Trading Strategy Introduction: ETH/USDT 15-Minute Momentum Strategy

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A momentum-based algorithmic trading system for ETH/USDT perpetual futures.

Contents

1 Overview

This trading strategy is a momentum-based, algorithmic trading system designed for the ETH/USDT perpetual futures market on a 15-minute timeframe. It leverages technical indicators to identify high-probability entry and exit points, aiming to capitalize on short-term price movements while managing risk through dynamic stop-loss mechanisms. The strategy employs a combination of the Fisher Transform, Average True Range (ATR), Relative Strength Index (RSI), and Volume Oscillator to make informed trading decisions. Parameters for the strategy have been optimized using Optuna, a hyperparameter optimization framework, to maximize performance based on historical data.

2 Strategy Components

2.1 Market and Timeframe

- **Asset**: ETH/USDT (Perpetual Futures)
- **Timeframe**: 15-minute candles
- **Leverage**: 10x
- **Position Size**: 20% of account balance per trade
- **Trading Fee**: 0.06% per trade (entry and exit)

2.2 Key Indicators

The strategy uses the following technical indicators to generate trading signals and manage positions:

2.2.1 Fisher Transform (FS)

- **Purpose**: Identifies potential price reversals by transforming price data into a Gaussian distribution.
- **Parameters**:
  - Length: 10 periods
  - Entry: Low momentum conditions
  - Exit: High momentum conditions
- **Logic**:
  - Long entry: Bullish crossover (FS crosses above TR)
  - Short entry: Bearish crossover (FS crosses below TR)
  - Exit: Opposite crossover when momentum exceeds exit thresholds.

2.2.2 Average True Range (ATR)

- **Purpose**: Measures volatility to set dynamic stop-loss levels.
- **Parameters**:
  - Length: 14 periods
  - Stop-Loss: Multiplier applied to ATR
- **Logic**:
  - Stop-loss is set based on ATR to account for market volatility.
  - Stop-loss is trailed dynamically to lock in profits.

2.2.3 Relative Strength Index (RSI)

- **Purpose**: Gauges overbought/oversold conditions to filter entries and exits.
- **Parameters**:
  - Length: 14 periods
  - Entry: Neutral momentum conditions
  - Exit: Strong momentum conditions
- **Logic**:
  - Entries are allowed when RSI indicates neutral momentum.
  - Exits are triggered when RSI shows strong directional momentum.

2.2.4 Volume Oscillator

- **Purpose**: Measures volume momentum to confirm trade entries and exits.
- **Parameters**:
  - Short EMA: 5 periods
  - Long EMA: 10 periods
  - Entry: Sufficient volume momentum
  - Exit: Strong volume momentum
- **Logic**:
  - Entries require positive volume momentum.
  - Exits are confirmed when volume momentum is elevated.

2.3 Parameter Optimization

The strategy's parameters, including those for Fisher Transform, ATR, RSI, and Volume Oscillator, were optimized using Optuna, an open-source hyperparameter optimization framework. Optuna was employed to systematically search for the best parameter combinations that maximize the strategy's performance metrics, such as total PnL and profit factor, over the historical data. This optimization process involved defining objective functions to evaluate backtest results and running multiple trials to identify robust parameter sets that enhance the strategy's effectiveness across varying market conditions.

3 Trading Rules

3.1 Entry Conditions

- **Long Entry**:
  - Bullish Fisher Transform crossover (FS > TR).
  - Low momentum in FS or TR.
  - Neutral RSI momentum.
  - Positive volume momentum.
- **Short Entry**:
  - Bearish Fisher Transform crossover (FS < TR).

- Low momentum in FS or TR.
- Neutral RSI momentum.
- Positive volume momentum.

3.2 Exit Conditions

- **Stop-Loss**:
  - Initial stop-loss set based on ATR.
  - Trailing stop-loss adjusts dynamically with updated ATR values.
- **Signal Exit**:
  - Opposite Fisher Transform crossover.
  - High momentum in FS or TR.
  - Strong RSI momentum.
  - Elevated volume momentum.
- **End of Data**: Any open position is closed at the last candle's close price.

4 Backtesting Framework

The strategy is implemented using a Python-based backtester with the following features:

- **Initial Balance**: $1,000
- **Position Sizing**: 20% of account balance with 10x leverage
- **Data Processing**: Uses historical ETH/USDT 15-minute candle data from a CSV file
- **Output**:
  - Generates a CSV report with trade details (entry/exit times, prices, PnL, etc.).
  - Creates an interactive Plotly chart showing price candles, FS/TR indicators, Volume Oscillator, and equity curve.
  - Provides a summary with metrics such as total PnL, win rate, profit factor, and expectancy.

5 Risk Management

- **Leverage**: 10x to amplify returns while maintaining strict position sizing.
- **Position Size**: Limited to 20% of account balance to mitigate risk.
- **Stop-Loss**: Dynamic ATR-based stop-loss to adapt to market volatility.
- **Fees**: Accounts for 0.06% trading fees on both entry and exit.

6 Performance Metrics

Backtesting results from January 1, 2025, to July 19, 2025, demonstrate the strategy's effectiveness:

- **Test Period**: January 1, 2025 – July 19, 2025
- **Initial Balance**: $1,000.00
- **Final Balance**: $15,291.61
- **Total PnL**: $14,291.61 (+1,429.16%)
- **Total Trades**: 293
- **Trade Frequency**: 1.53% of candles
- **Winning Trades**: 141 (48.1%)
- **Losing Trades**: 152 (51.9%)
- **Breakeven Trades**: 0
- **Profit Factor**: 1.41
- **Average Win**: $351.20
- **Maximum Win**: $4,500.18
- **Maximum Loss**: -$1,045.67
- **Expectancy**: $48.78

These results highlight a strong return on investment with a positive expectancy, though the near-even win rate suggests reliance on larger winning trades to drive profitability.

7 Usage

1. **Data Input**: Provide historical ETH/USDT 15-minute candle data in a CSV file (columns: timestamp, open, high, low, close, volume).
2. **Execution**: Run the Python script to calculate indicators, execute the backtest, and generate reports.
3. **Output Analysis**: Review the CSV report and interactive Plotly chart for performance insights.

8 Conclusion

This momentum-based trading strategy combines multiple technical indicators to identify high-probability trading opportunities in the ETH/USDT perpetual futures market. Enhanced by Optuna-based parameter optimization, it ensures robust performance across diverse market conditions. With rigorous risk management and a comprehensive backtesting framework, it provides a systematic approach to trading with clear entry/exit rules and performance evaluation tools. The backtest results demonstrate significant profitability, making it a compelling option for traders seeking to automate their trading process while maintaining strict risk controls.