Binance Futures Order Bot: Analysis and Documentation

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July 2025

Abstract

This report provides an analysis of a CLI-based trading bot developed for Binance USDT-M Futures using the Binance Testnet API. The bot supports market and limit orders (mandatory) and advanced orders including OCO, TWAP, and grid orders (bonus features). It includes robust input validation and structured logging. This document explains the functionality of each order type, discusses the implementation approach, and describes placeholder screenshots of the bot's operation.

1 Introduction

The Binance Futures Order Bot is a command-line interface (CLI) application designed to execute various order types on Binance USDT-M Futures using the Binance Testnet API (available at https://testnet.binance.vision/). Developed in Python, the bot fulfills the requirements outlined in the "Instructions Python Developer (1)-1.pdf" document, supporting mandatory order types—market and limit orders—and implementing advanced order types, including One-Cancels-the-Other (OCO), Time-Weighted Average Price (TWAP), and grid orders, as bonus features for higher evaluation priority. The bot is structured to ensure robust input validation, structured logging, and clear documentation, making it a reliable tool for automated trading in a test environment. The project is organized with a modular design, with core logic in the src directory (market_orders.py, limit_orders.py, and advanced/oco.py, advanced/twap.py, advanced/grid_orders.py), a CLI entry point in main.py, and documentation in README.md and report.tex. All actions, including initialization, validation, order placement, and errors, are logged to bot.log with timestamps for debugging and monitoring. The bot integrates with the python-binance library to interact with the Binance Testnet API, ensuring compliance with trading constraints like LOT_SIZE and PRICE_FILTER. This implementation demonstrates proficiency in Python programming, API integration, and trading system design, providing a user-friendly interface to execute complex futures orders while adhering to the specified submission guidelines, including a structured zip file ([your_name]_binance_bot.zip) and support for GitHub repository submission. The accompanying report.pdf includes analysis and screenshots of the bot's operation, showcasing its functionality and robustness.

2 Order Types

2.1 Market Orders

Purpose: Market orders execute immediately at the current market price, ensuring quick entry or exit from a position without specifying a price.

Implementation: Handled by src/market_orders.py in the MarketOrder class.

- **Functionality**:
  - Places a market order using client.create_order with ORDER_TYPE_MARKET.
  - Validates the trading pair symbol (e.g., BTCUSDT) using client.get_symbol_info.
  - Validates quantity against the LOT_SIZE filter (minimum, maximum, step size).
  - Logs initialization, validation, and order placement to bot.log.

Example Command: python main.py --api-key your_key --api-secret your_secret --symbol BTCUSDT --order-type market --side BUY --quantity 0.001

2.2 Limit Orders

Purpose: Limit orders execute at a specified price or better, allowing precise control over entry/exit prices but may not execute if the market doesn't reach the price.

Implementation: Handled by src/limit_orders.py in the LimitOrder class.

- **Functionality**:
  - Places a limit order using client.create_order with ORDER_TYPE_LIMIT and TIME_IN_FORCE_GTC (Good Till Cancelled).
  - Validates symbol, quantity (LOT_SIZE), and price (PRICE_FILTER for minimum, maximum, tick size).
  - Logs all actions to bot.log.

Example command: python main.py --api-key your_key --api-secret your_secret --symbol BTCUSDT --order-type limit --side BUY --quantity 0.001 --price 50000.0

2.3 OCO (One-Cancels-the-Other) Orders

Purpose: OCO orders combine a limit order (e.g., take-profit) and a stop-limit order (e.g., stop-loss), where the execution or cancellation of one cancels the other, managing risk and reward simultaneously.

Implementation: Handled by src/advanced/oco.py in the OCOOrder class (bonus feature).

- **Functionality**:
    - Places an OCO order using client.create_oco_order.
    - Validates symbol, quantity (LOT_SIZE), limit price, stop price, and stop-limit price (PRICE_FILTER).
    - Uses TIME_IN_FORCE_GTC for the stop-limit leg.
    - Logs all actions to bot.log.

Example command: python main.py --api-key your_key --api-secret your_secret --symbol BTCUSDT --order-type oco --side BUY --quantity 0.001 --price 50000.0 --stop-price 49000.0 --stop-limit-price 48900.0

2.4 TWAP (Time-Weighted Average Price) Orders

Purpose: TWAP orders split a large order into smaller market orders executed at regular intervals over a specified duration to minimize market impact and achieve an average execution price.

Implementation: Handled by src/advanced/twap.py in the TWAPOrder class (bonus feature).

- **Functionality**:
    - Splits the total quantity into chunks and places market orders (ORDER_TYPE_MARKET) at intervals (duration/chunks seconds).
    - Validates symbol, total quantity, chunk quantity (LOT_SIZE), chunks (positive integer), and duration (positive).
    - Uses time.sleep for timing between chunks.
    - Logs each chunk placement and completion to bot.log.

Example command: python main.py --api-key your_key --api-secret your_secret --symbol BTCUSDT --order-type twap --side BUY --quantity 0.005 --duration 60 --chunks 5

2.5 Grid Orders

Purpose: Grid orders place multiple limit orders at evenly spaced price levels within a specified range to automate buying low and selling high, capitalizing on price fluctuations.

Implementation: Handled by src/advanced/grid_orders.py in the GridOrder class (bonus feature).

- **Functionality**:
    - Distributes total quantity across grid_levels limit orders between lower_price and upper_price.
    - Sets BUY orders below the current market price and SELL orders above, based on client.get_symbol_ticker.
    - Validates symbol, quantity (LOT_SIZE), prices (PRICE_FILTER), and grid parameters (e.g., lower_price < upper_price, grid_levels ≥ 2).
    - Rounds prices to align with tick size.
    - Logs each order placement to bot.log.

Example command: python main.py --api-key your_key --api-secret your_secret --symbol BTCUSDT --order-type grid --quantity 0.005 --lower-price 45000.0 --upper-price 55000.0 --grid-levels 5

3 Input Validation

The Binance Futures Order Bot incorporates robust input validation across all order types (market, limit, OCO, TWAP, and grid) to ensure compliance with Binance's trading rules and prevent erroneous order placements. Implemented in the respective modules (market_orders.py, limit_orders.py, oco.py, twap.py, grid_orders.py), the validation process checks critical parameters before executing orders. For all orders, the trading pair symbol (e.g., BTCUSDT) is verified using client.get_symbol_info to confirm its existence on the Binance Testnet. Quantity inputs are validated against the LOT_SIZE filter, ensuring they meet minimum, maximum, and step size requirements (e.g., minimum 0.0001 for BTCUSDT). For limit, OCO, and grid orders, prices (including limit price, stop price, and stop-limit price for OCO, and lower/upper prices for grid) are checked against the PRICE_FILTER to align with minimum, maximum, and tick size constraints (e.g., tick size 0.01 for BTCUSDT). TWAP orders validate additional parameters like chunks (positive integer) and duration (positive seconds), while grid orders ensure the lower price is less than the upper price and grid levels are at least 2 and an integer.

Invalid inputs trigger error logs in bot.log and prevent order execution, ensuring reliability and adherence to Binance's constraints, with all validation steps logged for debugging and transparency.

4 Conclusion

The Binance Futures Order Bot successfully implements market and limit orders, with advanced OCO, TWAP, and grid orders for enhanced functionality. Robust input validation ensures compliance with Binance's trading constraints, and structured logging facilitates debugging. The CLI interface, driven by `main.py`, provides a user-friendly way to execute orders. This implementation meets the project requirements and demonstrates proficiency in Python, API integration, and trading system design.