Visualization of Stock Market Charts

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ABSTRACT

With this work in progress we propose a visualization system for stock market charts. Insight into stock charts is important in technical stock market analysis where exclusively the chart shape is considered in decision making. We focus on *clustering* existing chart shapes. Clustering delivers *representative* charts representing a set of similar charts. In our work, we generate a 2D map of these representative charts and implement tools like zooming, levels of details and selection. Thus, we present a new approach of automatically generating the whole picture of the stock market dynamics.

Keywords

Multi-dimensional visualization, information visualization, stock market, technical chart analysis

1 INTRODUCTION

The stock market is one important domain where complex data arise. There are thousands of companies in the market, and the performance of each one is typically measured by chart diagrams showing price fluctuation over time. Analysing and understanding these charts by, i.e., tables of numbers are difficult if generally possible.

Stock market investors make their decisions based on two different kinds of analysis – the first is known as fundamental analysis and the second as technical analysis. Technical analysis is a study of share price patterns in the past, while fundamental analysis looks at the company's financial condition, management and competitive position in its industry or sector. For finding investing decision, fundamental analysts look at a company's annual report while a technical analyst looks at the chart of the stock's price movements in the history.

The basic of technical analysis is following [5]: Investor analyse long-term and short-term charts of each segments (market, sector and stock) to find those that meet specific criteria. First it is considered the marked in general, using some of the composite indexes (for example S&P500). If the broader market were considered to be in bullish mode (stock is bullish when it promises increase of the price), analysis would proceed to a selection of sector charts. The most promising sectors would be singled out for individual stock analysis. Once the sector list is narrowed to 3-4 industry groups, individual stock selection can begin. With a selection of 10-20 stock charts from each industry, a selection of 3-4 of the most promising stocks in each group can be made.

However, this scenario of choosing stocks has a shortcoming. Namely, composite indexes (of broad market and sectors) that are analysed in this scenario, are calculated by averaging the price of all stocks that are in this market or sector (and possible by weighing with the number of outstanding shares and normalized as in Nasdaq Composite index). Shapes that are not in majority will not be represented in this composite chart and can be missed. Since the technical analyst is interested in all the different chart shapes that exist in the market, this is the problem.

In this work we propose a visualization system that gives insight into existing chart shapes in stock data.

1.1 Related work

The usual visualization of a stock chart looks like a 2-dimensional graph, where the x-axis represents time and the y-axis the stock price. This visualization implements insight into price fluctuation of one stock. In figure 1 comparison of ACAM (Acambis plc) and ITMN (InterMune) stock is shown. However, if we are interested to get insight into several stock charts in a way that we can compare charts, this technique will hardly do.

There are several approaches that visualize the stock market as a whole. Some of them propose visualization system of current state of stock market

and others consider visualization of stock market dynamics where temporal data is important.

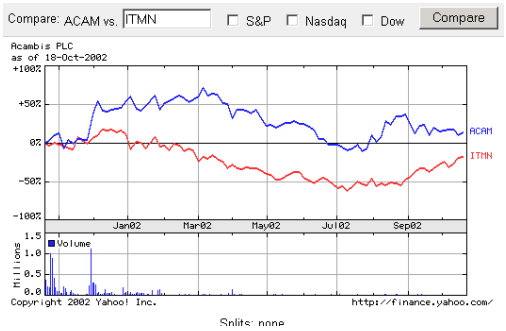

Figure 1 Yahoo web finance system comparison of two charts

Jungmeister and Turo [8] propose stock portfolio visualization using treemap techniques which is interesting for banks, brokerage firms and similar organization where large hierarchies exist. Here the relation between hierarchy levels and share information is visualized.

In [1] the stock market is visualized as a treemap again but now instead of exposing the hierarchy of managerial structure, the classification of companies into broad sectors (like health care, financial, technology, etc.) is visualized and within these sectors the specific industries. For instance, in health care there are pharmaceuticals, biotechnology, medical products, …). Each stock is represented by a rectangle, its size standing for market capitalization and its color for the price performance.

In [2], as in this work, the *Kohonen self-organizing map* is used for the visualization of emerging stock markets. The fundamentals data and technical indicators are used to create clusters of stocks which are visualized by 2-dimensional map.

Tim Wyer and Peter Eades [7] propose a system that visualizes the movements of fund managers within the UK Stock Market in terms of their share ownership over time. Their data set includes portfolio data at various points in time including knowing *who* was involved in each transaction. They utilized graph visualization techniques where they used as time third dimension.

1.2 Our solution

Instead of visualizing charts explicitly, we propose a way of showing the principal distribution of chart shapes. From the whole chart data set we generate *representative* charts representing *clusters* of similar charts. These representative charts are visualized on 2d map. To find representative charts, we use the *self-organizing Kohonen feature map (SOM)* [3]. Additionally, SOM will distribute representative charts topologically and according to the input space.

We also developed an interface that enables the user to explore the charts, choose the level of detail and zoom chosen part of the map.

2 VISUALIZATION OF CHART DATA

2.1 Pre-processing the data and loading the SOM

Stock market charts data were obtained from the Nasdaq stock market of the year 2000. We tested data from 500 companies, taking 30 trading days (from 16 of November until 29 of December). Since we are interested in the shape of the chart only we normalized the charts by obtaining the percentage increase from the first day.

The way data is processed and loaded into the SOM is shown in figure 2. Our SOM consist of 30 neurons in the input layer, each neuron corresponding to one day. After pre-processing the price values, they are loaded into the SOM, the price of the first day into the first neuron, the price of the second day into the second neuron, etc. The output layer was chosen as a 32x32 matrix of neurons.

2.2 Visualization interface, results

All 500 charts are pre-processed and used to train the Kohonen SOM. As a result, we got a 2-dimensional map of neurons. We visualized these neurons as pictures of the particular reference chart. This visualization has following features:

- Input charts are mapped to representative chart in following way: we calculate the distance to every representative chart and map the chart to representative chart that has minimum distance. This is repeated for each input chart. What we got is reduction of number of charts, that are easier to comprehend visually than complete set of charts.

- Representative charts are distributed according to input charts. This means that representative charts are chosen so that they give an efficient representation of input charts.

- Representative charts are organized on the map in a way that they preserve a topological order which means that similar representative charts lie close to each other.

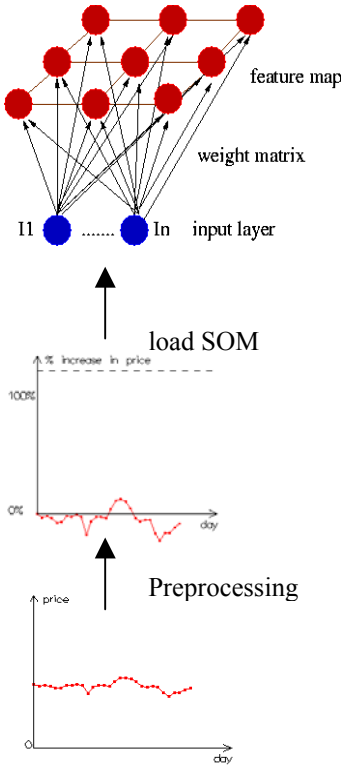

Figure 2 Pre-processing and loading data into SOM

These features were the reason for using Kohonen SOM as a tool to visualize charts data.

In our visualization of the Kohonen SOM, we do not draw representative neurons that do not have any input charts that are mapped to it, because these are 'empty' representative charts and they do not represent any chart. Besides, these empty regions define borders between clusters.

To visualize certain charts, the user can select a representative chart that he is interested in and then get the names of the companies that are represented by this chart. Further, he can select one of the listed companies and see the chart of this company.

To give the user the possibility to choose the level of detail of chart visualization we developed a level of detail option. This is metaphor for "looking from far away", seeing the stock market with smaller number of representative charts. This option is used when the user is not interested in small variations of chart shapes. After choosing a lower level of detail, four neighboring representative charts are merged by averaging price value. In figure 3 the level of detail functionality is shown. In the last picture one can see 4 major types of charts that exist in the input data.

If the user chooses very high level of detail, there will be many charts visualized and they will become quite small. For the case the user is interested only in one specific chart shapes, we developed zoom option that gives the user the possibility to choose one representative chart and zoom into it. Zooming is illustrated in figure 4.

It is possible that input charts are not distributed equally, such that there exist clusters of charts. To visualize these we coloured rectangles corresponding to representative charts. The color is proportional to the average distance from the neighbouring representative charts. Dark colors mean the distances are high and light colours mean they are small. If there exist clusters of charts in input space, their representative charts will be colored more lightly.

Further, we used our visualization to show relationship between chart shape and sector to which the chart belong to. We visualized charts mapped to a representative chart as points at a random position in the rectangular. Then we colored them to show to which sector they belong to. With this visualization we discovered that some sectors have chart shapes that are quite similar and others are distributed in all shapes. We can see this on figure 5. Red points are showing shapes from financial and services sector respectively and blue from other sectors. This visualization also proves our statement that the standard way to look for the chart shape is not optimal. Since some sectors have shapes that are distributed in all existing shapes, their composite index will not be a good representative of these shapes.

3 CONCLUSION AND FUTURE WORK

In this paper we described a visualization technique for stock market chart visualization. With this visualization, the user has general insight into charts behavior. We developed several interaction mechanisms that help user to interact with this visualization. Further, we visualized the relationship between the chart shape and the sector to which the chart belongs to.

In future work, we will visualize the relationship between the chart shape and the future course of the chart. We suppose that such a relationship exist.

Also, we are planning to test our visualization together with professionals using technical chart analysis to adapt our ideas to their practical needs.

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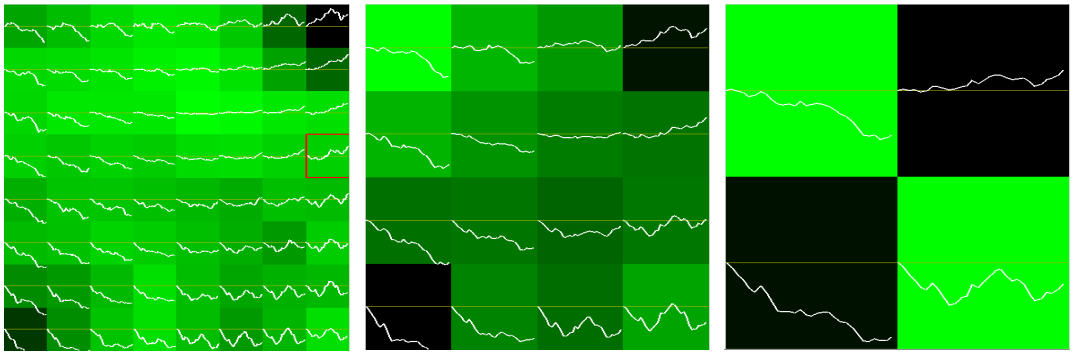

Figure 3 Level of detail option

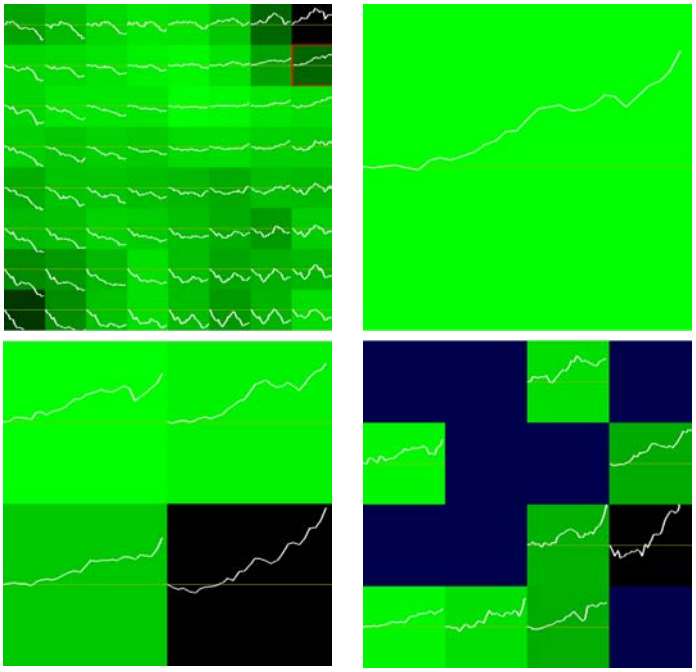

Figure 4 Zooming option

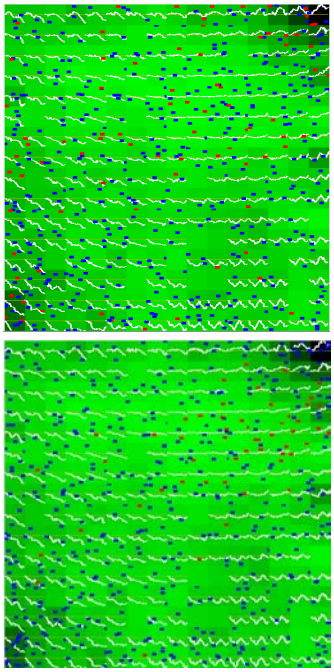

Figure 5 Financial (down) and services (up) sector