

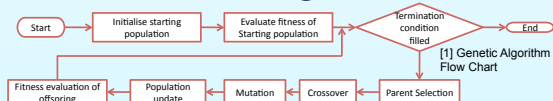
Genetic Algorithms in Financial Modelling

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Introduction

GENETIC algorithms (GAs) and their application in the financial domain is an area which has undergone extensive research and documentation. Financial models have improved with the advent of genetic algorithms. Genetic algorithms are particularly well suited to financial applications because: They are driven to find improvements in predictive power or returns over a benchmark, they are inherently quantitative and well suited to parameter optimisation, they allow a wide variety of extensions and constraints, and they are robust.

Genetic Algorithms

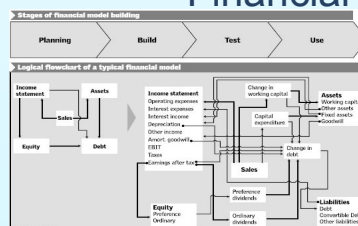


A genetic algorithm is a search technique to find exact or approximate solutions to optimisation and search problem by moving from one population of encoded chromosomes to a new population by simulating natural selection.

Encoding	Crossover	Mutation
Chromosome 1 1101100100110110	Chromosome 1 11011 00100110110	Original offspring 1 1101111000011110
Chromosome 2 1101111000011110	Chromosome 2 11011 11000011110	Original offspring 2 1101100100110110
Offspring 1 11011 11000011110	Offspring 1 11011 11000011110	Mutated offspring 1 1100111000011110
Offspring 2 11011 00100110110	Offspring 2 11011 00100110110	Mutated offspring 2 1101101100110110

[2] Genetic Algorithm Operators

Financial Modelling



[3] Stages of Financial Model Building

A process of forecasting performance of a certain asset, using relationships among operating, investing, and financing variables. The central aim of all financial modelling is valuation under uncertainty: how to estimate the value of a security when its future trajectory, or the trajectory of the other securities or economic variables it depends on, is unknown.

Credit Control & Evaluation

Credit scoring is a business problem which deals with assessing the risk with any form of investment. Even a slight improvement can translate into significant future savings.

GAFF - Genetic Algorithm for the Approximation of Formula
Searches for the formula that will accurately predict a set of values in a training set.

Chromosome	A mathematical formula
Encoding	Tree structure of algebraic notations
Evaluation	Accuracy
Crossover	Exchanging sub trees
Mutation	Switching nodes

GABC - Genetic Algorithm for the Optimisation of a Bayesian Classifier (BC)
Algorithm to optimise a BC for credit control from set of examples.

Chromosome	Value categories for each attribute
Encoding	Integer representing boundaries
Evaluation	Accuracy of the converted BC
Crossover	Random combination
Mutation	Shifting of boundaries

Business Status Forecasting

Forecasting is useful because it can provide the users with an idea of the trends for the future. The way to judge a forecasting model's performance is not by the amount of error included, but how much better is it than the alternative.

Genetic Algorithm Learning and the Cobweb Model
The cobweb model explains why supply and demand may be subject to periodic fluctuations.

Chromosome	Decision rules at time t
Encoding	Fixed length binary string
Evaluation	Value of profit at time t
Crossover	Random exchange of strings
Mutation	Flipping a random bit

Modelling Bankruptcy Prediction with Genetic Algorithms
The algorithm finds thresholds for the variables which contain financial ratios

Chromosome	Rules to show prob. of bankruptcy
Encoding	Fixed real string
Evaluation	Highest hit ratio
Crossover	Exchange part of string
Mutation	Flipping a random bit

Financial Trading

Financial trading is the buying and selling of various financial instruments including currencies and stocks with the goal of making a profit from the difference between the buying and selling price.

Genetic Algorithms and Foreign Exchange (FX) Trading
The model developed is based on the financial relationships of money supply, inflation, interest rates, and economic activity.

Chromosome	Specific FX monthly trading rule
Encoding	Fixed length binary string
Evaluation	Maximum profit
Crossover	Exchanging parts of binary string
Mutation	Flipping random bits

Genetic Algorithms and Stock Market Trading
A genetic algorithm for feature discretization and the determination of connection weights for an ANN to predict stock index prices.

Discretized data can simplify the learning process for ANN's by reducing noisy and redundant data. Searches for the optimal or near optimal connection weights and thresholds for feature discretization.

2008 Financial Crisis

- Economic crisis began in the U.S.A
- financial situation in the U.S worse since 1930's
- Trigger is the subprime mortgage crisis
- Subprime loans given to borrowers who would not normally qualify at higher interest rates
- Mortgage lenders can pass the rights to mortgage payments and related credit risk to third party investors
- Many borrowers defaulted on their loans which led to the repossession of their houses dragging down the housing market and leading to big losses for financial corporations.

- Genetic Algorithms model bankruptcy, credit, determining financial vulnerability, creating early warning detection systems
- All failed to predict crisis because:
 - 1.institutions took unusually high credit risks,
 - 2.No precedence for mortgage sales
 - 3.Failure to model industry linkages
 - 4.Potentially false paradigm of self correcting markets tending to equilibrium imbedded in GA making it blind.

Future and Conclusion

The future of genetic algorithms in finance lies in two directions. The first path is in a supporting role optimising machine learning techniques such as neural networks which by their structure are excellent modelling tools. The second path involves the use of genetic algorithms to model financial data. It is only when models based on genetic algorithms, can cover all areas of the financial sector can we say that its financial modelling potential has been fulfilled.

The overall theme coming out of the review is that genetic algorithms work well in niche areas. There is however much work to be done in getting them to work on a wider scale. There is a need for more robust models and the ability to deal with outlier events, only then will they be able to accurately predict a market's financial crisis

References

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