Market Visualization

Project Goals

The goals of the market visualization project are to display an organized overview of stock market data. The overview is organized by different market industries and sectors, and aims to enable analysts and ordinary users to evaluate the behavior of a specific industry or sector, as well as to analyze the performance of a specific stock. In addition, the visualization aims to display large amount of stock data in a limited space with special attention to stocks of interest such as best or worst performing stocks, various important indices and customized views to fit user preferences.

Related work

There are many websites and services that display stock market data. However, most of them do not give an overview of the market, and mainly provide tools for analyzing a specific stock or a specific stock portfolio. Services such as yahoo finance, allow user to build a portfolio of his favorite stocks, and display graphs of the stock performance overtime. While this information is very useful, it doesn't give an overall picture of the market.

BigCharts website[1] provides a simple tree view of all the market's industries, super-sectors, sectors and sub-sectors. Their visualization (as depicted in figure 1) is of a basic tree, the folders represent the industries, and the links on the right show the sector hierarchy. The visualization is not effective, since it only shows sector names, without giving any indication of its performance, size etc. In order to get any additional information the user needs to drill down into this hierarchy.

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[1] http://bigcharts.marketwatch.com/industry/bigcharts-com/default.asp?bcind_ind=bc_all&bcind_period=3mo

Figure 1 - BigCharts market data

Another existing visualization, which is probably one of the best market visualization, is the 'Map of the Market'[2]. This visualization uses tree-map in order to provide an overview of the market. The Map of the Market displays about 600 stocks chosen by SmartMoney from the NYSE and the NASDAQ. The map is divided to different industries and sectors. However, sectors' boundaries are not very prominent, and the visualization flattens the hierarchy to only 3 out of the 5 existing levels. The visualization uses colors effectively in order to encode stock performance, and allows interactive drilling down to a specific sector. The specific sector view is a larger view of the overall picture, and it allows another drill down to a more specific view that displays information such as the stock name, and its market cap.
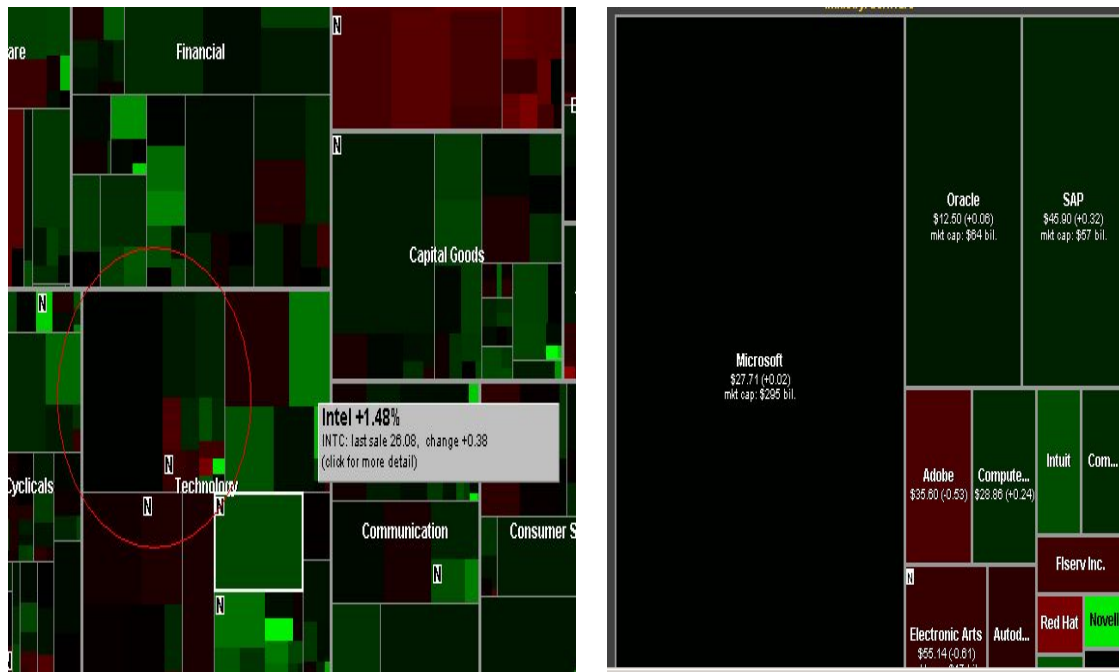
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[2] http://www.smartmoney.com/market**map**/

Figure 2 - Map of the Market sector view and a drill down view

Figure 2 focuses on the technology industry; the red circle surrounds the software section. Finding a sector is not very intuitive, and it is hard to compare the relative sizes of different industries and sectors. The strengths of this visualization are the view of the market as a whole, the effective use of colors to convey stock performance and the elegant spatial layout. However, as one of the users in my user-study pointed out, this spatial layout doesn't allow users to reorder stocks based on name, performance or market cap – finding a specific stock, especially if it has a small market cap is therefore quite cumbersome task.

Other attempts, show panel data in for an overview of the markets. However, many visualizations display only a very limited amount of data, this data is usually non-interactive. The most common approach is to graph the most important indicators such as the Nasdaq100 or the DJIA. For example, figure 3 taken from 'Advanced Financial Network'[3] presents a dashboard panel data of the main markets and indicators. These

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[3] http://www.advfn.com/p.php

graphs are not interactive and some of them are not very useful. For example, the

'Market Gainers vs. Losers' pie graph is provides confusing information, and has strange

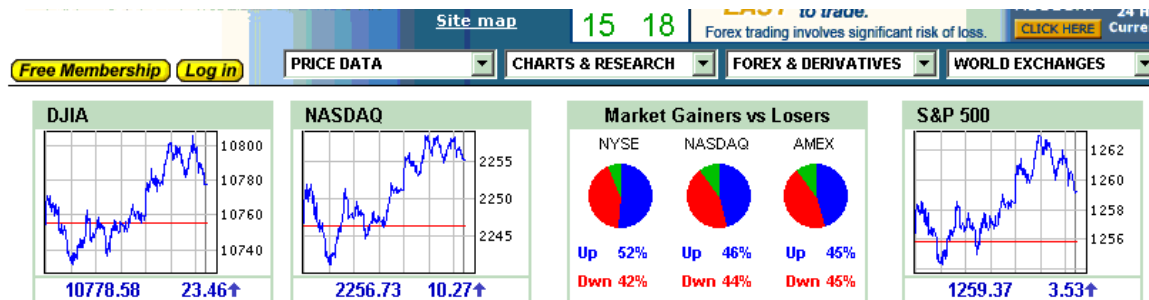use of colors (up is represented in blue, and there is undefined green segment).

Figure 3 - a control panel type view of the mark

The last visualization is probably one of the worst. This is a 3D visualization,

which attempts to show all the market sectors in a fancy 3D visualization. The

Minder3D[4] sector visualization is confusing in every aspect. It does not provide any

useful information of the overall market performance, it is impossible to understand how

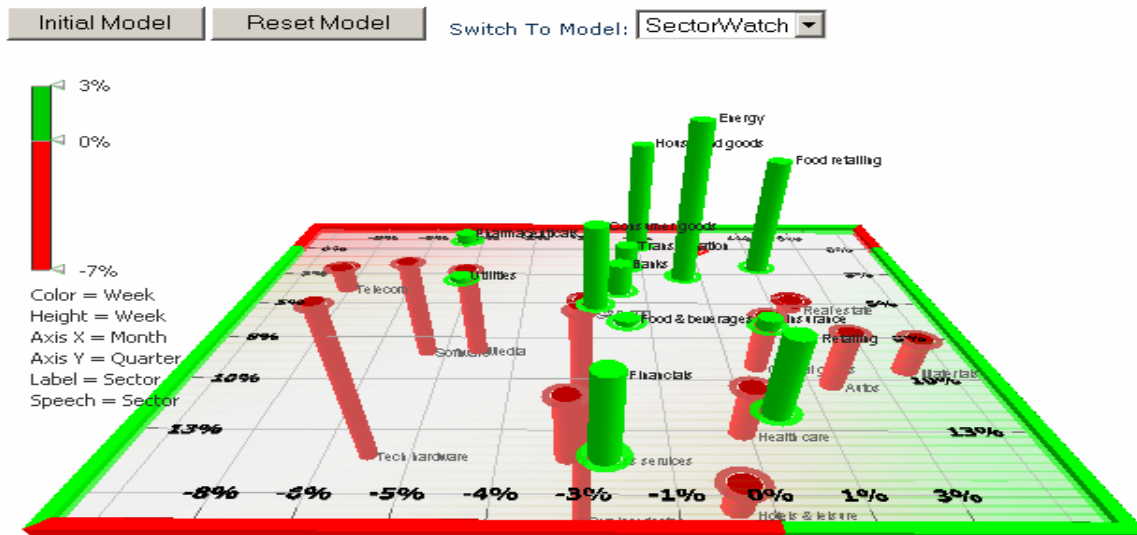an individual sector performs, and it is even very hard to find a specific sector.

Figure 4 - 3D view of the market sectors

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[4] http://www.miner3d.com/demos/stock_market.html

Data

I used data from DOWJONES indices[5] and BigCharts websites[6]. The data includes a 5 level hierarchy: Industry → Super-Sector → Sector → Sub-Sector → Stock. The visualization aims to give an overview of the top 4 levels in its main screen, and then to allow a drill down to the sector level, which includes stock level data. The stock level data is gathered into groups of the best and worst performing stocks, Dow Jones predefined indices and custom indices. Overall there are thousands of stocks, and hundreds of available indexes. My visualization does not display all stocks, instead it presents the best and words stocks per sub sector, predefined Dow Jones indices, and enable the user to create a customize index of stock of interest in a specific sub sector.

Design

I experimented with several design options. My initial idea was to use pie charts in order to supply an overview of the different industries. However, this approach was not very successful, especially because it is hard to compare sizes between different pie diagrams, and it is hard to place labels effectively.

Next I explored some options of using bar charts. I experimented with vertical and horizontal bars, and ended up developing an extended version of horizontal bars. I created a new visualization that can display a 4 level hierarchy using the traditional horizontal bar charts. Figure 5 shows the 4 levels (Industry (1), Super-Sector (2), Sector (3) and Sub-Sector (4)). This visualization enables presentation of hierarchical data in a limited space, while maintaining the ability to easily measure and compare the size of different elements.

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[5] http://www.djindexes.com/mdsidx/index.cfm?event=showTotalMarket
[6] http://bigcharts.marketwatch.com/industry/bigcharts-com/default.asp?bcind_ind=bc_all&bcind_period=3mo
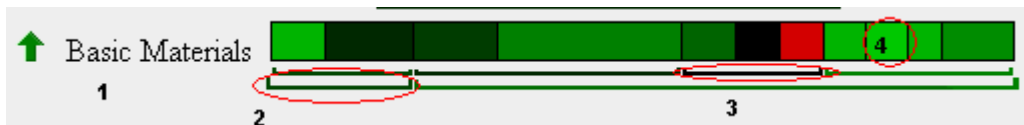
Figure 5 - a four level hierarchy using horizontal bar chart

Main Screen

The main screen aims to give an overview of the market, and provide users with an overall picture of the stock market status. The main design motivation was to enable easy comparison between different elements and to allow quick and easy access to a more detailed view.

Figure 6 – Main screen: All industries overview

Each bar includes data on all the industries' sub-sectors. The open rectangles below the bars represent Sectors and Super-Sectors. When the user mouse-over an entity

the relevant area is highlighted and a tool tip containing the stock performance and exact

market share is displayed (figure 7). The scale bar on top enables the users to easily find
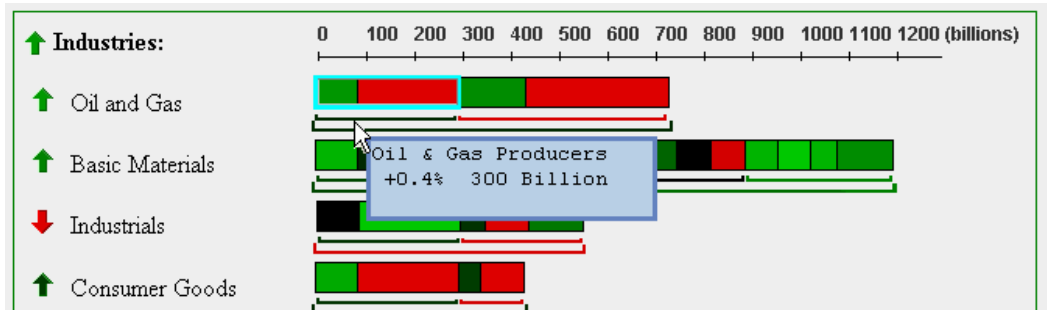
the market cap of each entity.

Figure 7 - Mouse over Sector – the sector is highlighted and tool tip provides information

Colors encode the different entities performance. The colors range from bright

red (strong negative) to bright green (strong positive). Although these colors may not be

perfect for people with color blindness, they are very intuitive to the rest of the

population. The Colored arrow icons are used to indicate the overall performance of the

entire market, and each of the industries. A colored border surrounds the industries data.

The rectangle color represents the overall market performance, and aims to unify all the

industries.

The slider on the top right corner (figure 6) enables the user to view the

performance of the market at different date ranges (up to 6 month back). The scale at the

top allows users to estimate the actual market cap of entities, without the need of

explicitly mouse-over it. In the user study the scale on top was proved to be very

beneficial in order to estimate the size of specific sectors as well as the size of the entire

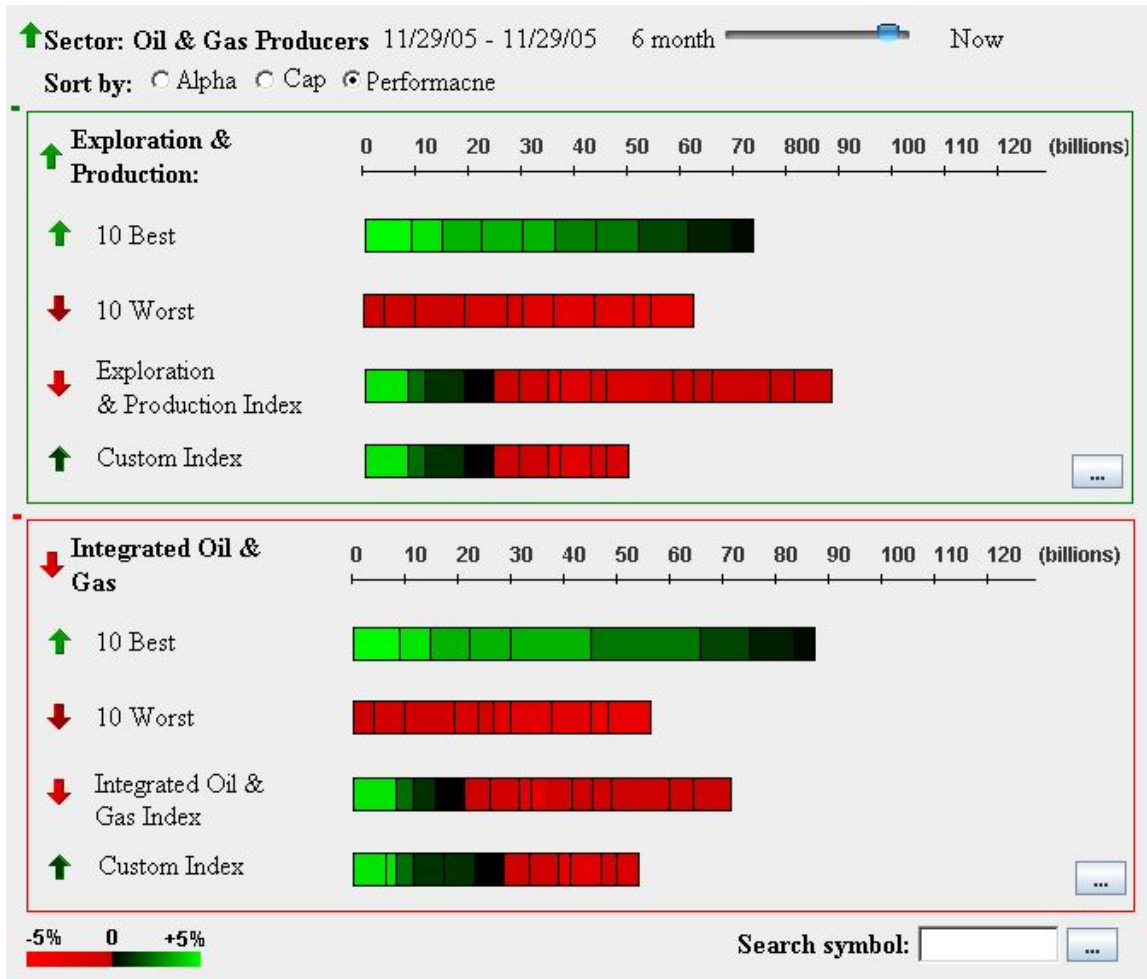industry.

Drill Down

Figure 8 - Sector view – show all the sub sectors and their main indicators

When the user clicks on a sector he moves to the Sector screen. The sector screen

provides detail view of the sub-sectors including indicators such as the 10 best stocks, 10

worst stocks, predefined Doe Jones indices, and custom index which the user can define

by clicking on the button on the right.   Stocks can be sorted alphabetically, by

performance or by market cap. When the user mouse over the bars, he can see the

performance of each individual stock. The size represents the market share of the stock,

and the color represents its performance. The rectangular colored border represents the

overall sub-sector performance, and creates a more integrated feel. Each section can be

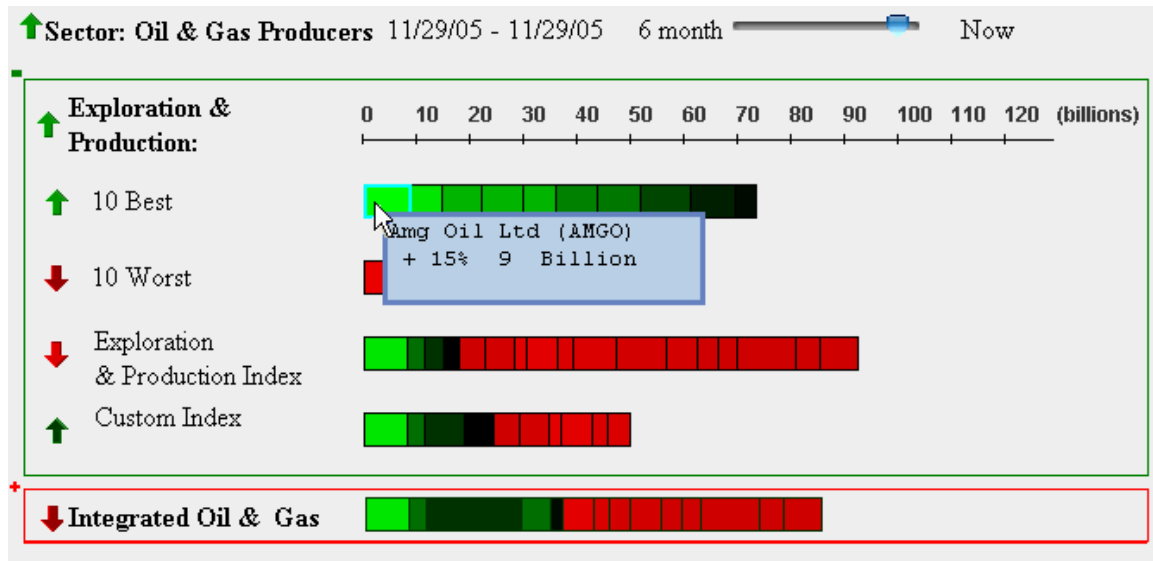collapsed or expanded using the plus or minus colored signs (figure 9).

Figure 9 - collapsed view of a sub-sector

During the design phase I tried to integrate the Sector view into the main screen by creating a zoom-in view. I hoped that this will allow a more fluid transition between the views. However, the results were problematic since the sector data is best viewed in a different scale than the industries data, and the view was confusing. Therefore, I decided to use my original approach, which opens the sector data in a new screen. This approach offers a somewhat degraded navigation experience, but the displayed data is more readable. Another limitation of this approach is that it is hard to compare sectors from different industries in the same screen. This problem may be solved with another selection mechanism (e.g. adding checkboxes to select sectors and then drill down to a group of sectors). Once the navigation issue is resolved the existing drill-down screen can be easily used to compare sectors.

Design Limitations

One of my original goals in the visualization was to display more information than the Map of the Market visualization. The final results only partially achieve these goals. In terms of showing the market structure, my visualization does a more effective job, since

it presents a deeper more organized hierarchy; it presents a more elaborated view of the

market structure and the actual market caps of each entity. However, this comes in the

expanse of displaying stock data in the main screen. Overall, once a user drills down he

can see more individual stock data, but the Map of the Market does a more effective job

displaying all this information in one screen. A more detailed user study should be

conducted in order to understand whether the target population is more interested in the

structure of the market, or in seeing large amount of stocks.

User study

I conducted a user study in order to evaluate my visualization and compare it to the Map

of the Market visualization. However, the comparison is somewhat problematic because

I only implemented a limited functionality using JavaScript in my html mockups. The

tasks given to the users had to fit this limited functionality. I interviewed 3 potential

users, 2 are MBA graduates and one is an Economics graduate. One of the users is a

product manager of financial applications; one is a product manager in a different

industry. All the users have some stock market experience; however, none of them follow

the market on a daily basis. The tasks given to the users were:

- What is the largest industry in the market and how it performed?

- Find a specific sector, what is the market share and how it performed?

- Find the best performing stock in a specific sector.

- What is the overall performance of the market?

- Which visualization gives a more integrated feel to the market?

- What is your overall impression of the tool? Would you use it?

I showed the Map of the Markets and my interface to the users, and ask them to complete the tasks and give their qualitative impressions. Since my implementation is still in a rudimentary phase the users knew which implementation was the existing one. The results of the user study showed that after a short explanation, users were able to complete the tasks quite easily (this is slightly biased, since the tasks given had to fit the limited implementation which made them a bit easier). Some of the tasks were much faster in my interface (e.g. finding the best stock in a specific sector – since in the Map of the Market the sector names are not very visible). The users said that it was mach easier to compare sizes and find market caps in my implementation, and they liked the fact that it could be organized by different properties such as performance, market cap etc. Users liked the fact that my implementation was very organized and claimed that the Map of the Market was organized randomly. One of the users, a MBA who works as a product manager in a different industry, said that the 'Map of the Market' loses a dimension in its spatial representation. The users in my study preferred my visualization, they said it was easier to understand, and more organized and informative, and they were more likely to use it. The users also said that the Map of the Market does give a more integrated feeling to the market, but they did not necessarily consider it as an important property. They also said that it was easier to find the overall market performance with the proposed visualization, especially if the market performance is mixed.

Summary

The Market visualization project offers an alternative to existing market visualizations. The approach taken for this project extends basic and well-known existing graphical representations. Bar chart was extended in order to support a 4 level hierarchal view. Based on the user feedback, the most effective aspects of the visualization were

presenting a clear overview and a structural view of the market. It allows easy navigation

in order to drill down into the more detailed views. Some of the shortcomings of the

visualization are in displaying large amount of stock data, and in viewing the market as a

whole.

Future work needs to further examine if the target audience is interested in this

approach. In addition, the detailed view needs to be integrated with more standard

analysis tools such as graphs for specific stocks and an ability to compare the

performance of different elements. Because the visualization has a strict hierarchical

structure, some of the most important challenges are in enabling work across sectors.

Overall the user feedback for this visualization was very positive, and in my small user

study, the user seemed to prefer this visualization to the Map of the Market visualization.

Resources:

Websites:

Advanced Financial Networks: http://www.advfn.com/p.php

Big Charts: http://bigcharts.marketwatch.com/industry/bigcharts-com/default.asp?bcind_ind=bc_all&bcind_period=3mo

Dow Jones Indexes: http://www.djindexes.com/mdsidx/index.cfm?event=showTotalMarket

Map of the Market: http://www.smartmoney.com/market**map**/

Miner3D: http://www.miner3d.com/demos/stock_market.html

Papers:

Hanrahan: To Draw a Tree,
http://www.sims.berkeley.edu/academics/courses/is247/f05/readings/Hanrahan_ToDrawATree_01.pdf

Shneiderman: Treemaps for space-constrained visualization of hierarchies,
http://www.sims.berkeley.edu/academics/courses/is247/f05/readings/Shneiderman_Treemaps_HCIL98.pdf