The University of Hong Kong

Department of Computer Science

2024–2025 COMP4801 Final Year Project

Project Plan

A Web Solution for Backtesting and Optimizing Retail Futures Trading

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1. Introduction

Recently, there have been a surge in retail participation in financial markets, be it in the traditional equity trading or the derivatives market, such as futures trading. In 2021, retail investors represented over 47.4% of the total global securities market volume, a rise from 39.6% in 2017, and is expected to account for 48.8% in 2026 [1]. Technological advancements are a key factor of this trend. Contemporary online platforms and mobile apps like Webull, Futu, have made trading more accessible. Concurrently, these online brokerages often offer a low or even zero trading fees with no capital requirements, thereby encouraging more retail market involvement. Furthermore, the COVID-19 pandemic enabled individuals to spend more time at home, leading some to engage in trading as a substitute for gambling [2]. The retails trading market is expected to continue its growth.

Futures trading is characterized by substantial liquidity and volume, critical for accurate backtesting and strategy development. The Futures Industry Association (FIA) reported that overall trading volume in 2023 reached 137.3 billion contracts, standing for a 64% increase from the previous year. This is the sixth consecutive year of record-setting activity in global listed derivatives markets [3]. Futures contracts allow the control of significant positions with very comparative small capital investment, using leverage of approximately 20 times, in contrast to stock trading, which commonly provides typically 2 times leverage. This leverage renders futures trading particularly attractive to retail traders aiming to maximize their investment potential. Additionally, futures encompass a variety of asset classes, including commodities, indices, currency and interest rate, enabling investors to efficiently diversify their portfolios.

1.1. Project Background

This project aims to develop a web-based backtesting solution specifically for futures trading. The platform will enable individuals without any programming knowledges to evaluate their trading strategies utilizing historical market data from the Chicago Mercantile Exchange (CME) in an intuitive user interface, providing comprehensive performance metrics and interactive visualizations.

We provide 3 Backtesting strategies:

1. Default Strategies with Parameter Modification: Users can start with pre-defined strategies, such as the RSI Strategy and BarUpDn Strategy, and adjust parameters to match their needs.
2. Replay Backtesting: This approach, similar to demo trading, allows users to trade with simulated capital. Users can reset the timeline to any historical period to practice trading skills prior to entering the real market. They can simulate situations like the 2008 Financial Situation or the COVID-19 pandemic.
3. Portfolio Backtesting: Modern trading strategies involve diversification across multiple assets to mitigate risk. Our solution makes it possible for individuals to backtest their entire futures profile, focusing not only on profit and loss but additionally on risk management and diversity levels.

1.2. Motivation

1.2.1. Valuable Market

The global derivatives market value reached USD 137.3 billion in 2023 (approximately HKD 1,071 billion) [3]. Retail traders are projected to comprise 48.6% of overall market participants by 2026 [1]. Consequently, we anticipate continued growth in retail involvement in futures trading.

1.2.2. Knowledge Gap Among Retail Traders

Derivatives, especially futures, are complicated financial products associated with significant risks and returns. To prevent retail traders from obsessed with temporary gains while disregarding risks, it is essential to advocate backtesting techniques. This enables traders to practice and fine-tune their strategies prior to entering the real market.

1.2.3. Limitations in Current Platforms

Many online brokerages offer demo trading; nevertheless, they lack comprehensive backtesting capabilities. Platforms like TradingView offer no-code options for backtesting, but its user-interface can be complicated and typically do not support portfolio-wide testing.

1.3. Project Objective

Thereby, considering the expected growth and retail participation in the futures market, the knowledge gap among retail traders, this project targets amateur to intermediate futures investors who wish to trade efficiently without prior expertise. The website application aims:

1. To provide a user-friendly platform that streamlines the backtesting process for users without any programming experience.
2. To educate users on risk management and strategy development through interactive tools and resources.
3. To offer comprehensive portfolio testing features, enabling users to evaluate multiple assets and optimize diversification.

2. Methodologies

The project uses a comprehensive technical stack designed to ensure a seamless and efficient user experience. To enhance frontend development, we utilize ReactJS and Next.js, enabling the creation of a dynamic and responsive interface that facilitates user interaction and accessibility. These technologies provide effective development and server-side capabilities, ensuring lowest latency and optimal performance.

We utilize Node.js with Express and Python (Flask) in the backend to manage API services and data processing. This combination offers a resilient and scalable framework for managing user requests and executing intricate calculations. Flask, a Python framework, is particularly advantageous due to its flexibility and simplicity in installing machine learning models and doing data analytic activities.

Data storage capacity is an essential component of the project, and we utilize a reliable database solution such as Firebase or AWS DynamoDB. These systems offer safe, scalable services for storing extensive historical market data from the Chicago Mercantile Exchange (CME) and user-defined strategies, ensuring data integrity and rapid retrieval times.

To empower users with powerful analytical tools, we implement a range of technical indicators, including Moving Averages, RSI, MACD, and Bollinger Bands. These indicators are essential for analyzing market trends and making informed trading decisions. Furthermore, we calculate key performance metrics, including the Sharpe Ratio, Sortino Ratio, and Maximum Drawdown, which provide a comprehensive assessment of trading strategy performance, risk, and return profiles.

We employ Plotly.js, a premier framework for generating interactive and visually appealing graphs, to visualize backtesting results. This technology enables users to analyze their data through intuitive visualizations, improving their ability to interpret complex results and refine their trading strategies effectively.

3. Expected Deliverables and Project Timeline

Date	Task
September	- Literature Review - Requirements Analysis - Project Planning
October	- Deliverable 1: Project Plan (1/10/2024) - System Design - UI/UX Design
November	- Core Frontend Setup: Set up ReactJS and Next.js environment, Develop basic UI/UX framework
December & January	- User Authentication Module: Implement signup/login features, Secure user data with JWT - Backend Setup: Set up Node.js and Express servers, Develop initial API structure - Data Integration: Connect to Firebase/AWS DynamoDB, Source CME data and ensure accessibility - Default Strategies Implementation: Develop RSI Strategy and BarUpDn Strategy, Allow parameter modification, Implement performance metrics (e.g., Sharpe Ratio, Sortino Ratio) - Deliverable 2: Interim Report (26/1/2025)
February	- Replay Backtesting Development: Enable timeline reset for historical trading - Portfolio Backtesting Features: Implement multi-asset testing
March	- Visualization Development: Use Plotly.js for interactive charts - Refinement and Optimization: Address feedback and improve usability, Optimize system performance - Comprehensive Testing: Conduct unit and integration testing, Perform user testing and gather feedback
April	- Documentation and Finalization: Complete user manuals and technical documentation

	- Deliverable 3: Final Report (21/4/2025) - Deliverable 4: Promotional Video and Poster

4. Reference

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