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## KEY=NETWORKS - MATHEWS ULISES

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### NEURAL NETWORKS AND THE FINANCIAL MARKETS

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#### PREDICTING, COMBINING AND PORTFOLIO OPTIMISATION

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Springer Science & Business Media This volume looks at financial prediction from a broad range of perspectives. It covers: - the economic arguments - the practicalities of the markets - how predictions are used - how predictions are made - how predictions are turned into something usable (asset locations) It combines a discussion of standard theory with state-of-the-art material on a wide range of information processing techniques as applied to cutting-edge financial problems. All the techniques are demonstrated with real examples using actual market data, and show that it is possible to extract information from very noisy, sparse data sets. Aimed primarily at researchers in financial prediction, time series analysis and information processing, this book will also be of interest to quantitative fund managers and other professionals involved in financial prediction.

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#### NEURAL NETWORKS IN FINANCE

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##### GAINING PREDICTIVE EDGE IN THE MARKET

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Academic Press This book explores the intuitive appeal of neural networks and the genetic algorithm in finance. It demonstrates how neural networks used in combination with evolutionary computation outperform classical econometric methods for accuracy in forecasting, classification and dimensionality reduction. McNelis utilizes a variety of examples, from forecasting automobile production and corporate bond spread, to inflation and deflation processes in Hong Kong and Japan, to credit card default in Germany to bank failures in Texas, to cap-floor volatilities in New York and Hong Kong. \* Offers a balanced, critical review of the neural network methods and genetic algorithms used in finance \* Includes numerous examples and applications \* Numerical illustrations use MATLAB code and the book is accompanied by a website

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#### FORECASTING FINANCIAL MARKETS USING NEURAL NETWORKS

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##### AN ANALYSIS OF METHODS AND ACCURACY

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This research examines and analyzes the use of neural networks as a forecasting tool. Specifically a neural network's ability to predict future trends of Stock Market Indices is tested. Accuracy is compared against a traditional forecasting method, multiple linear regression analysis. Finally, the probability of the model's forecast being correct is calculated using conditional probabilities. While only briefly discussing neural network theory, this research determines the feasibility and practicality of using neural networks as a forecasting tool for the individual investor. This study builds upon the work done by Edward Gately in his book Neural Networks for Financial Forecasting. This research validates the work of Gately and describes the development of a neural network that achieved a 93.3 percent probability of predicting a market rise, and an 88.07 percent probability of predicting a market drop in the S&P500. It was concluded that neural networks do have the capability to forecast financial markets and, if properly trained, the individual investor could benefit from the use of this forecasting tool.

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#### STOCK MARKET PREDICTION AND EFFICIENCY ANALYSIS USING RECURRENT NEURAL NETWORK

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GRIN Verlag Project Report from the year 2018 in the subject Computer Science - Technical Computer Science, , course: Computer Science, language: English, abstract: Modeling and Forecasting of the financial market have been an attractive topic to scholars and researchers from various academic fields. The financial market is an abstract concept where financial commodities such as stocks, bonds, and precious metals transactions happen between buyers and sellers. In the present scenario of the financial market world,

especially in the stock market, forecasting the trend or the price of stocks using machine learning techniques and artificial neural networks are the most attractive issue to be investigated. As Giles explained, financial forecasting is an instance of signal processing problem which is difficult because of high noise, small sample size, non-stationary, and non-linearity. The noisy characteristics mean the incomplete information gap between past stock trading price and volume with a future price. The stock market is sensitive with the political and macroeconomic environment. However, these two kinds of information are too complex and unstable to gather. The above information that cannot be included in features are considered as noise. The sample size of financial data is determined by real-world transaction records. On one hand, a larger sample size refers a longer period of transaction records; on the other hand, large sample size increases the uncertainty of financial environment during the 2 sample period. In this project, we use stock data instead of daily data in order to reduce the probability of uncertain noise, and relatively increase the sample size within a certain period of time. By non-stationarity, one means that the distribution of stock data is various during time changing. Non-linearity implies that feature correlation of different individual stocks is various. Efficient Market Hypothesis was developed by Burton G. Malkiel in 1991.

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#### **CLASSIFICATION-BASED FINANCIAL MARKETS PREDICTION USING DEEP NEURAL NETWORKS**

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Deep neural networks (DNNs) are powerful types of artificial neural networks (ANNs) that use several hidden layers. They have recently gained considerable attention in the speech transcription and image recognition community for their superior predictive properties including robustness to over fitting. However their application to algorithmic trading has not been previously researched, partly because of their computational complexity. This paper describes the application of DNNs to predicting financial market movement directions. In particular we describe the configuration and training approach and then demonstrate their application to back testing a simple trading strategy over 43 different Commodity and FX future mid-prices at 5-minute intervals. All results in this paper are generated using a C implementation on the Intel Xeon Phi co-processor which is 11.4x faster than the serial version and a Python strategy back testing environment both of which are available as open source code written by the authors.

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#### **NEURAL NETWORK TIME SERIES**

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#### **FORECASTING OF FINANCIAL MARKETS**

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John Wiley & Son Limited Comprehensively specified benchmarks are provided (including weight values), drawn from time series examples in chaos theory and financial futures. The book covers data preprocessing, random walk theory, trading systems and risk analysis. It also provides a literature review, a tutorial on backpropagation, and a chapter on further reading and software.

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#### **FINANCIAL FORECASTING USING ARTIFICIAL NEURAL NETWORKS**

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Despite the extent of a theoretical framework in financial market studies, a vast majority of the traders, investors and computer scientists have relied only on technical and timeseries data for predicting future prices. So far, the forecasting models have rarely incorporated macro-economic and market fundamentals successfully, especially with short-term predictions ranging less than a month. In this investigation on the predictability of certain financial markets, an attempt has been made to incorporate a un-examined and encompassing set of parameters into an Artificial Neural Network prediction system. Experiments were carried out on three market instruments - namely currency exchange rates, share prices and oil prices. The choice of parameters for inclusion or exclusion, and the time frame adopted for the experimental sets were derived from the market literature. Good directional prediction accuracies were achieved for currency exchange rates and share prices with certain parameters as inputs, which consisted of predicting short-term movements based on past movements. These predictions were better than the results produced by a traditional least square prediction method. The trading strategy developed based on the predictions also achieved a higher percentage of winning trades. No significant predictions were observed for oil prices. These results open up questions in the microstructure of the markets and provide an insight into the inputs required for market forecasting in the corresponding time frame, for future investigation. The study concludes by advocating the use of trend based input parameters and suggests ways to improve neural network forecasting models.

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#### **NEURAL NETWORK SOLUTIONS FOR TRADING IN FINANCIAL MARKETS**

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Financial Times Management Offers an alternative technique in forecasting to the traditional techniques used in trading and dealing. The book explains the shortcomings of traditional techniques and shows how neural networks overcome many of the disadvantages of these traditional systems.

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#### **FORECAST OF FINANCIAL MARKETS STOCK PRICES USING NEURAL NETWORKS AND ANFIS**

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The financial market is a very complex nonlinear series of time. There have been a lot of opinions in the topic of the predictability of it. The need to predict a next day, week, or month has always existed for the final purpose of making money. The most common way of forecasting this time series is with statistic methods and linear regression models. However, the use of artificial intelligence algorithms may have a better outcome, due to the capability of them to handle nonlinear data. The present thesis will be focused on evaluating the use of artificial intelligence algorithms as forecasters for financial markets stock prices. Two algorithms will be used, Feed-Forward Neural networks and Adaptive Neuro-Fuzzy Inference Systems (ANFIS). All forecasts are made with the purpose of a short term trading strategy. Three stocks will be used as an example of the consistency of the method; Google, Apple and the Mexican stock ALFA. These three stocks have different distributed data and different behavior from the neural networks and ANFIS is expected.

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#### **FORECASTING INDIAN FINANCIAL MARKETS USING NEURAL NETWORK**

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Serials Publications

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#### **APPLICATION OF NEURAL NETWORKS TO AN EMERGING FINANCIAL MARKET**

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#### **FORECASTING AND TRADING THE TAIWAN STOCK INDEX**

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In the last decade, neural networks have drawn noticeable attention from many computer and operations researchers. While some previous studies have found encouraging results with using this artificial intelligence technique to predict the movements of established financial markets, it is interesting to verify the persistence of this performance in the emerging markets. These rapid growing financial markets are usually characterized by high volatility, relatively smaller capitalization, and less price efficiency, features which may hinder the effectiveness of those forecasting models developed for established markets. In this study, we attempt to model and predict the direction of return on the Taiwan Stock Exchange Index, one of the fastest growing financial exchanges in developing Asian countries. Our approach is based on the notion that trading strategies guided by forecasts of the direction of price movement may be more effective and lead to higher profits. The Probabilistic Neural Network (PNN) is used to forecast the direction of index return after it is trained by historical data. The forecasts are applied to various index trading strategies, of which the performances are compared with those generated by the buy and hold strategy, and the investment strategies guided by the forecasts estimated by the random walk model and the parametric Generalized Methods of Moments (GMM) with Kalman filter. Empirical results show that the PNN-based investment strategies obtain higher returns than other investment strategies examined in this study. The influences of the length of investment horizon and the commission rate are also considered.

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#### **FORECAST STOCK INDEX USING NEURAL NETWORKS AND EVOLUTIONARY COMPUTING**

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LAP Lambert Academic Publishing Forecasting price index is an important problem in financial markets. In the past decades the prediction of stock index has played a vital role in the financial situation of several companies which have stocks in the market. In the past this prediction process was simple and easy for several reasons: the behavior of the stocks was known and not complicated beside the existence of a number of experts in this field. Several techniques are used to predict and model the stock market behavior and try to increase the accuracy of prediction. Neural networks have several characteristics which make them good models to predict the complex behavior of stock index and increase the accuracy of the prediction. Combining neural networks with evolutionary computational methods like Genetic Algorithms and Simulated Annealing can give better results in learning neural networks specially for problem of forecasting stock index.

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### PREDICTION OF STOCK MARKET USING STOCHASTIC NEURAL NETWORKS

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The primary objective of investors and stockbrokers is to make profits by being able to predict the financial markets. However, forecasting is a complex task since the financial markets have a complicated pattern. This study addresses the direction of the stock price index for Japanese Nikkei 225. The research compares two prediction models, i.e., the Stochastic Neural Networks (SNN) and fusion of Long-Short Term Memory and Stochastic Neural Networks (LSTM - SNN) for predicting the index. The input layer includes computation of fifteen technical indicators using stock market parameters (open, high, low, close prices, and volume). Accuracy of each of the prediction models was evaluated using price and trend performance metrics. The evaluation was carried out for historical data from 23rd January 2007 to 30th December 2013 of the Tokyo Stock Exchange (TSE). The experimental outcomes recommend that for the SNN, the model gave an accuracy of 85.37% and hybrid of LSTM - SNN gave accuracy of 86.28%. The increase in the accuracy of LSTM - SNN was due to the introduction of LSTM layer. Experimental outcomes also illustrate that the performance of both the prediction models progress when these technical indicators are added to the input layer of the proposed models.

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### ORDINARY SHARES, EXOTIC METHODS

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### FINANCIAL FORECASTING USING DATA MINING TECHNIQUES

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World Scientific Exotic methods refer to specific functions within general soft computing methods such as genetic algorithms, neural networks and rough sets theory. They are applied to ordinary shares for a variety of financial purposes, such as portfolio selection and optimization, classification of market states, forecasting of market states and data mining. This is in contrast to the wide spectrum of work done on exotic financial instruments, wherein advanced mathematics is used to construct financial instruments for hedging risks and for investment. In this book, particular aspects of the general method are used to create interesting applications. For instance, genetic niching produces a family of portfolios for the trader to choose from. Support vector machines, a special form of neural networks, forecast the financial markets; such a forecast is on market states, of which there are three — uptrending, mean reverting and downtrending. A self-organizing map displays in a vivid manner the states of the market. Rough sets with a new discretization method extract information from stock prices. Contents: Financial Forecasting Problem and Data Mining Techniques Genetic Algorithms and Genetic Niching Portfolio Selection and Optimization Using Genetic Operators The Rough Sets Theory Basics and Its Applications in Economic and Financial Forecasting Time Series Forecasting Using Rough Sets Theory A Review of Support Vector Machines in Regression Estimation Application of Support Vector Machines in Financial Time Series Forecasting Other Methods and Their Applications Readership: Researchers and practitioners in soft computing and artificial intelligence, as well as graduate students in related areas. Keywords:

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### APPLICATION OF NEURAL NETWORKS TO AN EMERGING FINANCIAL MARKET

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### FORECASTING AND TRADING THE TAIWAN STOCK INDEX

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Although there exists some studies which deal with the issues of forecasting stock market index and development of trading strategies, most of the empirical findings are associated with the developed financial markets (e.g., U.S., U.K., and Japan). Currently, many international investment bankers and brokerage firms have major stakes in overseas markets. Given the economic success of Taiwan in the last two decades, the financial markets in this Asian country have attracted considerable global investments. Our study models and predicts the TSE Index using neural networks. Their performance is compared with that of parametric forecasting approaches, namely the Generalized Methods of Moments (GMM) and random walk. These rapidly growing financial markets are usually characterized by high volatility, relatively smaller capitalization, and less price efficiency, features which may hinder the effectiveness of those forecasting models developed for established markets. The good performance of the PNN suggests that the neural network models are useful in predicting the direction of index returns. Furthermore, PNN has demonstrated a stronger predictive power than both the GMM-Kalman filter and the random walk forecasting models. This superiority is partially attributed to PNN's ability to identify outliers and erroneous data. Compared to the other two parametric techniques examined in this study, PNN does not require any assumption of the underlying probability density functions of the class populations. The trading experiment shows that the PNN-guided trading strategies obtain higher profits than the other investment strategies utilizing the market direction generated by the parametric forecasting methods. In addition, the PNN-guided trading with multiple triggering thresholds is generally better than the one with single triggering thresholds. The multiple threshold version is able to consider the degree of certainty of a particular PNN classification and thereby reduce potential loss in the market.

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### NEURAL NETWORKS IN FINANCE AND INVESTING

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### USING ARTIFICIAL INTELLIGENCE TO IMPROVE REAL-WORLD PERFORMANCE

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Irwin Professional Publishing Many believe that neural networks will eventually out-perform even the best traders and investors, yet this extraordinary technology remained largely inaccessible to practitioners--prior to this landmark text. Nowhere else will you find such a thorough and relevant examination of the applications and potential of this cutting-edge technology. This book not only contains many examples of neural networks for prediction and risk assessment, but provides promising systems for forecasting and explaining price movements of stocks and securities. Sections include neural network overview; analysis of financial condition; business failure prediction; debt risk assessment; security market applications; and neural network approaches to financial forecasting.

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### PRICAI 2014: TRENDS IN ARTIFICIAL INTELLIGENCE

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### 13TH PACIFIC RIM INTERNATIONAL CONFERENCE ON ARTIFICIAL INTELLIGENCE, PRICAI 2014, GOLD COAST, QLD, AUSTRALIA, DECEMBER 1-5, 2014, PROCEEDINGS

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Springer This book constitutes the refereed proceedings of the 13th Pacific Rim Conference on Artificial Intelligence, PRICAI 2014, held in Gold Coast, Queensland, Australia, in December 2014. The 74 full papers and 20 short papers presented in this volume were carefully reviewed and selected from 203 submissions. The topics include inference; reasoning; robotics; social intelligence. AI foundations; applications of AI; agents; Bayesian networks; neural networks; Markov networks; bioinformatics; cognitive systems; constraint satisfaction; data mining and knowledge discovery; decision theory; evolutionary computation; games and interactive entertainment; heuristics; knowledge acquisition and ontology; knowledge representation, machine learning; multimodal interaction; natural language processing; planning and scheduling; probabilistic.

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### BUILDING NEURAL NETWORKS

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Addison-Wesley Professional This practical introduction describes the kinds of real-world problems neural network technology can solve. Surveying a range of neural network applications, the book demonstrates the construction and operation of artificial neural systems. Through numerous examples, the author explains the process of building neural-network applications that utilize recent connectionist developments, and conveys an understanding both of the potential, and the limitations of different network models. Examples are described in enough detail for you to assimilate the information and then use the accumulated experience of others to create your own applications. These examples are deliberately restricted to those that can be easily understood, and recreated, by any reader, even the novice practitioner. In some cases the author describes alternative approaches to the same application, to allow you to compare and contrast their advantages and disadvantages. Organized by application areas, rather than by specific network architectures or learning algorithms, Building Neural Networks shows why certain networks are more suitable than others for solving specific kinds of problems. Skapura also reviews principles of neural information processing and furnishes an operations summary of the most popular neural-network processing models. Finally, the book provides information on the practical aspects of application design, and contains six topic-oriented chapters on specific applications of neural-network systems. These applications include networks that perform: Pattern matching, storage, and recall Business and financial systems Data extraction from images Mechanical process control systems New neural networks that combine pattern matching with fuzzy logic The book includes application-oriented exercises that further help you see how a neural network solves a problem, and that reinforce your understanding of modeling techniques. 0201539217B04062001

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### STOCK MARKET PREDICTION USING ARTIFICIAL NEURAL NETWORKS

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Advances in telecommunication and software technologies have changed the way that securities are traded on the stock market. Algorithmic trading, which is also referred to as automated or black box trading, accounts for a large percentage of orders placed in the

market, especially after the year 2000. It provides investors with many benefits such as reduced transaction costs, higher accuracy and speed, anonymity, transparency, and also access to different markets. Yet, it has a few limitations including lack of intelligence and lack of adaptability to the market conditions. Algorithms execute blindly what they are trained without having the capability to distinguish different conditions in the market. Such weaknesses make it vulnerable to unforeseen events like market crises, which may result in a large amount of loss. For example, on May 6th, 2010, the Dow Jones Industrial Average fell 600 points in about five minutes that led to a loss of \$600 billion in the market value of US corporate stocks. A large number of researchers attribute that crash to algorithmic trading orders, which were not intelligent enough to find out the financial crisis. Algorithms should be able to determine when to place different orders such as buy and sell, and more importantly algorithms through supervised learning processes is of great importance to algorithmic trading. In this thesis, a new algorithmic based on value trading is proposed to identify when to place, buy, sell, or stop orders. After classifying the order into those three categories, an Artificial Neural Network (ANN) with three layers, input, hidden, and the output is used to learn from previous trades. The ANN has five neurons in the input layer, ten neurons in the hidden layer, and three neurons in the output layer and is used to learn from the past patterns and make predictions for the future. In the last phase, the learning performance measures including accuracy, precision, recall, and F-score are measured.

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#### FINANCIAL PREDICTION USING NEURAL NETWORKS

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Itp - Media Focusing on approaches to performing trend analysis through the use of neural nets, this book compares the results of experiments on various types of markets, and includes a review of current work in the area. It appeals to students in both neural computing and finance as well as to financial analysts and academic and professional researchers in the field of neural network applications.

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#### NEURAL NETWORKS IN FINANCE AND INVESTING

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#### USING ARTIFICIAL INTELLIGENCE TO IMPROVE REAL-WORLD PERFORMANCE

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Irwin Professional Publishing This completely updated version of the classic first edition offers a wealth of new material reflecting the latest developments in the field. For investment professionals seeking to maximize this exciting new technology, this handbook is the definitive information source.

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#### USING ARTIFICIAL NEURAL NETWORKS FOR TIMESERIES SMOOTHING AND FORECASTING

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#### CASE STUDIES IN ECONOMICS

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Springer Nature The aim of this publication is to identify and apply suitable methods for analysing and predicting the time series of gold prices, together with acquainting the reader with the history and characteristics of the methods and with the time series issues in general. Both statistical and econometric methods, and especially artificial intelligence methods, are used in the case studies. The publication presents both traditional and innovative methods on the theoretical level, always accompanied by a case study, i.e. their specific use in practice. Furthermore, a comprehensive comparative analysis of the individual methods is provided. The book is intended for readers from the ranks of academic staff, students of universities of economics, but also the scientists and practitioners dealing with the time series prediction. From the point of view of practical application, it could provide useful information for speculators and traders on financial markets, especially the commodity markets.

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#### PATTERN LEARNING VIA ARTIFICIAL NEURAL NETWORKS FOR FINANCIAL MARKET PREDICTIONS

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Convolutional neural networks (CNN) and long short-term memory (LSTM) networks have become a staple of sequence learning. Due to the well-established fact that financial time series data exhibit exceptionally noisy characteristics, capital market anomalies are virtually impossible to detect. We deploy CNN networks for predicting out-of-sample stock movements for 200 high-volume European stocks from 1994 until 2014, and compare its overall performance with a modified LSTM model as in Fischer, Krauss (2017). Specifically, we compare empirical training and validation accuracies of both model architectures and reveal portfolio performance characteristics in terms of return and risk metrics for different portfolio sizes, trying to derive common patterns within the top and flop stocks. Thus, we unveil sources of long-term profitability and demonstrate, that both LSTM and CNN networks are able to extract meaningful information from such noisy financial time series.

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#### IMPLEMENTING DEEP NEURAL NETWORKS FOR FINANCIAL MARKET PREDICTION ON THE INTEL XEON PHI

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Deep neural networks (DNNs) are powerful types of artificial neural networks (ANNs) that use several hidden layers. They have recently gained considerable attention in the speech transcription and image recognition community (Krizhevsky et al., 2012) for their superior predictive properties including robustness to overfitting. However their application to financial market prediction has not been previously researched, partly because of their computational complexity. This paper describes the application of DNNs to predicting financial market movement directions. A critical step in the viability of the approach in practice is the ability to effectively deploy the algorithm on general purpose high performance computing infrastructure. Using an Intel Xeon Phi co-processor with 61 cores, we describe the process for efficient implementation of the batched stochastic gradient descent algorithm and demonstrate a 11.4x speedup on the Intel Xeon Phi over a serial implementation on the Intel Xeon.

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#### NEURAL NETWORKS FOR FINANCIAL FORECASTING

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Wiley Succinctly explains how neural networks function, what they can accomplish as well as how to use, construct and apply them for maximum profit. Selecting what is to be predicted and choosing proper inputs, deciding on the best network architecture, training, and algorithms are among the topics discussed. Highlights examples of successful networks. Numerous graphs and spreadsheets are used to illustrate concepts. The appendix features lists of neural network suppliers, useful publications and more.

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#### EMPIRICAL ASSET PRICING

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#### MODELS AND METHODS

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MIT Press An introduction to the theory and methods of empirical asset pricing, integrating classical foundations with recent developments. This book offers a comprehensive advanced introduction to asset pricing, the study of models for the prices and returns of various securities. The focus is empirical, emphasizing how the models relate to the data. The book offers a uniquely integrated treatment, combining classical foundations with more recent developments in the literature and relating some of the material to applications in investment management. It covers the theory of empirical asset pricing, the main empirical methods, and a range of applied topics. The book introduces the theory of empirical asset pricing through three main paradigms: mean variance analysis, stochastic discount factors, and beta pricing models. It describes empirical methods, beginning with the generalized method of moments (GMM) and viewing other methods as special cases of GMM; offers a comprehensive review of fund performance evaluation; and presents selected applied topics, including a substantial chapter on predictability in asset markets that covers predicting the level of returns, volatility and higher moments, and predicting cross-sectional differences in returns. Other chapters cover production-based asset pricing, long-run risk models, the Campbell-Shiller approximation, the debate on covariance versus characteristics, and the relation of volatility to the cross-section of stock returns. An extensive reference section captures the current state of the field. The book is intended for use by graduate students in finance and economics; it can also serve as a reference for professionals.

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#### FOREIGN-EXCHANGE-RATE FORECASTING WITH ARTIFICIAL NEURAL NETWORKS

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Springer Science & Business Media This book focuses on forecasting foreign exchange rates via artificial neural networks (ANNs), creating and applying the highly useful computational techniques of Artificial Neural Networks (ANNs) to foreign-exchange rate forecasting. The result is an up-to-date review of the most recent research developments in forecasting foreign exchange rates coupled with a highly useful methodological approach to predicting rate changes in foreign currency exchanges.

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## MACHINE LEARNING AND AI IN FINANCE

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Routledge The significant amount of information available in any field requires a systematic and analytical approach to select the most critical information and anticipate major events. During the last decade, the world has witnessed a rapid expansion of applications of artificial intelligence (AI) and machine learning (ML) algorithms to an increasingly broad range of financial markets and problems. Machine learning and AI algorithms facilitate this process understanding, modelling and forecasting the behaviour of the most relevant financial variables. The main contribution of this book is the presentation of new theoretical and applied AI perspectives to find solutions to unsolved finance questions. This volume proposes an optimal model for the volatility smile, for modelling high-frequency liquidity demand and supply and for the simulation of market microstructure features. Other new AI developments explored in this book includes building a universal model for a large number of stocks, developing predictive models based on the average price of the crowd, forecasting the stock price using the attention mechanism in a neural network, clustering multivariate time series into different market states, proposing a multivariate distance nonlinear causality test and filtering out false investment strategies with an unsupervised learning algorithm. Machine Learning and AI in Finance explores the most recent advances in the application of innovative machine learning and artificial intelligence models to predict financial time series, to simulate the structure of the financial markets, to explore nonlinear causality models, to test investment strategies and to price financial options. The chapters in this book were originally published as a special issue of the Quantitative Finance journal.

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## ARTIFICIAL NEURAL NETWORKS

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### APPLICATIONS IN FINANCIAL FORECASTING

Createspace Independent Publishing Platform Neural networks are state-of-the-art, trainable algorithms that emulate certain major aspects in the functioning of the human brain. This gives them a unique, self-training ability, the ability to formalize unclassified information and, most importantly, the ability to make forecasts based on the historical information they have at their disposal. Neural networks have been used increasingly in a variety of business applications, including forecasting and marketing research solutions. In some areas, such as fraud detection or risk assessment, they are the indisputable leaders. The major fields in which neural networks have found application are financial operations, enterprise planning, trading, business analytics and product maintenance. Neural networks can be applied gainfully by all kinds of traders, so if you're a trader and you haven't yet been introduced to neural networks, we'll take you through this method of technical analysis and show you how to apply it to your trading style. Neural networks have been touted as all-powerful tools in stock-market prediction. Companies such as MJ Futures claim amazing 199.2% returns over a 2-year period using their neural network prediction methods. They also claim great ease of use; as technical editor John Sweeney said in a 1995 issue of "Technical Analysis of Stocks and Commodities," "you can skip developing complex rules (and redeveloping them as their effectiveness fades) . . . just define the price series and indicators you want to use, and the neural network does the rest."

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## ARTIFICIAL INTELLIGENCE IN FINANCIAL MARKETS

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### CUTTING EDGE APPLICATIONS FOR RISK MANAGEMENT, PORTFOLIO OPTIMIZATION AND ECONOMICS

Springer As technology advancement has increased, so to have computational applications for forecasting, modelling and trading financial markets and information, and practitioners are finding ever more complex solutions to financial challenges. Neural networking is a highly effective, trainable algorithmic approach which emulates certain aspects of human brain functions, and is used extensively in financial forecasting allowing for quick investment decision making. This book presents the most cutting-edge artificial intelligence (AI)/neural networking applications for markets, assets and other areas of finance. Split into four sections, the book first explores time series analysis for forecasting and trading across a range of assets, including derivatives, exchange traded funds, debt and equity instruments. This section will focus on pattern recognition, market timing models, forecasting and trading of financial time series. Section II provides insights into macro and microeconomics and how AI techniques could be used to better understand and predict economic variables. Section III focuses on corporate finance and credit analysis providing an insight into corporate structures and credit, and establishing a relationship between financial statement analysis and the influence of various financial scenarios. Section IV focuses on portfolio management, exploring applications for portfolio theory, asset allocation and optimization. This book also provides some of the latest research in the field of artificial intelligence and finance, and provides in-depth analysis and highly applicable tools and techniques for practitioners and researchers in this field.

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## DEEP LEARNING WITH PYTHON

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Simon and Schuster Summary Deep Learning with Python introduces the field of deep learning using the Python language and the powerful Keras library. Written by Keras creator and Google AI researcher François Chollet, this book builds your understanding through intuitive explanations and practical examples. Purchase of the print book includes a free eBook in PDF, Kindle, and ePub formats from Manning Publications. About the Technology Machine learning has made remarkable progress in recent years. We went from near-unusable speech and image recognition, to near-human accuracy. We went from machines that couldn't beat a serious Go player, to defeating a world champion. Behind this progress is deep learning—a combination of engineering advances, best practices, and theory that enables a wealth of previously impossible smart applications. About the Book Deep Learning with Python introduces the field of deep learning using the Python language and the powerful Keras library. Written by Keras creator and Google AI researcher François Chollet, this book builds your understanding through intuitive explanations and practical examples. You'll explore challenging concepts and practice with applications in computer vision, natural-language processing, and generative models. By the time you finish, you'll have the knowledge and hands-on skills to apply deep learning in your own projects. What's Inside Deep learning from first principles Setting up your own deep-learning environment Image-classification models Deep learning for text and sequences Neural style transfer, text generation, and image generation About the Reader Readers need intermediate Python skills. No previous experience with Keras, TensorFlow, or machine learning is required. About the Author François Chollet works on deep learning at Google in Mountain View, CA. He is the creator of the Keras deep-learning library, as well as a contributor to the TensorFlow machine-learning framework. He also does deep-learning research, with a focus on computer vision and the application of machine learning to formal reasoning. His papers have been published at major conferences in the field, including the Conference on Computer Vision and Pattern Recognition (CVPR), the Conference and Workshop on Neural Information Processing Systems (NIPS), the International Conference on Learning Representations (ICLR), and others. Table of Contents PART 1 - FUNDAMENTALS OF DEEP LEARNING What is deep learning? Before we begin: the mathematical building blocks of neural networks Getting started with neural networks Fundamentals of machine learning PART 2 - DEEP LEARNING IN PRACTICE Deep learning for computer vision Deep learning for text and sequences Advanced deep-learning best practices Generative deep learning Conclusions appendix A - Installing Keras and its dependencies on Ubuntu appendix B - Running Jupyter notebooks on an EC2 GPU instance

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## PREDICTING STOCK PRICES IN DUBAI FINANCIAL MARKET USING NEURAL NETWORKS AND POLYNOMIAL CLASSIFIERS

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"This thesis is based on technical analysis of stock prices movement in an emerging market: Dubai Financial Market (DFM). The historical prices of three active companies were used as the data to the intelligent systems developed in this study, namely, neural networks and polynomial classifiers."--Abstract, p. iv.

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## ARTIFICIAL INTELLIGENCE FOR FINANCIAL MARKETS

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### THE POLYMODEL APPROACH

Springer Nature This book introduces the novel artificial intelligence technique of polymodels and applies it to the prediction of stock returns. The idea of polymodels is to describe a system by its sensitivities to an environment, and to monitor it, imitating what a natural brain does spontaneously. In practice this involves running a collection of non-linear univariate models. This very powerful standalone technique has several advantages over traditional multivariate regressions. With its easy to interpret results, this method provides an ideal preliminary step towards the traditional neural network approach. The first two chapters compare the technique with other regression alternatives and introduces an estimation method which regularizes a polynomial regression using cross-validation. The rest of the book applies these ideas to financial markets. Certain equity return components are predicted using polymodels in very different ways, and a genetic algorithm is described which combines these different predictions into a single portfolio, aiming to optimize the portfolio returns net of transaction costs. Addressed to investors at all levels of experience this book will also be of interest to both seasoned and non-seasoned statisticians.

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## APPLICATIONS OF ARTIFICIAL NEURAL NETWORKS IN FINANCIAL MARKET FORECASTING

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### FINANCIAL PREDICTION FOR COMMODITIES MARKET USING NEURAL NETWORKS

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#### A NEURAL NETWORK MODEL FOR PREDICTING STOCK MARKET PRICES

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LAP Lambert Academic Publishing Stock exchanges are considered major players in the financial sector of many countries. In such exchanges, it is Stockbrokers who execute stock trade deals and advise clients on where to invest. Most of these Stockbrokers use technical, fundamental or time series analysis in trying to predict future stock prices, so as to advise clients on appropriate investments. However, these strategies do not usually guarantee good returns because they guide on trends and not the most likely trade price of a future date. It is therefore necessary to explore improved methods of prediction. The research uses Artificial Neural Network (ANN) that is feedforward multi-layer perceptron (MLP) with error backpropagation to develop a model ANN of configuration 5:21:21:1 using 80% data for training in 130,000 cycles. The research then develops a prototype and tests it using 2008-2012 data from various stock markets, such as the Nairobi Securities Exchange (NSE) and New York Stock Exchange (NYSE). Results showed that the model predicted prices with MAPE of 0.71% to 2.77%. Validation done using Neuroph & Encog showed close RMSE. The model can therefore be used in any typical stock market predict.

#### PERFORMANCE ANALYSIS OF ARTIFICIAL NEURAL NETWORKS IN FORECASTING FINANCIAL TIME SERIES

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"Forecasting stock prices is of critical importance for investors who wish to reduce investment risks. Forecasting is based on the idea that stock prices move in patterns. So far, it is understood that developed, emerging, and frontier markets have different general characteristics. Subsequently, this research uses design of experiments (DOE) to study the significance and behavior of artificial neural networks (ANN) design parameters and their effect on the performance of predicting movement of developed, emerging, and frontier markets. In this study, each classification is represented by two market indices. The data is based on Morgan Stanley Country Index (MSCI), and includes the indices of UAE, Jordan, Egypt, Turkey, Japan, and UK. Two designed experiments are conducted where 5 neural network design parameters are varied between two levels"--Abstract.

### INTELLIGENT SYSTEMS AND APPLICATIONS

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#### PROCEEDINGS OF THE 2019 INTELLIGENT SYSTEMS CONFERENCE (INTELLISYS) VOLUME 1

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Springer Nature The book presents a remarkable collection of chapters covering a wide range of topics in the areas of intelligent systems and artificial intelligence, and their real-world applications. It gathers the proceedings of the Intelligent Systems Conference 2019, which attracted a total of 546 submissions from pioneering researchers, scientists, industrial engineers, and students from all around the world. These submissions underwent a double-blind peer-review process, after which 190 were selected for inclusion in these proceedings. As intelligent systems continue to replace and sometimes outperform human intelligence in decision-making processes, they have made it possible to tackle a host of problems more effectively. This branching out of computational intelligence in several directions and use of intelligent systems in everyday applications have created the need for an international conference as a venue for reporting on the latest innovations and trends. This book collects both theory and application based chapters on virtually all aspects of artificial intelligence; presenting state-of-the-art intelligent methods and techniques for solving real-world problems, along with a vision for future research, it represents a unique and valuable asset.