

# Preface

Financial markets have received an increasing interest from financial people and computational intelligence researchers over the past years because it is an area with vast amounts of money, and it is becoming easier for everyone to access and operate. One of the main challenges is to predict the future trend of prices, in order to obtain the highest profit with the lowest risk. To achieve that, it is necessary to define investment strategies that are able to process large amounts of data and consequently generate appropriate buy/sell signals. The data can be obtained from several sources: fundamental analysis, technical analysis, and time series. To solve this complex problem, the computational intelligence area is very useful. One way used by traders to predict the behavior of the markets is studying and analyzing chart patterns in the historical prices of the financial assets.

The visual identification of chart patterns is very complicated because the patterns in time series are not clear and perfect as the ones in the books. So, in order to identify patterns, automatic systems from computational intelligence must be used. In this work, a new approach to pattern discovery is presented, which is built on rules between Perceptually Important Points (PIPs), the Symbolic Aggregate approXimation (SAX) representation, optimized by Genetic Algorithm (GA). The identification of PIPs allows a huge dimensional reduction in the time series and, at the same time, maintains the main characteristics of its data. The definition of rules between near or adjacent PIPs allows the explicit definition of relationships between time series points. The mapping between rules and characters allowed the distinction of the different types of trends between the PIPs of time series and also allowed the representation of time series by a sequence of characters, which facilitated the identification of patterns. The GA is used to optimize the type of pattern to be identified and the investment rules used in the trading simulation. This new approach is called Symbolic Important Rules (SIR). The proposed approach was tested with real data from S&P500 index, and all the results obtained outperform the Buy&Hold strategy. Three different case studies that test SIR/GA approach are presented. With this approach, it was possible to obtain in the period 2011–2014 a total return of 76.7%, which outperformed the Buy&Hold strategy (61.9%).

Chapter 1 describes the problem addressed by this book, the portfolio optimization using GA. The main goals for the work are presented in this chapter and the document's structure.

Chapter 2 presents background information and reviews the existing literature that is relevant to the development of this project. In the first part of the chapter, a brief description of the existing approaches to invest is presented, and Sect. 2.1 will describe in detail the fundamental and the technical analysis. The optimization technique, named Genetic Algorithms, is presented in Sect. 2.2. A review of the existing literature about pattern recognition/detection and its techniques to invest in the market is detailed in Sect. 2.3.

Chapter 3 will explain in detail the new approach, SIR/GA methodology, for pattern discovery, and also the architecture of the proposed solution.

Chapter 4 will demonstrate the experiences done with the SIR/GA approach and will show the results and explain the conclusion taken from the experiences.

Chapter 5 presents the conclusions and the future work.

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New Approach Combining Rules Between PIPs and SAX

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