A list of the table of contents for back issues of the Journal of Computational Intelligence in Finance (formerly NeuroVest Journal) is provided, covering Vol.1, No.1 (September/October 1993) to the present.

See "http://ourworld.compuserve.com/homepages/ftpub/order.htm" for details on ordering back issue volumes (Vols. 1 and 2 are out of print, Vols. 3, 4, 5, 6 and 7 currently available).

***

September/October 1993
Vol.1, No.1

A Primer on Market Forecasting with Neural Networks (Part1) 6
Mark Jurik
The first part of this primer presents a basic neural network example, covers backpropagation, back-percolation, a market forecasting overview, and preprocessing data.

A Fuzzy Expert System and Market Psychology: A Primer (Part 1) 10
James F. Derry
The first part of this primer describes a market psychology example, and looks at fuzzifying the data, making decisions, and evaluating and/or connectives.

Fuzzy Systems and Trading 13
(The editors)
A brief overview of fuzzy logic and variables, investing and trading, and neural networks.

Predicting Stock Price Performance: A Neural Network Approach 14
Youngohc Yoon and George Swales
This study looks at neural network (NN) learning in a comparison of NN techniques with multiple discriminant analysis (MDA) methods with regard to the predictability of stock price performance. Evidence indicates that the network can improve an investor’s decision-making capability.

Selecting the Right Neural Network Tool 19
(The editors)
The pros, cons, user type and cost for various forms of neural network tools: from programming languages to development shells.

Product Review: Brainmaker Professional, version 2.53 20
Mark R. Thomason
The journal begins the first of its highly-acclaimed product reviews, beginning with an early commercial neural network development program.

FROM THE EDITOR 2
INFORMATION EXCHANGE forums, bulletin board systems and networks 4
NEXT-GENERATION TOOLS product announcements and news 23
QUESTIONNAIRE 26

***

November/December 1993
Vol.1, No.2

Guest Editorial: Performance Evaluation of Automated Investment Systems 3
Yuval Lirov
The author addresses the issue of quantitative systems performance evaluation.

Performance Evaluation Overview 4
(The editors)

A Primer on Market Forecasting with Neural Networks (Part2) 7
Mark Jurik
The second part of this primer covers data preprocessing and brings all of
the components together for a financial forecasting example.

A Fuzzy Expert System and Market Psychology: A Primer (Part 2) 12
James F. Derry
The second part of this primer describes several decision-making methods using an example of market psychology based on bullish and bearish market sentiment indicators.

Selecting Indicators for Improved Financial Prediction 16
Manoel Tenorio and William Hsu
This paper deals with the problem of parameter significance estimation, and its application to predicting next-day returns for the DM-US currency exchange rate. The authors propose a novel neural architecture called SupNet for estimating the significance of various parameters.

Selecting the Right Neural Network Tool (expanded) 21
(the editors)
A comprehensive list of neural network products, from programming language libraries to complete development systems.

Product Review: NeuroShell 2 25
Robert D. Fiori
An early look at this popular neural network development system, with support for multiple network architectures and training algorithms.

FROM THE EDITOR 2
NEXT-GENERATION TOOLS product announcements and news 28
QUESTIONNAIRE 31

***
January/February 1994
Vol.2, No.1
Title: Chaos in the Markets

Guest Editorial: Distributed Intelligence Systems 5
James Bowen
Addresses some of the issues relevant to hybrid approaches to capital market decision support systems.

Designing Back Propagation Neural Networks: A Financial Predictor Example 8
Jeannette Lawrence
This paper first answers some of the fundamental design questions regarding neural network design, focusing on back propagation networks. Rules are proposed for a five-step design process, illustrated by a simple example of a neural network design for a financial predictor.

Estimating Optimal Distance using Chaos Analysis 14
Mark Jurik
This article considers the application of chaotic analysis toward estimating the optimal forecast distance of futures closing prices in models that process only closing prices.

Sidebar on Chaos Theory and the Financial Markets 19
(the editors) [included in above article]

A Fuzzy Expert System and Market Psychology (Part 3) 20
James Derry
In the third and final part of this introductory level article, the author discusses an application using four market indicators, and discusses rule separation, perturbations affecting rule validity, and other relational operators.

Book Review: Neural Networks in Finance and Investing 23
Randall Caldwell
A review of a recent title edited by Robert Trippi and Efraim Turban.
Product Review: Genetic Training Option
Mark Thomason
Review of a product that works with BrainMaker Professional.

FROM THE EDITOR
OPEN EXCHANGE  letters, comments, questions
CONVERGENCE  news, announcements, errata
NEXT-GENERATION TOOLS  product announcements and news
QUESTIONNAIRE

March/April 1994
Vol.2, No.2
Title: A Framework

IJCNN '93
Francis Wong
A review of the International Joint Conference on Neural Networks recently held in Nagoya, Japan on matters of interest to our readers.

Guest Editorial:  A Framework of Issues: Tools, Tasks and Topics
Mark Thomason
Issues relevant to the subject of the journal are extensive. Our guest editorial proposes a means of classifying and organizing them for the purpose of gaining perspective.

Lexicon and Beyond: A Definition of Terms
Randall Caldwell
To assist readers new to certain technologies and theories, we present a collection of definitions for certain technologies and theories that have become a part of the language of investors and traders.

A Method for Determining Optimal Performance Error in Neural Networks
Mark Jurik
The popular approach to optimizing neural network performance solely on its ability to generalize on new data is challenged. A new method is proposed.

Feedforward Neural Network and Canonical Correlation Models as Approximators with an Application to One-Year Ahead Forecasting
Petier Otter
How do neural networks compare with two classical forecasting techniques based on time-series modeling and canonical correlation? Structure and forecasting results are presented from a statistical perspective.

A Fuzzy Expert System and Market Psychology: (Listings for Part 3)
James Derry
Source code for the last part of the author’s primer is provided.

Book Review: State-of-the-Art Portfolio Selection
Randall Caldwell

Product Review: Braincel version 2.0
John Payne
A new version of a low-cost neural network product is reviewed with an eye on applying it in the financial arena.

FROM THE EDITOR
OPEN EXCHANGE  letters, comments, questions
CONVERGENCE  news, announcements, errata
NEXT-GENERATION TOOLS  product announcements and news
QUESTIONNAIRE
May/June 1994
Vol.2, No.3
Title: Special Topic: Neural and Fuzzy Systems

Guest Editorial: Neurofuzzy Computing Technology  8
Francis Wong
The author presents an example neural network and fuzzy logic hybrid system, and explains how integrating these two technologies can help overcome the drawbacks of the other.

Neurofuzzy Hybrid Systems  11
James Derry
A large number of systems have been developed using the combination of neural network and fuzzy logic technologies. Here is an overview on several such systems.

Interpretation of Neural Network Outputs using Fuzzy Logic  15
Randall Caldwell
Using basic spreadsheet formulas, a fuzzy expert system is applied to the task of interpreting multiple outputs from a neural network designed to generate signals for trading the S&P 500 index.

Thoughts on Desirable Features for a Neural Network-based Financial Trading System  19
Howard Bandy
The authors covers some of the fundamental issues faced by those planning to develop a neural network-based financial trading system, and offers a list of features that you might want to look for when purchasing a neural network product.

Selecting the Right Fuzzy Logic Tool  23
(the editors)
Adding to our earlier selection guide on neural networks, we provide a list of fuzzy logic products along with a few hints on which ones might most interest you.

A Suggested Reference List: Recent Books of Interest  25
(the editors)
In response to readers' requests, we present a list of books, some of which you will want to have for reference.

Product Review: CubiCalc Professional 2.0  28
Mark Thomason
A popular, fuzzy logic tool is reviewed. Is the product ready for investors and traders? The answer may be somewhat fuzzy itself.

FROM THE EDITOR  5
OPEN EXCHANGE letters, comments, questions  6
CONVERGENCE news, announcements, errata  7
NEXT-GENERATION TOOLS product announcements and news  31

July/August 1994
Vol.2, No.4
Title: Special Topic: Neural and Genetic Systems

Guest Editorial: Neurogenetics and its use in Trading System Development  8
Jeffrey Katz and Donna McCormick
The authors discuss some of the differences between standard neural technology and neurogenetics, and present a basic example of how an S&P trading system might be developed using neurogenetics.

Neurogenetic Computing Technology  12
Francis Wong
Genetic algorithms can be usefully applied to the optimization of neural networks for forecasting and classification problems. The author discusses
this general application area along with a specific financial application.

An Introduction to Genetic Algorithms: A Mutual Fund Screening Example
Richard J. Bauer, Jr.
The basic mechanics of genetic algorithms are covered. A mutual fund screening example is used to illustrate the process and to suggest ways in which the technology might be used to explore various trading strategies.

Selecting the Right Genetic Algorithm Tool
(9he editors)
Adding to our earlier selection guides on neural networks and fuzzy logic products, we provide a list of genetic algorithm products along with a few hints on which ones might most interest you.

Nonlinear Trading System Costs: Dollars and Time
Mark Thomason

The Neurophyte Column: Elements of Interest to the Novice

Book Reviews: Three Books on Time Series Forecasting
M. Edward Borasky

Product Review: MicroGA
Steven Swernofsky
A genetic algorithm product for developing applications in C++ is reviewed. It runs on the PC and the Mac, and includes an interesting C++ code generator.

FROM THE EDITOR

OPEN EXCHANGE letters, comments, questions
CONVERGENCE news, announcements, errata
MUSINGS OF NOTE
NEXT-GENERATION TOOLS product announcements and news
COMING UP IN FUTURE ISSUES Back Cover

***
September/October 1994
Vol.2, No.5
Title: Special Topic: Neural Network Design

Guest Editorial: A Neural Network Project Roadmap
James E. Bowen
An overview of relevant issues and considerations of neural network development projects at a systems level.

Design of Neural Network-based Financial Forecasting Systems:
Data Selection and Data Processing
Randall Caldwell
An in-depth review of two tasks critical to neural network design are presented, including metrics, parameters, and concerns of interest to investors and traders.

Design Issues in Neural Network Development
Peter C. Davies
The author addresses several fundamental considerations to be made, during the design phase of a project, when developing a neural network application.

Neural Network-based Trading System Design:
Prediction and Measurement Tasks
Howard B. Bandy
A discussion of four closely-related tasks fundamental to the design of a neural network-based trading system is provided, along with a spreadsheet implementation of a profitability tester.
Applying Nonlinear Financial Tools: Getting Started 33
Mark R. Thomason

The Neurophyte Column: Elements of Interest to the Novice

Book Review: Trading on the Edge 35
Sandy Warrick
The reviewer looks at a new, ambitious book, edited by Guido Deboeck, that describes a wide variety of new technologies and techniques currently being applied to the world's markets.

FROM THE EDITOR 4
OPEN EXCHANGE letters, comments, questions 5
CONVERGENCE news, announcements, errata 6
MUSINGS OF NOTE reflections on the literature 25
NEXT-GENERATION TOOLS product announcements and news 39
COMING UP IN FUTURE ISSUES Back Cover

***
November/December 1994
Vol.2, No.6
Title: Neural Network Implementation

Implementation Issues in Neural Network Development 7
Peter C. Davies
This article addresses several fundamental considerations to be made, during the implementation phase of a project, when developing a neural network application.

Discriminant Analysis Versus Neural Networks in Credit Scoring 11
R.J. van Eyden and J.J.L. Cronje
The authors implementation of a neural network for comparison with multiple discriminant analysis, using a financial application.

Selecting the Right Neural Network Tool 16
(the editors)
In support of the task of implementation, we provide an update to our popular guide to neural network products, along with comment on how readers might select the one most appropriate for them.

A Basic Neural Network-based Trading System Development Project #1 23
Mark Thomason

Product Review: AIM for Windows 28
Howard B. Bandy
The Reviewer looks at a modeling product that often compares itself with neural networks, and provides an analysis of its performance using a financial time series.

Book Reviews: Two recent book on finance and advanced technologies 32
Mark R. Thomason
Two recent single-author titles of particular interest to most readers are reviewed, one on neural networks and one on genetic algorithm. "Neural Network Time Series Forecasting of Financial Markets" by E. Michael Azoff, and "Genetic Algorithms and Investment Strategies" by Richard J. Bauer, Jr.

FROM THE EDITOR 4
OPEN EXCHANGE letters, comments, questions 5
CONVERGENCE news, announcements, errata 6
MUSINGS OF NOTE reflections on the literature 22
INFFC update on the First International Nonlinear Financial Forecasting Competition 36
NEXT-GENERATION TOOLS product announcements and news 37
BACK ISSUES 39
COMING UP IN FUTURE ISSUES Back Cover
Extracting Meaning from a Neural Network
E. Michael Azoff
A method for performing weight perturbation differential analysis as a more
accurate approach than simple weight magnitude analysis is provided. This
supports the claim that the black box tag often attached to neural networks
by newcomers to the field is not an inherent property of the technology.

Induction: Learning Rules From Data (Part 1)
James F. Derry
The author embarks on the task of extracting expertise from databases for
the purpose of market analysis and forecasting, offering insight into a
useful tool that may have been overlooked by many investors.

Secondary Pre-processing
John Payne
A method for performing a second stage of neural network pre-processing is
suggested, using a group of standard functions (squares, square roots and
logarithms). The results are tested for empirical evidence of the usefulness
of the method.

A Basic Neural Network-based Trading System Development Project #2
Mark Thomason

The Neurophyte Column: Elements of Interest to the Novice

An Index to NEUROVEST JOURNAL: September 1993 to December 1994
Indexed by general topics is the material published in the Journal to date.

Product Review: Propagator for Windows
Howard B. Bandy
An inexpensive, stand alone, neural network development system based on the
backpropagation algorithm is reviewed. What are the high and low points of
this addition to the commercial neural network product base?

Book Review: An Introduction to the Bootstrap
Mark R. Thomason
A book by the inventor of a method for estimating distributions, parameters
and error rates is reviewed, including suggestions as to why the method is
relevant to investors and traders.

FROM THE EDITOR: a competitive task
OPEN EXCHANGE letters, comments and questions
CONVERGENCE news, announcements, addenda, errata
MUSINGS OF NOTE reflections on the literature
INFFC update on the First International Nonlinear Financial Forecasting
Competition
NEXT-GENERATION TOOLS product announcements and news
BACK ISSUES
COMING UP IN FUTURE ISSUES Back Cover

March/April 1995
Vol.3, No.2
Title: Special Focus: Performance Metrics

NNCM-94
Ypke Hiemstra
A review of the Neural Networks in the Capital Markets workshop held last
year in Pasedena, California on matters of interest to our readers.

Monitoring Forecast Performance Using the Breakeven Locus
E. Michael Azoff
A method for visual, qualitative analysis of trading system performance is
presented, including a practical example of its application.

Performance Metrics for Neural Network-based Trading System Development 13
Randall B. Caldwell
An overview of prediction, neural network, and financial forecasting performance metrics and methods is presented, along with strategies for their application to neural network-based trading system development.

A Basic Neural Network-based Trading System Development Project #3 25
Mark R. Thomason
The Neurophyte Column: Elements of Interest to the Novice

The Stochastics Indicator: A New Perspective Using Neural Networks 31
Randall B. Caldwell
Technical Analytica: Technical Market Analysis and Insight

Product Review: Neuralyst for Windows 36
Howard B. Bandy
The latest version of this popular neural network development system, which functions as an Excel add-in, is reviewed. New features include genetic algorithms and trading system tools.

Randall B. Caldwell
One of the few books to focus exclusively on the design and testing of trading systems is reviewed in light of this issue’s special focus on the subject of performance metrics.

FROM THE EDITOR performance metrics 4
OPEN EXCHANGE letters, comments and questions 5
CONVERGENCE news, announcements, addenda, errata 6
MUSINGS OF NOTE reflections on the literature 24
REVIEWS IN BRIEF NeuroForecaster 4.0, The New Technical Trader 40
NEXT-GENERATION TOOLS product announcements and news 41
BACK ISSUES 43
COMING UP IN FUTURE ISSUES Back Cover

***
May/June 1995
Vol.3, No.3
Title: Special Topic: Chaos in the Markets

Meeting of the Society for Nonlinear Dynamics and Econometrics 7
Robert McClelland
A review of the 1995 SNDE meeting in New York on matters of interest to our readers.

A Direct Approach to Forecasting Stock Equities using Nonlinear Dynamics Modeling 8
Bernard V. Kessler
The first part of an introductory overview of the application of nonlinear dynamics (NLD) and chaos theory to the prediction of stock market equity prices is presented.

A Neural Network Supports the Chaotic Paradigm for the S&P 500 Index 16
Mary E. Malliaris
Challenging the efficient market hypothesis and supporting those who claim that they have found statistical evidence that a chaotic dynamics structure underlies the market, this paper constructs a neural network which lends support to the deterministic paradigm.

Chaos and Prediction Horizons in Silver Futures Trading 22
Ted W. Frison
The dynamical structure of a silver futures contract is determined. The system has chaotic like behavior, the evidence coming from the Lyapunov exponents.
A Basic Neural Network-based Trading System Development Project #4
Mark R. Thomason
The Neurophyte Column: Elements of Interest to the Novice

Product Reviews: Three Products on Chaos from the Academic Software Library
Mark R. Thomason
Three introductory-level software tools on chaos analysis and demonstrations are reviewed from a supplier of educational physics-related software. Chaos Data Analyzer, Dynamics Workbench, and Chaos Demonstrations

Book Review: Fractal Market Analysis
Sandy Warrick
The follow-up to the popular title Chaos and Order in the Capital Markets is reviewed in light of its author’s continuing study of chaotic financial market behavior.

FROM THE EDITOR  chaos in the markets
OPEN EXCHANGE  letters, comments and questions
CONVERGENCE  news, announcements, addenda, errata
MUSINGS OF NOTE  reflections on the literature
REVIEWS IN BRIEF  Profiting from Chaos, Chaos Theory in the Financial Markets
NEXT-GENERATION TOOLS  product announcements and news
BACK ISSUES
COMING UP IN FUTURE ISSUES

Title: Going on Three

Supervised Evolution of the Neural Trader Component of a Stock Portfolio Trading System (Part 1)
David L. March
A method is described for adjusting neural network weights in situations where there is no advance knowledge about the correspondence between the network input and output, and where the target objective or profit function is stepwise instead of continuous.

Induction: Learning Rules From Data (Part 2)
James F. Derry
The author completes his report on extracting expertise from databases for the purpose of market analysis and forecasting, offering insight into a potentially useful tool that may have been overlooked by many investors.

The Adaptive Moving Average
Howard B. Bandy
In this issue of Technical Analytica the details of constructing and applying adaptive moving averages to trading are described, along with explicit mathematical and spreadsheet formulas.

A Basic Neural Network-based Trading System Development Project #5
Mark R. Thomason
The Neurophyte column continues with details on training and selecting best networks, this time completing the prediction component of the system.

User Survey ’95: Results
A summary of the results to our first survey of readers regarding commercial neural network products for financial applications is presented.

Product Review: Pattern Recognition Workbench
Howard B. Bandy
A new high-end neural network development system for the professional is reviewed with an eye towards its application to finance.
Two recent titles on neural networks, both of which include C++ software on disk, are separately reviewed. "Advanced Algorithms for Neural Networks" by Timothy Masters, and "Neural Network and Fuzzy Logic Applications in C/C++" by Stephen Welstead.

FROM THE EDITOR going on three
OPEN EXCHANGE letters, comments and questions
CONVERGENCE news, announcements, addenda, errata
MUSINGS OF NOTE reflections on the literature
REVIEWS IN BRIEF NeuroShell 2 v.2, Momentum Data on CD-ROM
INFFC an update on the First International Nonlinear Financial Forecasting Competition
NEXT-GENERATION TOOLS product announcements and news
BACK ISSUES
COMING UP IN FUTURE ISSUES Back Cover

***

September/October 1995
Vol.3, No.5
Title: Special Topic: Anything but Backpropagation

Neural Networks in Finance: Design and Applications, Louvain-la-Neuve, Belgium
Eric de Bodt
An overview of a recent seminar on neural networks in finance is presented.

Backpropagation versus Conjugate Gradient Training Methods
Paul A. Billings
An alternative to backpropagation, with less critical "user-tunable" parameters, is discussed. Benchmarks are generated to compare these two algorithms for training multilayer perceptrons.

The General Regression Neural Network
Timothy Masters
An objective and intuitive look at the details of a neural network, as a modification to probabilistic networks to allow for function mapping. Both its strengths and weaknesses are discussed.

Supervised Evolution of the Neural Trader Component of a Stock Portfolio Trading System (Part 2)
David L. March
The author completes his 2-part report on neural network traders with detailed examples on applying the methods presented earlier to stock portfolio trading.

Improved Prediction Performance Metrics for Neural Network-based Financial Forecasting Systems
Randall B. Caldwell
This paper presents a study of traditional and new measures for comparing the prediction performance of neural network-based trading systems. Results reported will be of significant interest to trading system developers using neural networks.

Generating Principal Components using TimeStat
James Hampton
In this issue of Technical Analytica, the details for using a new freeware product to generate principal components are described.

A Basic Neural Network-based Trading System Development Project #6
Mark R. Thomason
The Neurophyte column continues with details on training and selecting best networks, this time completing the prediction component of the system.

Product Review: Neural Network Tutor
Randall B. Caldwell
A new, unique product on learning neural networks is reviewed, including a
look at its built-in neural network simulator.

FROM THE EDITOR  anything but backpropagation                              4
OPEN EXCHANGE  letters, comments and questions                              5
CONVERGENCE  news, announcements, addenda, errata                          6
MUSINGS OF NOTE  reflections on the literature                              28
REVIEWS IN BRIEF  the new science of technical analysis, virtual trading    38
ESSAY AWARD CONTEST  congratulating the winner of our first award           39
NEXT-GENERATION TOOLS  product announcements and news                      41
BACK ISSUES

A Resource List:
Software, Books and Articles on Principal Components Analysis            7
(the editors)
In response to reader requests, we provide a resource on the subject.

Input Variable Set Diversity and a Neural Network's
Financial Forecasting Ability                                             8
Andrew A. Kramer
This paper explores the ability of three different sets of input variables to
predict a biotechnology stock index, and compares the results using both
multilayer feedforward and generalized regression neural networks.

An Explicit Feature Selection Strategy for
Predictive Models of the S&P 500 Index                                     14
Tim Chenoweth and Zoran Obradovic
This paper focuses on the selection of an appropriate set of features for a
feedforward neural network model used to predict both future market direction
and future returns for the S&P 500 Index. Daily and monthly predictions of
returns and market direction are analyzed.

Three Methods of Neural Network Sensitivity Analysis for
Input Variable Reduction: A Case Study in Forecasting the
S&P 500 Index (Part 1)                                                     22
Randall B. Caldwell
This paper examines three commonly-applied sensitivity analysis methods using
a financial forecasting problem for the S&P 500 index as an example.
Preliminary results indicate that financial practitioners and researchers
should consider the use of alternative sensitivity metrics to those commonly
employed.

The Fast Fourier Transform for Analyzing
Financial Time Series                                                     26
James Hampton
In this issue of Technical Analytica, the author addresses the processing
steps necessary to apply FFTs to time series analysis by financial
practitioners. Issues regarding the stationarity and persistence of market
cycles are addressed. An approach to using FFTs and cyclic market
information as part of a data selection strategy for neural networks applied
to forecasting the Dow Jones 20-Bond Average index is presented.

Product Review: GeneHunter                                                34
Howard B. Bandy
A new, genetic algorithm add-in product for Excel is reviewed with the
financial practitioner in mind.

Book Reviews: Bayesian Forecasting and Artificial Life                   38
James Hampton
Two books on entirely different subjects are reviewed for their relevance to
trading and investing. "Applied Bayesian Forecasting and Time Series
Analysis" by Andy Pole et al., and "Artificial Life: An Overview" by
Christopher Langton.
INFFC Update 7
A summary of preliminary results of the first International Nonlinear
Financial Forecasting Competition is presented.

Forecasting the 30-year U.S. Treasury Bond with a
System of Neural Networks 10
Wei Cheng, Lorry Wagner, and Chien-Hua Lin
A forecasting model based on a system of artificial neural networks is
used to predict the direction of the 30-Year U.S. Treasury Bond on a weekly
basis. This paper describes the methods used for data selection, training
and testing, the basic system architecture, and how the decision model
improved the total system accuracy as compared to individual networks.

Three Methods of Neural Network Sensitivity Analysis for
Input Variable Reduction: A Case Study in Forecasting the
S&P 500 Index (Part 2) 16
Randall B. Caldwell
This paper concludes an examination of three commonly-applied sensitivity
analysis methods using a financial forecasting problem for the S&P 500 index
as an example. Preliminary results indicate that financial practitioners
should consider the use of alternative sensitivity metrics to those commonly
employed.

Rescaled Range Analysis:
Approaches for the Financial Practitioner (Part 1) 23
James Hampton
Technical Analytica: This paper begins an investigation of the application of
rescaled range (R/S) analysis techniques to analyzing financial time series.
An example using the S&P 500 daily index is utilized to illustrate the
material presented.

Principal Components Analysis for Neural Network Input
Variable Reduction and Financial Forecasting (Part 1) 29
Mark R. Thomason
The Neurophyte: Principal components analysis (PCA) has been successfully
applied to neural network-based systems in finance, particularly in the area
of dimension reduction and input variable selection. This paper presents an
objective analysis of PCA accessible to the financial practitioner and to
the applied researcher interested in exploring financial applications,
providing a foundation for future work on the subject.

James F. Derry
A popular and very readable tutorial on the subject of fuzzy systems,
complete with practical examples and C++ code, is reviewed.

An Index to the NEUROVEST JOURNAL:
September 1993 to December 1995 38
An index for locating past articles and reviews in volumes 1, 2 and 3.
Visualization Tools for Complexity and Finance
(or Looking Before We Leap) 7
James Hampton and Randall Caldwell
Before embarking on the development of new visualization tools for
implementation on advanced visualization platforms, it is important to
briefly review some of the tools and techniques currently available to us,
as practitioners and applied researchers in finance.

An Overview of Data Dimensions and Visualization 14
Brand Fortner
An introductory overview of data dimensions and visualization is presented.
The purpose is to illustrate the following: for all kinds of data, even
financial data, being fully aware of its dimensionality can be very helpful
to visualization and analysis tasks.

Visualization and Neural Network Tools under Linux 21
Kenneth Lin
Hundreds of powerful and useful software programs are available which run
under Linux, a public-domain version of Unix for the Intel x86 platform.
This introductory paper presents information on a few of those programs
which support visualization applications and neural network development.

A Visualization Technique for Selecting
Neural Network Trading Thresholds 25
James Hampton
Trading systems which use neural networks trained to predict future price
variances are often based upon a single pair of crossover thresholds as part
of a trading strategy. This paper proposes a visualization method that can
be used to greatly simplify the task of selecting the most robust yet
profitable trading thresholds based on common risk and reward measures.

Principal Components Analysis for Neural Network Input
Variable Reduction and Financial Forecasting (Part 2) 30
Mark R. Thomason
The Neurophyte: Principal components analysis (PCA) has been successfully
applied to neural network-based systems in finance, particularly in the area
of dimension reduction and input variable selection. This paper presents an
objective analysis of PCA accessible to the financial practitioner and to
the applied researcher interested in exploring financial applications,
providing a foundation for future work on the subject.

Product Review: MatLab and Neural Network Toolbox 35
Mark Thomason
The latest version of a popular program which integrates matrix computation,
numerical analysis, signal processing, data analysis, and graphics into a
common interactive environment is reviewed along with its neural network
add-on toolbox.
Conference Report: CIFEr '96
Mario Bortoli
A report on the second conference on "Computational Intelligence in Financial Engineering.

Applying Neural Networks and Genetic Algorithms to Tactical Asset Allocation
Ypke Hiemstra
Tactical Asset Allocation (TAA) involves the prediction of asset class returns and adjustment of the strategic portfolio. The paper claims that by its very nature the return generating process is nonlinear, and presents a neural network that applies a fundamental approach to predict the S&P500. An optimization model using genetic algorithms exploits the predictions to adjust the strategic portfolio.

Using a Fuzzy Logic Model for Portfolio Insurance of Japanese Stocks
Kay-Hwang and Woon-Seng Gan
In this paper a portfolio insurance strategy based on Nikkei Stock Index Futures is used to insure a portfolio of Japanese Stocks which has the same component stocks as in the Nikkei 225 Stock Index. A new approach using fuzzy logic is developed to decide when to rebalance the replicating portfolio, and is compared with the conventional method which rebalances the portfolio daily.

Rescaled Range Analysis: Approaches for the Financial Practitioner (Part 2)
James Hampton
Technical Analytica: The second part of a paper which investigates the application of rescaled range (R/S) analysis techniques to analyzing financial time series. An example using the S&P 500 daily index is utilized to illustrate the material presented.

Neural Network Input Variable Selection (Revisited)
Mark R. Thomason
The Neurophyte: Methods for selecting variables as inputs to neural networks for financial forecasting purposes represent a subject of considerable interest. This paper briefly elaborates on the topic and discusses the related topics of multicolinearity, degrees of freedom and performance metrics.

Product Review: NeuroGenetic Optimizer
Mark Thomason
The latest version of a neural network development system which uses genetic algorithms to optimize network architectures and input variables is reviewed. The software includes special features for time series prediction.
INFFC Update
Manoel F. Tenorio and Randall B. Caldwell
The latest on the first International Nonlinear Financial Forecasting
Competition, along with final results for the Prediction Strategy entries.

Nonstationary Time-Series Forecasting within a
Neural Network Framework
Sara M. Abecasis and Evangelina S. Lapenta
Modeling and forecasting the behavior of univariate time series with the
back-propagation learning algorithm is presented in this paper.
Nonstationary time series were mapped to stationary ones by the use of the
power transformation. Some success was achieved regarding predictions based
on the validation data samples.

Nonstationary State Space Models for
Multivariate Financial Time Series: An Introduction
Mario Bortoli
A simple class of State Space Models is presented, as black-box, parametric,
stochastic and dynamic models that can be effectively used to describe the
dynamics of nonstationary multivariate time series. A brief comparison
between State Space Models and other techniques (Auto Regressive Integrated
Moving Average, Error Correction Models and Neural Networks) is proposed.
An example for predicting financial time series is presented.

Rescaled Range Analysis:
Approaches for the Financial Practitioner (Part 3)
James Hampton
Technical Analytica: The third part of a paper which investigates the
application of rescaled range (R/S) analysis techniques to analyzing
financial time series. An example using the S&P 500 daily index is utilized
to illustrate the material presented.

An Introduction to Nonstationary Analysis and
Financial Time Series Preprocessing
Mark R. Thomason
The Neurophyte: Reviewed is the procedure of price differencing for
financial time series, its use in conjunction with other preprocessing
techniques, its association with data stationarity in the context of the
time-frequency relationship, along with the autocorrelation function for
analysis. Discussion addresses practical considerations to be made when
applying filtered data as inputs to neural network predictors.

Product Review: Market Skill-Builder
James Hampton
A new tool for developing trading skills within a familiar spreadsheet
environment is reviewed.

FROM THE EDITOR  nonstationary analysis and finance  4
OPEN EXCHANGE  letters, comments and questions  5
CONVERGENCE  news, announcements, addenda, errata  6
REVIEWS IN BRIEF  39
a friendly guide to wavelets
resampling stats
MUSINGS OF NOTE  reflections on the literature  40
NEXT-GENERATION TOOLS  product announcements and news  41
COMING UP IN FUTURE ISSUES  Back Cover

***
September/October 1996
Vol.4, No.5
Title: On Non-Traditional Tools

Regime Signaling Techniques for
Non-Stationary Time-Series Forecasting
Radu Drossu and Zoran Obradovic
An accuracy-based signaling technique as an alternative to statistics-based
signaling for detecting changes in a time series distribution is proposed. The validity of the proposed technique is evaluated in the context of either low-noise or high-noise, non-stationary time series.

Comparing Conventional and Artificial Neural Network Models for the Pricing of Options on Futures 16
Paul Lajbcygier, Christopher Boek, Andrew Filtman and Marimuthu Palaniswami
Pricing of American-style options on futures is compared using conventional models and artificial neural networks. The conventional models used in the evaluation are the Black-Scholes, the modified Black and the Barone-Adesi/Whaley models, while the alternative considered are feedforward artificial neural networks.

Rescaled Range Analysis: Approaches for the Financial Practitioner (Part 4) 24
James Hampton
Technical Analytica: The final part of a paper which investigates the application of rescaled range (R/S) analysis techniques to analyzing financial time series. The series concludes with a discussion on applying local Hurst estimates as inputs to neural network-based financial forecasters.

Selecting the Right Neural Network Tool — Third Edition 33
(the editors)
Our first update on commercial neural network products in almost two years is presented. Results from our survey of vendors indicate that, though there are a few new players, the overall number has substantially decreased.

FROM THE EDITOR on non-traditional tools 4
OPEN EXCHANGE letters, comments and questions 5
CONVERGENCE news, announcements, addenda, errata 6
REVIEWS IN BRIEF 38
artificial intelligence in finance & investing
neural networks in finance and investing
modelquest
neuroclassifier
MUSINGS OF NOTE reflections on the literature 40
NEXT-GENERATION TOOLS product announcements and news 41
COMING UP IN FUTURE ISSUES Back Cover

November/December 1996
Vol.4, No.6
Title: Predictors Anonymous

Neural Network Model Development and Optimization 7
Costas Siriopoulos and Raphael N. Markellos
This paper is concerned with applying artificial neural network (ANN) models in forecasting financial time series. The methodology includes a model development and optimization stage and the translation of forecasts into investment timing decisions. Performance is evaluated in terms of both statistical and economic significance. The use of BDS and R/S analysis results for ANN modelling is explored.

Qualitative Information in Finance:
Natural Language Processing and Information Extraction 14
Marco Costantino, Russell J. Collingham and Richard G. Morgan
This article describes the importance of qualitative information in the financial operators' investment decision-making process and how natural language processing can be successfully used for processing and analyzing such information. Natural language processing is briefly compared to other artificial intelligence techniques which are widely employed in finance: neural networks and expert systems.

Rough Sets Help Time the OEX 20
Chris Skalkos
Technical Analytica: This paper describes an application of rough sets
analysis to trading the OEX. Using rough sets techniques, a set of rules for short-term trading the OEX based on the Hines indicator is extracted. A system is then developed, encompassing all of the derived rules, in order to evaluate trading system performance.

Application of Wavelet Filters to Non-Stationary Financial Time Series
Mark R. Thomason

The Neurophyte: This paper proposes an application of the discrete wavelet transform to the processing of nonstationary data within the context of financial time series analysis and prediction. Shortcomings, limitations and advantages of wavelets, with respect to filtering financial time series for prediction applications, are discussed.

Product Review: ThinksPro
Mark R. Thomason

A new comprehensive neural network development system, with features for time series analysis and an abundance of network options and parameters, is reviewed.

FROM THE EDITOR predictions anonymous 4
OPEN EXCHANGE letters, comments and questions 5
CONVERGENCE news, announcements, addenda, errata 6
REVIEWS IN BRIEF pattern recognition and prediction with applications to signal characterization wavelet toolbox for matlab an introduction to neural networks an introduction to genetic algorithms MUSINGS OF NOTE reflections on the literature 43
NEXT-GENERATION TOOLS product announcements and news 44
COMING UP IN FUTURE ISSUES Back Cover

A Neural-Fuzzy System for Financial Forecasting
Zuohong Pan, Xiaodi Liu and Olugbenga Mejabi
This paper introduces a hybrid Neural-Fuzzy system for financial modeling and forecasting. The model's performance is compared with a random walk model, an ARIMA model, a regression model corrected for autocorrelation, a regression corrected for autoregressive conditional heteroskedasticity, and a regression model corrected for both autocorrelation and ARCH. The power and predictive ability of the models are evaluated on the basis of mean absolute error, root mean squared error, turning point prediction, pattern recognition, correlation between output pattern and actual pattern, and conditional efficiency.

A New Neural Network for Nonlinear Time-Series Modeling
Amir Hussain, John J.Soraghan and Tariq S. Durrani
This paper describes a new two-layer linear-in-the-parameters feedforward network termed the Functionally Expanded Neural Network (FENN). The new structure can be considered to be a hybrid neural network incorporating to a variable extent the combined modeling capabilities of the conventional Multi-Layered Perceptron (MLP), Radial Basis Function (RBF) and Volterra Neural Networks (VNN) structures. Simulated chaotic Mackey-Glass time series and real-world noisy, highly non-stationary sunspot and actual stock market time series data are used to illustrate the superior modeling and prediction performance of the FENN compared with other recently reported, more complex feedforward and recurrent neural network based predictor models.
The Pricing and Trading of Options using a Hybrid Neural Network Model with Historical Volatility
Paul Lajbcygier, Andrew Fillman, Anthony Swan and Rob Hyndman
The residuals between conventional option pricing models and market prices have persistent patterns or biases. The "hybrid" method models the residuals using an artificial neural network. The pricing accuracy of the hybrid method is demonstrated on real data using the Australian All Ordinaries Share Price Index options on futures and is compared with all major competing conventional models. The hybrid method is found to be both statistically and economically superior to the conventional models alone.

A First Multi-Network Hybrid for Financial Forecasting
Mark R. Thomason
The Neurophyte: A basic approach to designing and analyzing multi-network hybrids for financial forecasting is presented. The hybrid consists of the combination of three MLP neural networks using simple linear combining techniques. Several market indicators are used as network input variables to forecast weekly S&P 500 prices at different horizons. The prediction and trading performance of the hybrid network is compared with that of the individual networks and a buy-and-hold trading strategy.

Product Review: The Financial Toolbox
Mark R. Thomason
A new toolbox from the maker of MatLab is reviewed with the interests of practitioners and applied researchers in finance in mind.

FROM THE EDITOR  hybrid neural networks for financial forecasting
OPEN EXCHANGE  letters, comments and questions
CONVERGENCE  news, announcements, addenda, errata
MUSINGS OF NOTE  reflections on the literature
REVIEWS IN BRIEF  advances in knowledge discovery and data mining
NEXT-GENERATION TOOLS  product announcements and news
COMING UP IN FUTURE ISSUES

March/April 1997
Vol.5, No.2
Title: In Search of a Discipline

Forecasting the CHF-USD Exchange Rates using Neural Networks
Jingtao Yao, Yili Li and Chew Lim Tan
A study of using neural networks to predict the exchange rates between Swiss Francs and American Dollars. Results show that a simple backpropagation-trained network with efficient learning and a simple set of technical indicators as inputs serves well as a predictive model. Issues on the frequency of sampling, choice of network architecture, forecasting periods, and measures for evaluating the model's predictive power are discussed.

Improving Decision-Making in the Financial Markets with the Probabilistic Neural Network Paradigm
Mike P. Foscolos and Sujinda Nilchan
This paper demonstrates the probabilistic neural network to be theoretically and practically the most suitable neural network algorithm for financial decision-making. The authors compare the decision-making ability of the probabilistic algorithm with the commonly-applied standard backpropagation algorithm and decisions formulated by fundamental financial analysts.

Time Synchronization of Technical Indicators as Model Inputs
James Hampton
Technical Analytica: Published reports on techniques applied in support of cycle analysis, technical analysis, and leading/lagging indicators often rely on the frequently subjective interpretation of charts and charting methods, and the existence of persistent, periodic market characteristics. Here, several issues are reviewed regarding phase and the time
synchronization of variables applied to data-driven financial systems.

Financial Forecasting with Wavelet Filters and Neural Networks 27
Mark R. Thomason
The Neurophyte: Band-pass filters based on wavelets for pre-processing inputs to neural network-based financial forecasters are studied. Results are compared with simple high-pass and low-pass filters. Results indicate that, for the dataset and test period studied, the wavelet filters provide improvement over the benchmark filters when used with neural networks for forecasting the S&P 500 Index.

Product Review: WAVEWISE Market Spreadsheet and Data Server 36
Edward Weiss
The new version of this spreadsheet application, with features specifically designed for data manipulation, market analysis and testing trading systems, is considered.

FROM THE EDITOR in search of a discipline 4
OPEN EXCHANGE letters, comments and questions 5
CONVERGENCE news, announcements, addenda, errata 6
REVIEWS IN BRIEF 39
analysis of observed chaotic data
neural network design
NEXT-GENERATION TOOLS product announcements and news 40
MUSINGS OF NOTE reflections on the literature 40
COMING UP IN FUTURE ISSUES Back Cover

May/June 1997
Vol.5, No.3
Title: Special Topic: Data Mining for Financial Applications

Database Mining/Knowledge Discovery in Financial Databases: An Overview 5
James F. Derry
An overview of database mining methods and implementations is presented. Of interest are financial applications in the areas of investing, trading, stock selection and portfolio optimization. The use of software agents for searching financial information on the Internet are addressed.

Sidebar: Rough Sets, Rough Neurons, Induction and Data Mining #2 10
Edward Weiss

Self-Organizing Data Mining for a Portfolio Trading System 12
Frank Lemke and Johann-Adolf Mueller
This paper describes the application of data mining algorithms for a portfolio trading system. Parametric models are adaptively created from data by the Group Method of Data Handling (GMDH) in the form of networks of optimized transfer functions. Nonparametric models are selected from a given variable set by analog complexing, representing one or more patterns of a trajectory of past behavior which are analogous to a chosen reference pattern. The trading system simulates trading a portfolio of diverse stocks using daily out-of-sample price data.

A Qualitative Approach to Pattern Identification for Financial Data Mining 27
Mirko Dohnal
This paper considers Interest Rate (IR) and Purchasing Rate (PR) models as two methods for forecasting exchange rates. An integrated model is created by merging IR and PR models using qualitatively-degraded conventional equations. Lists of all possible qualitative scenarios are generated as part of the case study presented in this paper. Qualitative scenarios result in the development of transition graphs, which capture all possible transitions between the scenarios. Since transition graphs provide insight into possible future market behavior, qualitative modelling can provide a tool for financial forecasting.
Title: Practice versus Research

Company Viability Prediction using Neural Networks with Sparse Data

Jeroen van Bussel and Leo P.J. Veelenturf

In research related to neural networks, the quantity of data is often restricted with respect to its dimension. This shortage of data occurs in problems such as the forecasting of the financial condition of a company. This paper describes the prediction of company viability using neural networks. Because of the large dimensional input space and limited datasets, three methods were examined for reducing the dimension of the input.

Predicting Deterministic Chaotic Time Series

Tim S. Hatamian

Auto-regressive (AR) linear prediction is a method commonly used to forecast the future values for a time series generated by a linear-stationary system. Extension of the method to (stationary) nonlinear systems requires a bit of non-trivial work. The basic derivation of these methods and several examples are discussed in the context of forecasting stock or futures prices.

The ABC's of BDS

Kenneth Lin

The BDS statistic represents a widely-used modern tool for testing serial dependence in a time series. It has demonstrated capabilities for detecting serial correlation even in difficult chaotic time series where others methods fail. It can thus be an effective tool for determining the forecastability of a time series. A very brief guide to the BDS test along with examples and software is presented.

Market Volatility as a Leading Indicator

James Hampton

Technical Analytica

Residual Analysis for Neural Network Financial Predictors: An Introduction

Mark R. Thomason

The Neurophyte

Product Review: Neural Connection

Edward Weiss
An Appraisal of Various Linear and Nonlinear Methods Utilized for Combining Neural Network Predictors: A Practitioner's Perspective

Robert J. Van Eyden

Seeing a phenomenon once does not mean it is de facto or de rigour. However, multiple observations can lead to the conclusion that it is to be expected or may be considered a natural consequence. The same notions hold for time series forecasting especially in the financial markets where the data is inherently noisy. In this arena, reliance on a single neural network result could be deemed unacceptable. This study seeks to combine the results of a collection of neural network forecasters in various manners to determine the best combination method for forecasting the South African long bond rates.

Modelling the Merval Index with Neural Networks and the Discrete Wavelet Transform

Sara M. Abecasis and Evangelina S. Lapenta

The crux of this research is the evaluation of the effectiveness of a neural network implementation for modelling the share prices of the Argentine stock index named Merval, taking into account the influence of different indices of the New York Stock Exchange. Four methods of sensitivity analysis and the Discrete Wavelet Transform are considered. Different metrics were applied for the purpose of determining the performance of the neural networks implemented.

Neural Network Approximation of Option-Pricing Formulas for Analytically Intractable Option-Pricing Models

Michael Hanke

A new method which combines numerical approximation techniques and artificial neural networks is used to approximate formulas for option prices and derivatives. Using this method, highly precise analytical formulas can be derived for option types (American, Asian, binaries,...) and models (GARCH, stochastic volatility,...) that are otherwise analytically intractable. Using the formulas derived according to this new approach, option prices and greeks under these models can be computed instantaneously.

The Construction of Risk-Adjusted Returns as Target Variables

James Hampton

Technical Analytica

A Primer on Radial Basis Function Networks for Financial Forecasting

Mark R. Thomason

The Neurophyte

Product Reviews: The Options Toolbox The Black-Scholes and Beyond Interactive Toolkit

Mark R. Thomason
November/December 1997
Vol.5, No.6
Title: On the Science of Finance

Backtesting Trading Systems
Raphael N. Markellos
Several procedures are described that can be used to assess the historical performance of trading systems on the basis of statistical and financial criteria. These procedures range from informal graphical analysis to sophisticated statistical techniques that employ GARCH modelling, cointegration analysis and bootstrapping simulation.

Adaptive Supervised Learning Decision Networks for Trading and Portfolio Management
Lei Xu and Yiu-Ming Cheung
A trading and portfolio management system is proposed, based on an Adaptive Supervised Learning Decision Network, which learns the best past investment decisions directly instead of making predictions first and then making investment decisions based on the predictions. Without any additional effort, this network can be realized directly utilizing any existing adaptive supervised-learning neural network.

Multivariate Embedding Methods: Forecasting High-Frequency Financial Data in the First INFFC
Carol Alexander and Ian Giblin
A forecasting method is described, where each point to be forecast is embedded in an m-dimensional library made from historic data. The approach is based on the well-known 'nearest neighbor' algorithm but there are important differences, including the facility for multivariate embedding, the use of predictor variables which may be different from the embedding variables, and the ‘rolling library’ which is of a constant size but is continuously updated as each successive point is forecast.

Rough Set Theory: The Basics (Part 1)
James Hampton
Technical Analytica

Multicollinearity Revisited
Mark R. Thomason
The Neurophyte

An Index to the Journal
Covering all issues of the Journal to present.

Product Review: ModelQuest Expert
Mark R. Thomason

FROM THE EDITOR on the science of finance
ESSAY AWARD recognizing the winning paper for 1997
REVIEWS IN BRIEF
an introduction to kolmogorov complexity and its applications, 2nd ed.
pattern recognition and neural networks
cyber investing, second edition
OPEN EXCHANGE letters, comments and questions
CONVERGENCE news, announcements, addenda, errata
MUSINGS OF NOTE reflections on the literature
NEXT-GENERATION TOOLS product announcements and news
Wavelet-based Density Estimator Model for Forecasting
Zuohong Pan and Xiaodi Wang
A nonparametric model for financial time series forecasting is presented. To address the issue of generalization in estimation, a density estimator based on wavelets is first established. Then, information in the given data is denoised through wavelet shrinkage to extract the true pattern, while ignoring the disturbing noises.

Exploiting Local Relations as Soft Constraints to Improve Forecasting
Andreas S. Weigend and Hans Georg Zimmermann
This paper introduces a new architecture for the development of predictive models for financial data. On the output side, we predict dynamical variables such as first derivatives and curvatures on different time spans. On the input side, we propose a new internal preprocessing layer connected with a diagonal matrix of positive weights to a layer of squashing functions.

The Use of Parsimonious Neural Networks for Forecasting Financial Time Series
Robert Dorsey and Randall Sexton
A genetic algorithm is used for global search and, by modifying the objective function, is used to simultaneously select a parsimonious structure. The chosen structure often eliminates all connections to unnecessary variables and thus identifies irrelevant variables. Models with the complete architecture are compared to those with the reduced structure. Based on the preliminary model analysis a composite model is constructed.

Adaptive Local Linear Models for Financial Time Series
Claudio Pizzi and Paolo Pellizzari
An adaptive local linear approach to model and forecast financial time series is developed. Local Linear Approximation (LLA) is estimated by a fuzzy weighted regression, where weights are essentially similarities between vectors of lagged observations (patterns). Hence, forecasts are mainly due to patterns that most resemble the vector containing the current observation. The method represents a flexible tool both in modeling nonlinearities and in coping with weak non-stationarities.
Wavelet-Based Feature Extraction and Decomposition Strategies for Financial Forecasting
Alex Aussem, Jonathan Campbell, and Fionn Murtagh
A wavelet decomposition of the original time series, with an adaptation accounting for the time-varying nature of the data, is first carried out to decompose the data into varying scales of temporal resolution. In transform space, a dynamic recurrent neural network (DRNN) is trained to provide five-day ahead forecasts for the S&P500 closing prices.

A Genetic Adaptive Neural Network Approach to Pricing Options: A Simulation Analysis
A. Jay White
This study examines a Genetic Adaptive Neural Network's (GANN) ability to approximate a pre-specified option-pricing function. It is shown that the GANN is able to approximate, to a high degree of accuracy, the complex, nonlinear option-pricing function used to produce the simulated call and put option prices.

Intelligent Stock Trading Decision Support System through the Integration of Artificial Neural Networks and Fuzzy Delphi Models
R.J. Kuo, L.C.Lee and C.F.Lee
Most research on the stock market is limited to the study of quantitative factors, such as price and volume data, instead of qualitative factors, such as political effects. However, qualitative factors play a critical role in the stock market environment. The proposed system consists of four parts: (1) factors collection, (2) a quantitative model, (3) a qualitative model, and (4) a decision integration.

Rough Set Theory: The Basics (Part 3)
James Hampton

Predicting and Trading the Sharpe Ratio
Mark R. Thomason

Product Review: BrainMaker Professional/MMX
James Hampton

Hierarchical and Feed-Forward Fuzzy Logic Systems for Interest Rate Prediction
Masoud Mohammadian, Mark Kingham and Bob Bignall
The development of novel hierarchical and feed-forward fuzzy logic systems using genetic algorithms is discussed. The systems developed are used for the prediction and modelling of fluctuations in interest rates in Australia. A genetic algorithm is proposed as a method for learning the fuzzy rules. The
results from the hierarchical and feed-forward fuzzy logic systems are compared.

Discovering Lawlike Regularities in Financial Time Series 12
Boris Kovalerchuk and Evgenii Vityaev
This paper seeks to discover regularities in financial time series using Machine Methods for Discovering Regularities (MMDR) and a related “discovery” software system. This is accomplished by combining mathematical logic and probability theory in data mining. Discovered regularities were used for forecasting a target variable, represented by the relative difference in percent between today’s closing price for the S&P 500 daily index and the price five days ahead.

Application of Reasoning Neural Networks to Financial Swaps 27
Ray Tsaih, Wei-Kuang Chen and Yi-Ping Lin
This study investigated two learning procedures to see which is better at extracting the trend of asset price movements. One is the Back Propagation learning algorithm, the other is a learning procedure call Reasoning Networks using Back Propagation. For this investigation, the application of these two learning procedures to forecasting the trends of interest-rate swap midrates is considered.

Model Validation by the Bootstrap 38
James Hampton and Edward Weiss
The Practitioner: Method and Tools

Product Review: S-PLUS 4.0 44
Mark R. Thomason

FROM THE EDITOR  on market efficiency and the internet 4
OPEN EXCHANGE  letters, comments and questions 48
CONVERGENCE  news, announcements, addenda, errata 48
REVIEWS IN BRIEF 47
neural network data analysis using simulnet
constructing intelligent agents with java
MUSINGS OF NOTE reflections on the literature 49
NEXT-GENERATION TOOLS product announcements and news 49

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July/August 1998
Vol.6, No.4
Title: Complexity and Dimensionality Reduction in Finance - Part 1

Complexity Reduction for Co-Trending Variables 6
Raphael N. Markellos and Terence C. Mills
Complexity reduction techniques for systems comprising co-trending variables are commonly used by financial practitioners in the form of simple ratios. The construction of ratios and ratio-based forecasting models and be formalized and improved upon using cointegration analysis and error-correction modeling, respectively. This paper reviews these methods and discusses a complexity reduction example in finance.

Forecasting Financial Time Series Using Stacked Generalization 14
James V. Hansen and Ray D. Nelson
This paper explores the efficacy of stacking models that in tandem accomplish data filtering and feature extraction, utilizing methods from both the statistics and machine learning communities. A meta-algorithm is provided along with evidence on reduction in the dimensionality of the search presented to the highest-level generalizer.

Applying Quantitative Representations to Data Mining in Financial Time-Series Databases 25
Xuemei Shi and Man-Chung Chan
One quantitative approach to data mining involves the extraction of general patterns from massive original data in terms of qualitative and linguistic variables. A critical problem associated with applying qualitative representations to time-series data is maintaining linguistic variables which are consistent over time. A new technique is proposed in
Bayesian Ying-Yang Dimension Reduction and Determination
Lei Xu

A new general theory is proposed for dimension reduction and determination (DRD), based on the so-called Bayesian Ying-Yang (BYY) learning theory developed in recent years. Examples presented include (a) a new algorithm for factor analysis in both batch and adaptive modes, (b) criteria for determining the number of factors and the dimension of the PCA subspace, (c) a procedure for implementing a specific nonlinear BYY DRD based on gaussian mixtures, and (d) extensions for auto-association and LMSER-based nonlinear PCA. Some experimental results are provided.

Time Deformation: Definition and Comparisons
Gaelle Le Fol and Ludovic Mercier

The practical importance of time deformation is to give a preprocessing technique to obtain a regularly spaced grid of data. A new trading strategy in which the trading timepoints are endogenous to prices is presented. It is shown that a changing timescale can improve daily gains.

Identifying Irrelevant Input Variables in Chaotic Time Series Problems: Using a Genetic Algorithm for Training Neural Networks
Randall S. Sexton

Because gradient search techniques are incapable of identifying unneeded weights in a solution, researchers have not been able to distinguish contributing inputs from those that are irrelevant. By using a global search technique (the genetic algorithm) for neural network optimization, it is possible to identify unneeded network weights and, thus, irrelevant input variables. This paper demonstrates, through an intensive Monte Carlo study, that the genetic algorithm can be utilized to automatically reduce the dimensionality of neural network models during network optimization.

Reducing Serial Bias of Direction-Oriented Forecasting Metrics
Mark R. Thomason and Randall B. Caldwell

Most financial forecasting performance criteria of practical benefit are functions of market direction. However, performance criteria that reward correct forecasts of market direction will naturally over-estimate performance on datasets that exhibit significant serial dependency in market direction. Here, two of many possible approaches for working with performance measures that are inherently biased in trending markets are considered.
Self-Organizing Maps for Data Analysis: An Application to the Belgian Leasing Market
Eric de Bodt, Emmanuel-Frederic Henrion, Marie Cottrell, and Charles Van Wymeersch
Self-Organizing Maps (SOM) have been used a great deal for data analysis in recent years. Here, we propose an application to a large real dataset, composed of the financial ratios of more than 12,000 Belgian companies. The objective of the study is to understand the role of leasing as a financing tool at the disposal of companies. The results clearly emphasize that the nonlinear and robust properties of SOM make this tool very useful for gaining a deeper understanding of the financing behavior of firms through the analysis of their accounting data.

Building a Warrant Trading System using Hierarchical Neural Networks
Kwok-fai Cheung and Kin-hong Wong
In this paper, a warrant trading system based on the warrant sensitivity formula is proposed. The estimation of parameter functions of the warrant sensitivity model is carried out by two methods: (1) computed analytically, (2) estimated by a hierarchical Correlation Basis Function (CBF) network. From our simulation results using 43 warrants, both the hierarchical CBF network trading system and the CBF network valuation trading system can outperform the analytical Black-Scholes formula and the warrant sensitivity formula respectively with regard to profitability.

Optimization of a Trading System using Global Search Techniques and Local Optimization
Donald L. Iglehart and Siegfried Voessner
In this paper, we present a Hybrid Algorithm (HA) that combines a robust genetic algorithm (GA) with a local optimization technique (LOT). The LOT uses a quasi-Newton algorithm (QNA) for continuous variables and a hill-climbing algorithm (HCA) for discrete variables. HA is applied to a rule-based system for trading the S&P500 Index using daily closing prices. The HA, which we compare to other algorithms, is shown to improve the performance of this trading system in a reasonable amount of computer time without using any previous knowledge of good parameter values.

Risk Management: The Equity Curve Revisited
James Hampton
Parameters that describe risk management criteria will naturally vary among investors and traders. One popular indicator for measuring risk is maximum equity drawdown. This article takes a new look at equity curves and drawdown as part of an investigation that encompasses equity variance and trendlines.

Product Review: BioComp Profit
Mark R. Thomason
Predicting Real Estate Returns using Neural Networks
Rakesh Bharati, Vijay S. Desai, and Manoj Gupta
Examined are the predictability of returns on real estate assets by employing variables used in the finance and economics literature. Rather than using conventional linear regression models to predict returns, a class of nonlinear models, namely neural networks, are used. The use of neural networks is motivated by the statistical evidence of neglected nonlinearity reported in this paper. A variety of methods for testing nonlinearity are employed.

Chaotic Prediction Applied to Financial Time Series
Carlos. A. Thompson, Claudio F. Silva, and Fabio Hochleitner
This paper deals with the development of a nonlinear Chaotic Prediction Method (CPM) to calculate the one-day-ahead forecasts for several values of the learning set size s, the maximum memory p and the retained dominant modes d. A software package especially developed for this work demonstrates, throughout computer experiments, that the predicted values strongly depend on the variation of these parameters. Artificial Neural Networks (ANN) are also used as an independent tool to estimate the time series data.

Neural Networks vs. Black-Scholes: An Empirical Comparison of the Pricing Accuracy of Two Fundamentally Different Option Pricing Methods
Michael Hanke
The aim of this paper is to empirically compare the pricing accuracy of the Black-Scholes formula to that of option pricing formulas approximated by neural networks. After demonstrating that previous comparisons found in the literature do not distinguish between forecasting and pricing capabilities of neural networks, it is shown that even in a framework that is advantageous for the Black-Scholes model, neural networks prove superior in terms of pricing accuracy.

Cointegration 101
James Hampton
The Practitioner: Method and Tools
Cointegration, as a tool for removing nonstationarity and reducing model dimensionality, can be perplexing to any new user. This article provides a brief overview of cointegration, unit root tests and error correction models for the purpose of preparing practitioners for the effort that may be required of them should they want to explore this tool in detail.

Product Review: Time Series and Forecasting for SimStat
Mark R. Thomason

Journal Index
An index to journal articles and reviews for Volumes 1 - 6.

FROM THE EDITOR  on frequentist versus bayesian inferencing
ADDENDA AND ERRATA
REVIEWS IN BRIEF
industrial applications of neural networks (two books of the same title)
resampling stats for windows 95
MUSINGS OF NOTE  reflections on the literature
ESSAY AWARD ACKNOWLEDGMENTS
These days textual information becomes increasingly available through the Web. This makes text an attractive resource from which to mine knowledge. The major difficulty in mining textual data is that the information is unstructured. Hence the data has to be preprocessed first so as to obtain some form of structured data which is amenable to data mining techniques. This paper focuses on this preprocessing step. The prediction accuracy achieved by the best text processing method is very close to what can be expected by human experts.

Analysis of Dealers' Processing Financial News
Based on an Artificial Market Approach 23
Kiyoshi Izumi and Kazuhiro Ueda
In this study we used a new agent-based approach to analyze the ways that dealers in a foreign exchange market process the information in financial news. An artificial market model is constructed using a Genetic Algorithm. Using the simulation results, we classified, according to the ways that agents regard the news, three categories of news data. We conclude that emergent phenomena can be explained by the phase transition of forecast variety, which is due to the interaction of agent forecasts and the demand-supply balance.

IE-Expert: Integrating Natural Language Processing and Expert System Techniques For Real-Time Equity Derivatives Trading 34
Marco Costantino
Quantitative data are today largely analyzed by automatic computer programs based on traditional or artificial intelligent techniques, which provide traders with quantitative information that helps them hedge their risks. Qualitative data and, in particular, articles from on-line news agencies are instead not yet successfully processed. As a result, financial operators, notably traders, suffer from qualitative data-overload. This paper describes how Natural Language Processing, Information Extraction and Expert Systems can be used for reducing the traders' qualitative information overload.

Mining Financial News 53
James Hampton
The Practitioner: Method and Tools
Data-driven market-forecasting tools primarily rely on quantitative information. Such information conforms well to forecasting models that are developed using algorithms which sequence through explicit, discrete samples of numbers. However, because of this, an abundance of potentially beneficial market information in the form of textual and non-periodic financial news is largely overlooked by most active investors and traders. Here, we take a look at how we might utilize this information for financial forecast modeling.

Product Review: Matlab and the Financial Toolbox 55
Mark R. Thomason
GUEST EDITORIAL financial news analysis using distributed data mining 4
FROM THE EDITOR 5
REVIEWS IN BRIEF 59
wordstat v1.2
MUSINGS OF NOTE reflections on the literature 59

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May/June 1999
Vol.7, No.3
Title: On Global Minds and Markets

Utilization of Vector Autoregressions and Neural Networks in Identifying the Return Interaction among Global, Asia-Pacific Regional and Local Stock Markets 5
Chih-Chou Chiu and Yin-Hua Yeh
This study investigates the interactions in the returns of the Global, Asia Pacific regional, and Local stock markets using the vector autoregressions (VAR) and artificial neural networks. As the results reveal, influences on the Hong Kong and Singapore stock markets by the stock market of South East
Asia do exist prior to the financial crisis in July 1997. This finding may explain why the stock market in South East Asia affected the stock markets in other Asian countries after the financial crisis.

The Wavelet Transform for Filtering Financial Data Streams
Zheng Gonghui, Jean-Luc Starck, Jonathan Campbell, and Fionn Murtagh
Relating this work to earlier results, the authors introduce a new wavelet transform, the Haar à trous transform. Its advantages for modeling and predicting financial data streams are described. The basic principles of decomposing the financial signal into scale-related components and fusing the forecasts at each scale remain the same. The denoising of time series data is also discussed. A multilayer perceptron is used to provide predictions, and to demonstrate the advantages of the new wavelet transform and wavelet-based denoising.

A Basic Neural Network-based Trading System
Project Revisited (Parts 1 and 2)
Mark R. Thomason
Due to reader interest, we revisit The Neurophyte, one of the most popular series ever published on the application of neural networks in finance for the novice. This included a neural network-based trading system project published in 6 parts. In this issue, we present an updated version of parts 1 and 2 of that project, published in November 1994 and January 1995, respectively.

Product Review: e Professional version 1.3
Mark R. Thomason

FROM THE EDITOR
REVIEWS IN BRIEF
specifying and diagnostically testing econometric models, second ed.
MUSINGS OF NOTE reflections on the literature

Performance Metrics for Financial Time Series Forecasting
Sara M. Abecasis, Evangelina S. Lapenta and Carlos E. Pedreira
In this paper the state of the art of performance metrics for financial time series forecasting is presented. The focus of interest is centered on prediction performance. However, part of the paper addresses the relevance of metrics to trading performance. Characteristics of prediction performance metrics are described. After we present the nomenclature, we describe each of the performance metrics in detail. Characteristics of interest to financial time series forecasting are noted. Finally, a survey on univariate and multivariate financial time series is presented. Our purpose is to provide a review of published research in this area as well as an opening for future research.

Multi-Agent Approach as a Catalyst to a Dynamic Financial Knowledge Discovery Process
Soe-Tsyr Yuan
Currently, most KDD research is focused on the automation of data mining, although users still setup up and integrate other processes (such as data collection and data engineering) manually. When confronting dynamic KDD extensive manual effort. Basically, dynamic KDD applications are characterized by dynamic data hunting and dynamic mining. Therefore, in the search for a generation of flexible KDD applications, what should the KDD flexible KDD applications? Our hypothesis is that the multi-agent approach fills this role perfectly. We support this hypothesis through our demonstration here of a cooperative information system for automating dynamic KDD applications from a large amount of stock data using multi-agent technology.

A Basic Neural Network-based Trading System
Due to reader interest, we revisit The Neurophyte, one of the most popular series ever published on the application of neural networks in finance for the novice. This included a neural network-based trading system project published in 6 parts. In this issue, we present an updated version of parts 3 and 4 of that project, published in March and May 1995, respectively.

Product Review: NeuroShell Predictor, Classifier and Run-Time Server

Mark R. Thomason

FROM THE EDITOR on performance metrics

REVIEWS IN BRIEF

neural smithing

MUSINGS OF NOTE reflections on the literature

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September/October 1999
Vol.7, No.5
Title: Advancements in Option Pricing Using Computational Intelligence

Literature Review:
The Problem With Modern Parametric Option Pricing
Paul Lajbcygier

Conventional parametric option-pricing models based on the Black-Scholes have been generalized to form a new class of models referred to as the modern parametric option-pricing models. The aim of this literature review is to introduce and critique the modern parametric option-pricing models. Conventional option pricing, although very accurate, has been shown to be persistently, systematically and significantly biased. In the hope of rectifying these biases, the assumptions of the conventional parametric option-pricing models (OPMs) have been generalized to produce the modern parametric OPMs.

Extraction of Intraday Implied Probability Distributions in Illiquid Option Markets
Fernando Gonzalez and Neil Burgess

This paper describes a method for recovering the risk neutral market's perceived probability distribution (RND) of European options on the FTSE100 Index in an hourly time basis. A nonparametric procedure is used to choose probabilities that minimize an objective function subject to requiring that the obtained probabilities comply with observed option prices. The optimization technique for estimating probability distributions incorporates a 'smoothness' and a 'variability' factor in the objective function to account for situations where little smoothness and high variability in the posterior distributions are plausible due to problems in the data.

Adaptive Hybrid Neural Network Option Pricing
Michael Hanke

Standard option pricing models show well-known deviations when compared to market prices. The best-known of these phenomena is the smile in implied market volatilities calculated from the Black/Scholes formula. In this paper, feedforward networks are used in an adaptive fashion to fit the smile on a day-to-day basis. This approach has some advantages compared to designs previously used in the literature, e.g. drastically reduced training times through a smaller number of parameters, resulting from the reduction of the input space dimension to one and smaller network sizes.

GUEST EDITORIAL advancements in option pricing using computational intelligence

FROM THE EDITOR

REVIEWS IN BRIEF

computation, causation and discovery

MUSINGS OF NOTE reflections on the literature

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Literature Review:
The non-parametric models
Paul Lajbcygier
Empirical option pricing is going through a crisis. Once, the seminal Black-Scholes model was thought to be the last word on option pricing; all that was needed, it was thought, was some adjustments and it could then be applied to any new instrument: futures, foreign exchange and bonds. However, in the past decade, increases in the bias of the Black-Scholes model (and the conventional parametric option pricing models derived using similar approaches) have led researchers to develop new models (coined modern parametric option pricing models).

An Artificial Neural Network Approach to the Valuation of Options and Forecasting of Volatility
David S. Geigle and Jay E. Aronson
Using data from the S&P 500 futures options from 1991 through 1996, artificial neural networks were trained to estimate the value of an option and forecast volatility of the underlying futures contract. Using the same variables as are used in the Black-Scholes and ISD formulas, ten artificial neural networks were trained in the valuation of an option and three artificial neural networks were trained in the forecasting of future volatility. The results of the artificial neural networks were compared to actual prices and the Black-Scholes results for the valuation analysis and to realized volatility, historical volatility and ISD for the volatility forecast analysis. The artificial neural networks performed well in both evaluations.

Option Pricing with the Genetic Programming Approach
Christian Keber
In this paper we derive analytical approximations for the valuation of American put options on non-dividend paying stocks using the genetic programming approach. Using experimental data sets we can show that the genetically determined formulas outperform other formulas presented in the literature. Furthermore, we derive a pure analytical approximation for determining the killing price used in several classical option valuation models. We can show that the results obtained by our formula are very close to the numerically calculated killing prices.

A Basic Neural Network-based Trading System Project Revisited (Parts 5 and 6)
Mark R. Thomason
Due to reader interest, we revisit The Neurophyte, one of the most popular series ever published on the application of neural networks in finance for the novice. This included a neural network-based trading system project published in 6 parts. In this issue, we present an updated version of parts 5 and 6 of that project, first published in July and September 1995, respectively.

GUEST EDITORIAL  advancements in option pricing using computational intelligence (part 2)
FROM THE EDITOR
REVIEWS IN BRIEF
derivatives: a powerplus picture book
MUSINGS OF NOTE  reflections on the literature