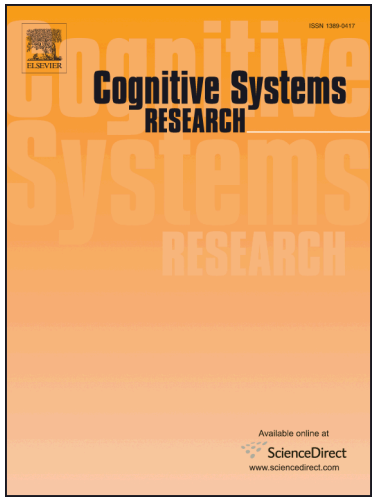

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Visual Knowledge Discovery and Machine Learning for Investment Strategy

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Abstract.

Knowledge discovery is an important aspect of human cognition. The advantage of the visual approach is in opportunity to substitute some complex cognitive tasks by easier perceptual tasks. However for cognitive tasks such as financial investment decision making this opportunity faces the challenge that financial data are abstract multidimensional and multivariate, i.e., outside of traditional visual perception in 2D or 3D world. This paper presents an approach to find an investment strategy based on pattern discovery in multidimensional space of specifically prepared time series. Visualization based on the lossless Collocated Paired Coordinates (CPC) plays an important role in this approach for building the criteria in the multidimensional space for finding an efficient investment strategy. Criteria generated with the CPC approach allow reducing/compressing space using simple directed graphs with beginnings and the ends located in different time points. The dedicated subspaces constructed for time series include characteristics such as Bollinger Band, difference between moving averages, changes in volume etc. Extensive simulation studies have been performed in learning/testing context. Effective relations were found for one-hour EURUSD pair for recent and historical data. Also the method has been explored for one-day EURUSD time series n 2D and 3D visualization spaces. The main positive result is finding the effective split of a normalized 3D space on 4x4x4 cubes in the visualization space that leads to a profitable investment decision (long, short position or nothing). The strategy is ready for implementation in algotrading mode.

Keywords: Visual knowledge discovery, cognitive algorithm, machine learning, multidimensional visualization, investment strategies, collocated paired coordinates, algorithmic trading, time series prediction, artificial intelligence, big data, classification, forex.

1. Introduction

While cognitive algorithms intend to mimic the functioning of the human brain for improving human decision-making often the scope of mimicking is not obvious. This is evident for the tasks with unclear human decision that must be mimicked. A market investment decision is one of examples with this difficulty due to complexity and uncertainty of the task and its high dynamics, i.e., a strategy that was correct at time t is not correct at time t+1. Thus for such tasks two stage cognitive algorithms are needed: stage (1) – mimicking good human decision process at the upper level, and stage (2) -- mimicking the functioning of the human brain to reproduce that good human decision. Both stages are active areas of research. This paper focuses on stage (1) for market investment decisions. The general