Algorithmic Trading of Futures via Machine Learning

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Algorithmic trading of securities has become a staple of modern approaches to financial investment. In this project, I attempt to obtain an effective strategy for trading a collection of 27 financial futures based solely on their past trading data. All of the strategies that I consider are based on predictions of the future price and volatility of the various securities under consideration, and so the majority of the effort in this project has been directed toward using machine learning techniques to obtain predictions for future price and volatility. This project was inspired by the Quantiacs futures competition, to which I submitted a number of the trading strategies I obtained during my work on this project.

Introduction

The Contest

The goal of this project was to obtain a high-performing trading strategy for the Quantiacs futures contest [1]. Quantiacs is a quantitative trading platform that invests in crowdsourced trading systems, and connects users trading systems with institutional investors, [sharing] a performance fee with the developer. The Quantiacs futures contest was a competition to obtain a trading strategy which invests in a collection of futures securities and attempts to maximize the Sharpe ratio (a measure of risk-adjusted return) over both a training period (Jan. 1, 2001 Nov. 30, 2014) and a live trading period (Dec. 1, 2014 Jan. 31, 2015). Trading systems are ranked using the minimum of the performance over these two intervals, and the top three performing strategies (determined January 31, 2015) will receive guaranteed minimum

investments ($250,000 for third place, $500,000 for second, and $1,000,000 for first).

The Trading Model

The trading model employed by Quantiacs is somewhat simplified relative to a real-world trading scenario. In particular, the daily closing price is what is used to determine the buying/selling price when orders are placed on a given day, and orders may only be placed once per day. However, the model does include small fees meant to simulate the effects of slippage and trading commissions, and so may offer a relatively realistic trading simulation for relatively long term investment strategies (where trades are being performed on a daily basis, as opposed to high frequency approaches with many trades being performed each second).

The Data

The backtesting data for the contest consisted of approximately 3800 days of trading price and volume data (from Jan. 1, 2001 to the present day) provided by Quantiacs for 27 different futures contracts (including various currencies, precious metals, agricultural products, etc.). More specifically, the data contained the daily high, low, opening, and closing prices, and daily trading volumes over this time period. In addition, the rules of the competition specified that on any given day, the only legal input into the trading strategy was the previous 504 trading days worth of this data for each of the 27 securities under consideration.

The Objective

As mentioned above, the goal in the Quantiacs futures competition is to obtain a trading strategy with opti-

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George H. John

Algorithmic Trading Of Futures Via Machine Learning:

High-performance Algorithmic Trading using Machine Learning Franck Bardol,2025-06-30 DESCRIPTION Machine learning is not just an advantage it is becoming standard practice among top performing trading firms As traditional strategies struggle to navigate noise complexity and speed ML powered systems extract alpha by identifying transient patterns beyond human reach This shift is transforming how hedge funds quant teams and algorithmic platforms operate and now these same capabilities are available to advanced practitioners This book is a practitioner s blueprint for building production grade ML trading systems from scratch It goes far beyond basic return sign classification tasks which often fail in live markets and delivers field tested techniques used inside elite quant desks It covers everything from the fundamentals of systematic trading and ML s role in detecting patterns to data preparation backtesting and model lifecycle management using Python libraries You will learn to implement supervised learning for advanced feature engineering and sophisticated ML models You will also learn to use unsupervised learning for pattern detection apply ultra fast pattern matching to chartist strategies and extract crucial trading signals from unstructured news and financial reports Finally you will be able to implement anomaly detection and association rules for comprehensive insights By the end of this book you will be ready to design test and deploy intelligent trading strategies to institutional standards WHAT YOU WILL LEARN Build end to end machine learning pipelines for trading systems Apply unsupervised learning to detect anomalies and regime shifts Extract alpha signals from financial text using modern NLP Use AutoML to optimize features models and parameters Design fast pattern detectors from signal processing techniques Backtest event driven strategies using professional grade tools Interpret ML results with clear visualizations and plots WHO THIS BOOK IS FOR This book is for robo traders algorithmic traders hedge fund managers portfolio managers Python developers engineers and analysts who want to understand master and integrate machine learning into trading strategies Readers should understand basic automated trading concepts and have some beginner experience writing Python code TABLE OF CONTENTS 1 Algorithmic Trading and Machine Learning in a Nutshell 2 Data Feed Backtests and Forward Testing 3 Optimizing Trading Systems Metrics and Automated Reporting 4 Implement Trading Strategies 5 Supervised Learning for Trading Systems 6 Improving Model Capability with Features 7 Advanced Machine Learning Models for Trading 8 AutoML and Low Code for Trading Strategies 9 Unsupervised Learning Methods for Trading 10 Unsupervised Learning with Pattern Matching 11 Trading Signals from Reports and News 12 Advanced Unsupervised Learning Anomaly Detection and Association Rules Appendix APIs and Libraries for each chapter

Hands-On Machine Learning for Algorithmic Trading Stefan Jansen,2018-12-31 Explore effective trading strategies in real world markets using NumPy spaCy pandas scikit learn and Keras Key FeaturesImplement machine learning algorithms to build train and validate algorithmic modelsCreate your own algorithmic design process to apply probabilistic machine learning approaches to trading decisionsDevelop neural networks for algorithmic trading to perform time series

forecasting and smart analyticsBook Description The explosive growth of digital data has boosted the demand for expertise in trading strategies that use machine learning ML This book enables you to use a broad range of supervised and unsupervised algorithms to extract signals from a wide variety of data sources and create powerful investment strategies This book shows how to access market fundamental and alternative data via API or web scraping and offers a framework to evaluate alternative data You ll practice the ML workflow from model design loss metric definition and parameter tuning to performance evaluation in a time series context You will understand ML algorithms such as Bayesian and ensemble methods and manifold learning and will know how to train and tune these models using pandas statsmodels sklearn PyMC3 xgboost lightgbm and catboost This book also teaches you how to extract features from text data using spaCy classify news and assign sentiment scores and to use gensim to model topics and learn word embeddings from financial reports You will also build and evaluate neural networks including RNNs and CNNs using Keras and PyTorch to exploit unstructured data for sophisticated strategies Finally you will apply transfer learning to satellite images to predict economic activity and use reinforcement learning to build agents that learn to trade in the OpenAI Gym What you will learnImplement machine learning techniques to solve investment and trading problemsLeverage market fundamental and alternative data to research alpha factorsDesign and fine tune supervised unsupervised and reinforcement learning modelsOptimize portfolio risk and performance using pandas NumPy and scikit learnIntegrate machine learning models into a live trading strategy on QuantopianEvaluate strategies using reliable backtesting methodologies for time seriesDesign and evaluate deep neural networks using Keras PyTorch and TensorFlowWork with reinforcement learning for trading strategies in the OpenAI GymWho this book is for Hands On Machine Learning for Algorithmic Trading is for data analysts data scientists and Python developers as well as investment analysts and portfolio managers working within the finance and investment industry If you want to perform efficient algorithmic trading by developing smart investigating strategies using machine learning algorithms this is the book for you Some understanding of Python and machine learning techniques is mandatory **Machine Learning for Algorithmic Trading** Stefan Jansen,2020-07-31 Leverage machine learning to design and back test automated trading strategies for real world markets using pandas TA Lib scikit learn LightGBM SpaCy Gensim TensorFlow 2 Zipline backtrader Alphalens and pyfolio Purchase of the print or Kindle book includes a free eBook in the PDF format Key Features Design train and evaluate machine learning algorithms that underpin automated trading strategies Create a research and strategy development process to apply predictive modeling to trading decisions Leverage NLP and deep learning to extract tradeable signals from market and alternative data Book DescriptionThe explosive growth of digital data has boosted the demand for expertise in trading strategies that use machine learning ML This revised and expanded second edition enables you to build and evaluate sophisticated supervised unsupervised and reinforcement learning models This book introduces end to end machine learning for the trading workflow from the idea and feature engineering to model

optimization strategy design and backtesting It illustrates this by using examples ranging from linear models and tree based ensembles to deep learning techniques from cutting edge research This edition shows how to work with market fundamental and alternative data such as tick data minute and daily bars SEC filings earnings call transcripts financial news or satellite images to generate tradeable signals It illustrates how to engineer financial features or alpha factors that enable an ML model to predict returns from price data for US and international stocks and ETFs It also shows how to assess the signal content of new features using Alphalens and SHAP values and includes a new appendix with over one hundred alpha factor examples By the end you will be proficient in translating ML model predictions into a trading strategy that operates at daily or intraday horizons and in evaluating its performance What you will learn Leverage market fundamental and alternative text and image data Research and evaluate alpha factors using statistics Alphalens and SHAP values Implement machine learning techniques to solve investment and trading problems Backtest and evaluate trading strategies based on machine learning using Zipline and Backtrader Optimize portfolio risk and performance analysis using pandas NumPy and pyfolio Create a pairs trading strategy based on cointegration for US equities and ETFs Train a gradient boosting model to predict intraday returns using AlgoSeek s high quality trades and quotes data Who this book is for If you are a data analyst data scientist Python developer investment analyst or portfolio manager interested in getting hands on machine learning knowledge for trading this book is for you This book is for you if you want to learn how to extract value from a diverse set of data sources using machine learning to design your own systematic trading strategies Some understanding of Python and machine learning techniques is required **Machine Learning and Modeling Techniques in Financial Data Science** Chen, Haojun,2025-01-22 The integration of machine learning and modeling in finance is transforming how data is analyzed enabling more accurate predictions risk assessments and strategic planning These advanced techniques empower financial professionals to uncover hidden patterns automate complex processes and enhance decision making in volatile markets As industries increasingly rely on data driven insights the adoption of these tools contributes to greater efficiency reduced uncertainty and competitive advantage This technological shift not only drives innovation within financial sectors but also supports broader economic stability and growth by improving forecasting and mitigating risks Machine Learning and Modeling Techniques in Financial Data Science provides an updated review and highlights recent theoretical advances and breakthroughs in professional practices within financial data science exploring the strategic roles of machine learning and modeling techniques across various domains in finance It offers a comprehensive collection that brings together a wealth of knowledge and experience Covering topics such as algorithmic trading financial technology FinTech and natural language processing NLP this book is an excellent resource for business professionals leaders policymakers researchers academicians and more **AI's Transformative Impact on Finance, Auditing, and Investment** Ghosn, Fadi,Awad, Ghina,Darwich, Karim,2025-05-29 AI s transformative impact on finance auditing and investment revolutionizes the way financial systems

operate making processes more efficient accurate and data driven In finance AI automates complex tasks like risk assessment fraud detection and predictive analytics allowing firms to make more informed decisions and manage risk with precision In auditing AI tools enhance the ability to analyze large amounts of financial data identifying discrepancies that may have gone unnoticed improving transparency and accountability Investment strategies are reshaped as AI powered algorithms optimize portfolio management forecast market trends and execute trades in real time reducing human error and enabling faster decision making While these advancements offer incredible benefits they also raise concerns about security data privacy and the potential for job displacement in traditional financial roles which requires further exploration AI s Transformative Impact on Finance Auditing and Investment examines how AI technologies are revolutionizing these critical sectors It examines foundational AI concepts including machine learning natural language processing and their applications in risk management fraud detection financial forecasting and audit automation discussing ethics regulatory considerations and future trends This book covers topics such as policymaking data analytics and financial technology and is a useful resource for business owners policymakers economists academicians researchers and data scientists <u>Florida Law Review</u> ,2015 **Using Statistically Implemented Neural Networks to Forecast S & P 500 Futures Contract Prices** Carl Cramer Maier,1996 <u>Advanced Trading Rules</u> Stephen Satchell,Emmanuel Acar,1998 An overview of financial markets trading rules It shows the financial market professional and student how to apply econometrics computer modelling technical and quantitative analysis to financial markets trading Also explained in this text are technical indicators neural networks genetic algorithms quantitative techniques and charts *Bitcoin Pricing. An Empirical Analysis* Andreas Bialek,2019-04-01 Master s Thesis from the year 2018 in the subject Business economics Miscellaneous grade 1 3 University of Hamburg language English abstract In this paper I analyze the relation between daily bitcoin returns and sentiment using a dataset reaching from 2013 to 2018 I find that daily bitcoin returns are not only affected contemporaneous by the bitcoin sentiment measures but also in the next three days while established stock market sentiment measures provide no explanatory power Additionally the negative emotions show return reversal patterns as often observed in sentiment induced mispricing literature resulting in higher returns the next two days after affecting returns negatively today I further find that trading volume affects re turns positively today in the next four days and that it is connected with stock market measures For what I wisdom this is also the first academic research that uses the recently introduced Thomson Reuters MarketPsych Indices on cryptocurrencies **Quantitative Asset Management: Factor Investing and Machine Learning for Institutional Investing** Michael Robbins,2023-06-24 Augment your asset allocation strategy with machine learning and factor investing for unprecedented returns and growth Whether you re managing institutional portfolios or private wealth Quantitative Asset Management will open your eyes to a new more successful way of investing one that harnesses the power of big data and artificial intelligence This innovative guide walks you through everything you need to know to fully leverage these

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