

# List of Dr. German Gunin's papers with abstracts (economics)

## I. Portfolio theory

1. "Managing portfolios using preferences of market participants", in the collected articles: *Economical cybernetics: system analysis in economics and management, St.Petersburg University of Economics and Finance (SPbUEF), 2001, vol.3, pp. 110-115.*

Abstract

Preferences of market participants are represented as arbitrary linear constraints imposed on portfolio assets. The problem of mean-variance optimal portfolio calculation subject to the constraints is investigated. It leads to generalization of critical line algorithm for efficient frontier calculation.

Key words: asset allocation, mean-variance optimization, critical line algorithm, corner portfolios.

2. "Fuzzy logic based asset allocation", in the collected articles: *Economical cybernetics: system analysis in economics and management, St.Petersburg University of Economics and Finance (SPbUEF), 2002, vol.4, pp. 72-76.*

Abstract

Let we have a set of return scenarios for a given portfolio during a certain time period (one-period investment). Let we also have minimum and maximum expected return estimates for each scenario. Then we can formulate a problem of finding an asset allocation which maximizes expected return on the set of possible scenarios in terms of fuzzy logic. For this purpose we define linear membership function for each scenario playing the role of fuzzy investment goal to be achieved. Then the desired asset allocation corresponds to maximum value of these membership functions' intersection. Finally, adding linear constraints on portfolio assets makes possible to solve the asset allocation problem by means of linear programming.

Key words: fuzzy logic, membership function, L. Zadeh, portfolio theory.

3. "Investment decision making with the Analytic Hierarchy Process", in the collected articles: *Economical cybernetics: system analysis in economics and management, collected scientific papers of St.Petersburg University of Economics and Finance (SPbUEF), 2002, vol.4, pp. 112-116.*

Abstract

Selecting a portfolio for an individual investor is a complex task since it should take into account lots of criteria including investment goal, time period, desired liquidity level, individual risk averse, etc. Currently there is no theory exhaustively describing the decision making process. However, we have expert knowledge helping to organize the criteria in a hierarchy, based on their priority and relative importance to each other. Then the desired asset allocation can be calculated using the formalism of the Analytic Hierarchy Process (AHP), a systematic multi-criteria decision making methodology.

Key words: The Analytic Hierarchy Process (AHP), T. Saaty, pairwise comparisons, portfolio theory.

4. "An efficient mathematical algorithm of transition from an index portfolio to a real securities portfolio", in the collected articles: *Economical cybernetics: system analysis in economics and management, St.Petersburg University of Economics and Finance (SPbUEF), 2003, vol.7, pp. 73-75.*

Abstract

Portfolio selection process is considered as a two-stage asset allocation. The first stage of the asset allocation is calculating a model portfolio (portfolio of market indices) for a given investor subject to investment goal, time period, desired liquidity level, individual risk averse, etc. The second stage is to fill in the model portfolio with real securities preserving its investment characteristic. A simple interactive algorithm is proposed for this purpose

Key words: model portfolio, index portfolio, efficient frontier.

## II. Risk management

1. **“Non-parametric approach to fixed-income securities rating system design”**, in the collected articles: *Economics and Enterprise Management, St.Petersburg North-West Technical University, 2002, vol.9, pp. 141-144.*

Abstract

The problem of creating fixed-income rating system is considered. Six basic rating categories are defined similar to Standard & Poor's ones (AAA, AA, A, BBB, BB, B). Five key accounting measures characterizing each fixed income security are chosen. Non-linear mapping of five dimensional space of accounting data into one dimensional space of rating indicator is proposed.

Key words: feed-forward neural network, classification problem, fixed-income securities.

2. **“Neural Network as a Bayesian estimator for posterior probability of bankruptcy”**, in the collected articles: *Economical cybernetics: system analysis in economics and management, St.Petersburg University of Economics and Finance (SPbUEF), 2002, vol.5, pp. 63-66.*

Abstract

Problem of a potential bankrupt recognition is well known in financial practice. Standard solutions of the problem are based on the assumption of linear separability of bankrupt and non-bankrupt datasets in multi-dimensional space of accounting data. However, failures of Altman's approach based on linear discriminant analysis might argue against the linear separability in general. In this situation a feed-forward neural network can be a perfect solution to the problem since it is able to approximate an arbitrary decision surface in a multi-dimensional space at an arbitrary accuracy. Considering the problem of a bankrupt recognition as a classification problem, one may interpret the neural network as an estimator for posterior probability of bankruptcy in the sense of Bayes.

Key words: feed-forward neural network, Altman approach, discriminant analysis, clustering, Bayes theorem.

3. **“Option pricing simulation with Neural Networks: general principles”**, in the collected articles: *Economical cybernetics: system analysis in economics and management, St.Petersburg University of Economics and Finance (SPbUEF), 2002, vol.5, pp. 67-70.*

Abstract

The Black-Scholes model of a European option is a non-linear relation between the option price and the price of underlying asset. This suggests using a feed-forward neural network as an option pricing model for both European and American options. It allows relaxing some important assumptions of Black-Scholes approach, such as constant interest rate and constant volatility assumption. So, we come to generalized non-linear model of option pricing which might overcome drawbacks of the traditional approach.

Key words: feed-forward neural network, Black-Scholes model of option pricing, implied volatility.

4. **“Self-Organizing Kohonen Map as a tool for analysis of economical data”**, in collected articles: *Economical cybernetics: system analysis in economics and management, St.Petersburg University of Economics and Finance (SPbUEF), 2002, vol.5, pp. 111-114.*

Abstract

Self-organizing map is a non-linear mapping of multi-dimensional space into plane. It possesses a topology preserving property when images of near multi-dimensional vectors are nearly located on the plane. It allows using self-organizing map as a non-linear classification tool to separate securities into clusters based on their investment attractiveness. Number of clusters can be considered as a free parameter of the model which needs to have economically meaningful interpretation.

Key words: unsupervised machine learning, Self-Organizing Kohonen Map, clustering.

### **III. Financial time series**

1. **"Neural Network's architecture selection for predictive data modeling in the stock market"**, in the collected articles: *Economical cybernetics: system analysis in economics and management, St.Petersburg University of Economics and Finance (SPbUEF), 2001, vol.3, pp. 115-120.*

#### Abstract

Selecting optimal feed-forward neural network architecture (number of nodes and layers) for predictive modeling of an equity quote time series is discussed. The problem of predictive modeling is reduced to the problem of non-linear function approximation (interpolation). Equation for calculating an optimal architecture is proposed based on estimates of autocorrelation coefficients and time series length.

Key words: supervised machine learning, feed-forward neural network, multi-layered perceptron, financial time series.

2. **"Neural Network's parameters estimation for predictive data modeling in the stock market"**, in the collected articles: *Economical cybernetics: system analysis in economics and management, St.Petersburg University of Economics and Finance (SPbUEF), 2001, vol.3, pp. 120-125.*

#### Abstract

The problem of a neural network's parameters estimation is considered. An optimal number of training iterations is related to minimum of validation error or to value of some pre-defined criterion such as Akaike criterion. Performed comparison of neural network and ARIMA model forecasting performance for 70 time series.

Key words: feed-forward neural network, early stop training approach, cross validation, jackknife technique, financial time series.

3. **"An effective non-parametric approach to financial time series forecasting"**, in the collected articles: *Economical cybernetics: system analysis in economics and management, St.Petersburg University of Economics and Finance (SPbUEF), 2002, vol.4, pp. 83-86.*

#### Abstract

Because of finite speed of money flows and delay in reaction of market participants on the events affecting asset prices, financial markets can not be considered as perfectly efficient at short time intervals. Players having large capital to minimize transaction costs and possessing sophisticated trading strategies may benefit from local market inefficiencies. Example of such trading strategy based on k-nearest neighbors algorithm is discussed.

Key words: statistical pattern recognition, k-nearest neighbors algorithm, time series.

4. **"Adaptive Filtering as a simple alternative to Box-Jenkins approach for financial time series forecasting"**, in the collected articles: *Economical cybernetics: system analysis in economics and management, St.Petersburg University of Economics and Finance (SPbUEF), 2003, vol.8, pp. 152-154.*

#### Abstract

Two different approaches to financial time series forecasting are investigated: Box-Jenkins (ARIMA) model and adaptive filtering model. It is demonstrated using concrete examples that adaptive filtering provides comparable forecasting results at much less efforts in parameters estimation.

Key words: Box-Jenkins (ARIMA) model, adaptive filtering, gradient descent, time series.