns, both to catch upward and downward trends. For sake of clarity, we suggest to keep bearish and bullish trends separated in the analysis;
2. Assume that you would buy at the close price of each bullish pattern and sell at each close price of each bearish pattern.
3. Define a metric to evaluate the quality of each pattern in identifying the following trend;
4. Find a proper optimization of the problem and provide an in-depth analysis.

2.2 Trade Management and Optimization

Objective Your objective is to create a trade management strategy that optimizes the outcome of a series of trades triggered by predefined entry signals. Whether you choose to work with tick-by-tick data or candles with various timeframes is up to you.

Key Elements

1. Entry Signals: You will receive specific entry signals including the trade direction (buy or sell), entry price, and entry time.
2. Trade Management: Your role is to manage each trade effectively. This involves:
   - Setting stop loss and take profit levels to control losses and secure gains, considering the trade's risk-reward ratio.
   - Implementing a trailing stop to lock in profits as the trade moves favorably.
   - Determining the appropriate position size for each trade based on your account balance, risk tolerance, and trade-specific parameters.
   - Employing risk management strategies to maintain trade exposure within acceptable limits.
3. Data Source: You can choose between using tick-by-tick data for real-time decision-making or candlestick data with a chosen timeframe for a more strategic approach.