ADAPTIVE PREDICTION METHOD FOR DEMAND AND PRICE FORECASTS

Field of the Invention

This invention relates to a method and a system of predicting a value in a next interval of a time period in a historical data. More particularly, this invention relates to a method and a system of predicting a value in the next interval of a time period in a historical data based on qualitative and quantitative inputs.

Prior Art

A prediction method that exploits data analytics technology has a wide range of applications that include intelligent logistic management, risk management and control, demand estimation, stock control, just-in-time manufacturing, purchasing plans and strategic investment.

One known prediction method involves using neural network analysis. A neural network analysis is performed by interconnecting a number of neurons to each other. Such a method is typically very complex, highly speculative and requires extensive resources and does not produce accurate results.

Another method is by getting users and experts to take part in a survey to predict the prices. The survey may be conducted via the Internet or other communication means. Users and experts are invited to take part in the survey. Based on the survey, a predicted price is calculated based on the average of all the estimated prices suggested by those who took part in the survey. Such a method is highly dependent on the accuracy of the estimated prices suggested by those who took part in the survey. Since, different people may have different views, the predicted price derives based on various users and experts are highly speculative and may yield results which are divergent from the actual price.

Therefore, those skilled in the art are constantly striving to provide a method and a system that can provide an improved prediction method that uses minimal system resources, is fast, and accurate.

Summary of the Invention

The above and other problems are solved and an advance in the art is made by the method and system in accordance with the present invention. A first advantage of a method and system in accordance with embodiments of this invention is that it provides an adaptive

method of prediction. A second advantage of a method and system in accordance with embodiments of this invention is that it can be implemented to predict a price of a product or a demand for a product in the near future. A third advantage of a method and system in accordance with embodiments of this invention is that it involves a simple algorithm which is less intensive which in turn is able to predict a price or demand in a very short time period. A forth advantage of a method and system in accordance with embodiments of this invention is that the predicted results are easily interpretable with respect to key events.

In accordance with embodiments of this invention, a method for predicting a value in a next interval of a time period in a historical data which contains actual values over said time period is provided. The method includes reading a score from each of a plurality of contributor groups stored in the media, determining a qualitative score based on the score of each of the plurality of contributor groups read from the media, receiving a key event input from a user, determining a quantitative information based on the key event received, determining a predicted value in the next interval of a time period based on the qualitative scores and quantitative information, storing the predicted value in the media, and determining a confidence level of the predicted value.

In accordance with embodiments of this invention, the quantitative information comprises an impact curve, a window period, a time lagging value, an impact duration and a score associated to the key event. In accordance with some of these embodiments, in response to the score associated to the key event is equal to or greater than the qualitative score, the confidence level is computed by the expression, Confidence level = (score of the qualitative score / score associated to the key event) * 100%. In accordance with some of these embodiments, in response to the score associated to the key event is smaller than the qualitative score, the confidence level is computed by the expression, Confidence level = (score associated to the key event / score of the qualitative score) * 100%.

In accordance with embodiments of this invention, the step of reading the score from each of the plurality of contributor groups includes obtaining inputs from a number of contributors for each of the plurality of contributor groups, determining the score for each of the plurality of contributor groups from the inputs, and storing the score for each of the plurality of contributor groups in the media. Preferably, the score is in a range of 1 to 5. More preferably, the score being a value of 1 indicates a decrease by 10%, a value of 2 indicates a decrease of 5%, a value

of 3 indicates 0%, a value of 4 indicates an increase of 5%, and a value of 5 indicates an increase of 10%.

In accordance with embodiments of this invention, the step of determining the qualitative score includes reading the inputs, determining an accuracy index for each of the inputs, storing the accuracy index in the media, comparing the accuracy index for each of the inputs with a predetermined amount, and removing one of the inputs from the media in response to the input having an accuracy index which is less than the predetermined amount.

In accordance with embodiments of this invention, the accuracy index may be determined in the following manner. A median from the inputs is first determined. The accuracy index is then determined by the expression:

$$accuracy\ index = \frac{value\ of\ a\ contributor}{base\ value}\ x\ 100\%$$

where $value\ of\ a\ contributor$ is one of said inputs, and $base\ value$ is said median.

In accordance with embodiments of this invention, the accuracy index may be determined in the following manner. A mean from the inputs is determined by the expression:

$$\text{mean} = \frac{\Sigma x}{n}$$

where Σx is the sum of all inputs, and n is the value of x. The method then determines the accuracy index by the expression:

$$accuracy\ index = \frac{value\ of\ a\ contributor}{base\ value}\ x\ 100\%$$

where $value\ of\ a\ contributor$ is one of said inputs, and $base\ value$ is said mean.

In accordance with embodiments of this invention, the accuracy index may be determined in the following manner. The method determines a mode from the inputs. The method then determines the accuracy index by the expression:

$$accuracy\ index = \frac{value\ of\ a\ contributor}{base\ value}\ x\ 100\%$$

where $value\ of\ a\ contributor$ is one of said inputs, and $base\ value$ is said mode.

In accordance with embodiments of this invention, the step of determining the score for

each of the plurality of contributor groups from the inputs includes reading a previous accuracy index of each of the contributors in the media, assigning a weightage to each of the contributors based on the previous accuracy index of each of the contributors, adjusting the value of the inputs based on the weightage of each of the contributors, and determining the score based on the adjusted value. In accordance with some of these embodiments, the step of determining the score based on the adjusted value includes determining the average of the adjusted value of the inputs.

In accordance with embodiments of this invention, the method further comprises reading a historical data in the media. The historical data is a data structure that contains previous prices or demand on a certain product. The method further includes identifying events occurred in the historical data, selecting a one of the identified events, determining the quantitative information by analysing changes in the historical data due to the selected one of the identified event, and storing the quantitative information in the media. In accordance with some of these embodiments, the method further comprises removing the changes due to the selected one of the identified event from the historical data.

In accordance with embodiments of this invention, the step of determining the quantitative information includes selecting a window period and determining a correlation coefficient by the expression:

$$r_{xy} = \frac{\sum_{i=0}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=0}^{n}(x_i - \bar{x})^2 (y_i - \bar{y})^2}}$$

where x is a price or demand in the historical data, y is a change due to the key event, n is the window period, $\bar{x}$ is an average value of x within the window period, $\bar{y}$ is an average value of y within the window period. The method further includes comparing the correlation coefficient with a predetermined correlation coefficient value, and determining the quantitative information in response to the correlation coefficient being more than the predetermined correlation coefficient value. Preferably, the predetermined correlation coefficient value is 0.7. More preferably, the quantitative information comprises the window period, an impact curve, a time lagging value and an impact duration.

In accordance with embodiments of this invention the step of determining the quantitative information further comprises updating the media with the quantitative information. The

quantitative information can be determined in the following manner. A percentage change in value over the impact duration in the key event is determined by the expression:

Percentage change = (Price – Price') * 100%

where Price is a value at a beginning of the impact duration and Price' is a value at an end of the impact duration. A score is then determined based on the percentage change. Preferably, the score is in a range of 1 to 5. A score if 1 is indicated if percentage change is between -10% to -7%. A score of 2 is indicated if percentage change is between -6% to -3%. A score of 3 is indicated if percentage change is between -2% to 2%. A score of 4 is indicated if percentage change is between 3% to 6%. A score of 5 is indicated if percentage change is between 7% to 10%. The score is then appended to the quantitative information.

In accordance with embodiments of this invention, a system for predicting a value in a next interval of a time period in a historical data which contains actual values over said time period is also provided.

Brief Description of the Drawings

The above and other features and advantages of a method and/or system in accordance with this invention are described in the following Detailed Description and are shown in the following drawings:

Figure 1 illustrates an overview of a system in accordance with an embodiment of the invention;

Figure 2 illustrates the various components of the system in accordance with an embodiment of the invention;

Figure 3 illustrates an exemplary processing system that represents a processing system in a computer system used by the system in accordance with an embodiment of the invention;

Figure 4 illustrates a flow diagram of a process for predicting a value performed by the system in accordance with an embodiment of the invention;

Figure 5 illustrates a flow diagram of a process for determining a qualitative score for each of a contributor groups performed by the system in accordance with an embodiment of the invention;

Figure 6 illustrates a flow diagram of a process for adjusting the qualitative score performed by the system in accordance with an embodiment of the invention;

Figure 7 illustrates a flow diagram of a process for determining the quantitative information performed by the system in accordance with an embodiment of the invention;

Figure 8 illustrates a flow diagram of a process for determining the impact curve, window period, time lagging value and impact duration performed by the system in accordance with an embodiment of the invention;

Figure 9 illustrates an example of a historical data;

Figure 10a and 10b illustrate an example of the changes in price of a product with respect to the inflation from year 2007 to year 2011;

Figure 11 illustrates an example of a straight line impact curve;

Figure 12 illustrates an example of a polynomial impact curve;

Figure 13 illustrates an example of a horizontal impact curve; and

Figure 14 illustrates a flow diagram of a process for determining a score associated to the key event.

Detailed Description

This invention relates to a method and a system of predicting a value in a next interval of a time period in a historical data. More particularly, this invention relates to a method and a system of predicting a value in the next interval of a time period in a historical data based on qualitative and quantitative inputs.

It is envisioned that a system and/or method in accordance with embodiments of this invention provides an innovative and accurate prediction method that intelligently integrates quantitative and qualitative analysis algorithms for predicting price and/or demand of a product that is more accurate than the traditional methods. The potential user for such prediction system and/or method are material suppliers, distributors for demand estimation; end users for stock control and purchasing plans; investment or private bankers for strategic investment; etc. A prediction method that exploits data analytics technology has a wide range of applications that include intelligent logistic management; risk management and control; demand estimation; stock control; just-in-time manufacturing; purchasing plans; and strategic investment.

Figure 1 illustrates an overview of the system and method. The method is generated in real time or updated periodically. Essentially, two sources are required, namely, qualitative and quantitative sources. Qualitative sources are obtained from various contribution groups such as experts in the relevant field, end users, etc. One skilled in the art will recognise that any number of the contribution groups may be included and the exact number of contribution groups is left as a choice for the skilled in the art. Further, the relevancy of the contribution groups is greatly

dependent on the type of price or demand that is predicted by the system. Assuming the system is used for predicting an estimated demand in the next quarter, contribution groups such as clients and marketing personnel may be more relevant. However, if the system is used for predicting an estimated price of a product in the next quarter, contribution groups such as material suppliers and procurement personnel may be more relevant. Hence, the exact choice of contribution groups to be used is left to those skilled in the art.

Quantitative sources are obtained external factors such as effect of inflation; effect of tax and incentive scheme changes; effect of currency fluctuation; effect of transport cost changes; effect of oil price variation; etc. One skilled in the art will recognise that any other external factors may be included and the exact number of contribution groups is left as a choice for the skilled in the art.

A score for each of the qualitative and quantitative sources is determined and a confidence level is determined. Based on the scores derived from the qualitative and quantitative sources, a prediction of the future value is determined. An actual value is eventually determined and an accuracy of the predicted value is computed with respect to the actual value. This accuracy is stored by a database or other memory for future use.

Figure 2 illustrates system 200 including a computer system 201, one or more keypads 202 and a database system 203. Computer system 201 is a typical processing system such as a desktop computer, laptop computer, tablet, mobile device or other computer terminal that executes applications that perform the required processes in accordance with this invention. Keypad 202 is a typical input device such as a numeric keypad, alphanumeric keyboard, other devices having a set of buttons arranged in a block for receiving input from a user. Database system 203 is a typical memory bank that collects and stores data.

Figure 3 illustrates an exemplary processing system 300 that represents the processing systems in computer systems 201 that execute instructions to perform the processes described below in accordance with this invention. One skilled in the art will recognize that the instructions may be stored and/or performed as hardware, firmware, or software without departing from this invention. One skilled in the art will recognize that the exact configuration of each processing system may be different and the exact configuration executing processes in accordance with this invention may vary and processing system 300 shown in Figure 3 is provided by way of example

only.

Processing system 300 includes Central Processing Unit (CPU) 305. CPU 305 is a processor, microprocessor, or any combination of processors and microprocessors that execute instructions to perform the processes in accordance with the present invention. CPU 305 connects to memory bus 310 and Input/ Output (I/O) bus 315. Memory bus 310 connects CPU 305 to memories 320 and 325 to transmit data and instructions between the memories and CPU 305. I/O bus 315 connects CPU 305 to peripheral devices to transmit data between CPU 305 and the peripheral devices. One skilled in the art will recognize that I/O bus 315 and memory bus 310 may be combined into one bus or subdivided into many other busses and the exact configuration is left to those skilled in the art.

A non-volatile memory 320, such as a Read Only Memory (ROM), is connected to memory bus 310. Non-volatile memory 320 stores instructions and data needed to operate various sub-systems of processing system 300 and to boot the system at start-up. One skilled in the art will recognize that any number of types of memory may be used to perform this function.

A volatile memory 325, such as Random Access Memory (RAM), is also connected to memory bus 310. Volatile memory 325 stores the instructions and data needed by CPU 305 to perform software instructions for processes such as the processes required for providing a system in accordance with this invention. One skilled in the art will recognize that any number of types of memory may be used as volatile memory and the exact type used is left as a design choice to those skilled in the art.

I/O device 330, keyboard 335, display 340, memory 345, network device 350 and any number of other peripheral devices connect to I/O bus 315 to exchange data with CPU 305 for use in applications being executed by CPU 305. I/O device 330 is any device that transmits and/or receives data from CPU 305. Keyboard 335 is a specific type of I/O that receives user input and transmits the input to CPU 305. Display 340 receives display data from CPU 305 and display images on a screen for a user to see. Memory 345 is a device that transmits and receives data to and from CPU 305 for storing data to a media. Network device 350 connects CPU 305 to a network for transmission of data to and from other processing systems.

Figure 4 illustrates a flow diagram of process 400 performed by a system in computer system 201 in accordance with an embodiment of this invention. The system is provided by processes stored in software, firmware, or hardware. Process 400 begins in step 405 by reading a score from each contributor groups stored in database 203. Contributor groups are qualitative sources groups of people that are selected by the user such as experts in the relevant field, end users, etc. Process 400 then determines a qualitative score for each of the contributor groups in step 408. The steps of determining the qualitative score will be described further with reference to figures 5 and 6 below.

In step 410, process 400 reads a key event input from a user via keypad 202. The key event may be a current occurrence of an important event or an event that the user believes may occur in the future. Process 400 then determines quantitative information such as impact curve, window period, time lagging value, impact duration, or a score for the key event received in step 415. The steps of determining the quantitative information will be described further with reference to figures 7-10 below.

In step 420, process 400 determines a predicted value based on all the qualitative scores determined for each of the contributor groups and one or more of the quantitative information determined in step 415. The predicted value may be determined by any mathematical combination of the scores determined for each of the contributor groups and the quantitative information determined in step 415. One method of determining the predicted value is by determining the average of all scores.

In step 425, the predicted value is displayed on the display to the user and stored in the database. A confidence level of the predicted value is then determined in step 430 and stored in database 203. Process 400 then ends.

The confidence level is determined based on the scores of each of the contributor groups and the score in the quantitative information. If the scores for each of the contributor groups are the same, confidence level is high. If the score from the quantitative information is the same as the scores of the contributor groups, confidence level increases further. The confidence level may be determined by the following expression.

If score of quantitative information is smaller than qualitative score:

Confidence level = (score of quantitative information / score of contributor group) * 100%

If score of quantitative information is greater than or equal to qualitative score:
Confidence level = (score of contributor group / score of quantitative information) * 100%

Assuming there are more than one contributor group involved, the score of the contributor groups is an average of the scores of all contributor groups involved.

Figure 5 illustrates a flow diagram of process 500 performed by a system in computer system 201 in accordance with an embodiment of this invention. Process 500 is an embodiment of a process for performing step 408 in process 400. Process 500 begins in step 505 by obtaining inputs from contributors from various contribution groups. The inputs are obtained when each of the contributors key in a value using keypad 202. In accordance with one example of an embodiment, each of the contributors has to input a value between a range of 1-5. A value of 3 indicates there is no change in price or demand. A value of 5 indicates that the price or demand is likely to go up by 10%. A value of 4 indicates that the price or demand is likely to go up by 5%. A value of 2 indicates that the price or demand is likely to go down by 5%. A value of 1 indicates that the price or demand is likely to go down by 10%. One skilled in the art will recognise that other ranges of value may be use without departing from the invention. For example, a wider range may be used to increase the accuracy of the change in percentage of price or demand. Further, one skilled in the art will recognise that the percentage change associated to each of the values may also change and the exact percentage change associated to each of the values is left as a design choice for those skilled in the art.

In step 510, process 500 determines a score for each of the contributor groups. The steps of determining the score for each of the contributor groups will be described further with reference to figure 6 below. Process 500 then stores the score of each of the contributor groups in media in step 515. Process 500 ends after step 515.

Figure 6 illustrates a flow diagram of process 600 performed by a system in computer system 201 in accordance with an embodiment of this invention. Process 600 is an embodiment of a process for performing step 510 in process 500. Process 600 begins in step 602 by reading the inputs from one of the contributor groups. In step 605, process 600 determines an accuracy index for each input from the contributors. For purpose of this

discussion, each of the contributor groups is defined as a data set. A data set comprises a number of data values which correspond to the inputs from contributors. The accuracy index is determined in the following manner. First, a base value is determined based on the mean, median or mode of each data set. The mean of a data set is the sum of all of the data values in the data set divided by the number of data values which is determined by the following expression:

$$\text{mean} = \frac{\Sigma x}{n}$$

Where Σx is the sum of all values in the data set, and n is the value of x value. The median of a data set is the middle value of the data set when it is arranged in ascending order, i.e. from the smallest value to the highest value. In the event that the number of values in the data set is even, the median is the average of the two middle values. The mode of a data set is the value that occurs most often. After the base value is determined, the accuracy index is determined by the following expression:

$$accuracy\ index = \frac{value\ of\ a\ contributor}{base\ value}\ x\ 100\%$$

After the accuracy index is determined, process 600 stores the accuracy index in the database in step 610. In step 615, extremes values are removed. This means that a data value input from a contributor is removed from the data set if the accuracy index of the data value is below certain threshold.

In step 620, process 600 reads a previous accuracy index from database 203. Process 600 then assigns a weightage to each of the contributors based on the previous accuracy index in step 625. The value of the input from each of the contributor is then adjusted based on the weightage. A score is determined based on the average of the adjusted inputs in step 635 and the score for the contributor group is stored in the database in step 640.

In step 645, process 600 determines if there are any more contributor groups that have yet to be processed to determine a score. If there is another contributor group, process 600 selects the next contributor group and repeats from step 605. Otherwise, process 600 ends.

Figure 7 illustrates a flow diagram of process 700 performed by a system in computer system 201 in accordance with an embodiment of this invention. Process 700 is an embodiment of a process that is performed for updating impact curve, window period, time lagging value and impact duration. The impact curve, window period, time lagging value and impact duration are updated so that the system can determine the best fit curve and derive the polynomial for future prediction.

For example, it is measured that the Gross Domestic Product (GDP) grows by 5% in year 2008 and the price of a product increases by 3% linearly with the lagging factor of 3 months. Hence, if the GDP also grows by 5% in year 2013, it can be predicted that the price of the product will likely increase by 3% linearly with the same lagging factor of 3 months, considering that all other factors such as tax, oil price, inflation, supply factor, etc. remain the same.

In an additional example, it is measured that the GDP grows by 5% in year 2006, inflation is 5% in the same year, and the price of the product increases by 8% with the lagging factor of 2 months in the same year. Hence, if the GDP grows by 5% and inflation is 5% in 2013, the system may first remove the factor caused by the GDP in year 2008 and then compute the prediction in year 2013 based on the effect cause by the GDP growth and inflation in year 2006, considering all other factors such as tax, oil price, supply factor, etc. remain the same.

Process 700 begins in step 705 by reading historical data. Historical data is a data structure that stores the previous prices or demands. Figure 9 illustrates an example of a historical data of a certain metal from a period of 1960 to 2011 plotted in a chart. As can be seen in the chart, there are certain spikes in prices at periods between Y1 and Y2, and between Y4 and Y5 and sudden drop in prices at period between Y2 and Y3. These could be due to quantitative factors in play which resulted in the spike and drop in prices. With the knowledge of such events taking place at certain period, a correlation between the event and the changes of price can be computed.

In step 710, process 700 identifies events that occurred in the historical data based on inputs from user. A user is required to input events that occurred at certain time in the historical data. In step 715, process 700 selects a first event, which is the earliest identified event. The changes due to the selected event are analysed in step 720. The analysis of the changes will

be described in figure 8 below.

In step 725, process 700 removes the data associated to the selected event. This is to remove multiple-factor effect. By removing multiple-factor effect, an impact curve (which will be described below) can be normalised. Multiple-factor effect occurs when more than one key event occur in the same period of time. Hence, in order to obtain a more accurate analysis of the selected key event, it is necessary to remove the key events that occur about the same period of the selected key event. The multiple factors can be offset with the following expression:

x_i = original x_i – effect on x_i caused by factor 1

Where x is the price and factor 1 is a key event prior to the selected key event. Assuming there are 2 key events prior to the selected key event, the impact curve can be normalised to offset multiple effect by removing the effect on price by the following expression:

x_i = original x_i – (effect on x_i caused by factor 1 + effect on x_i caused by factor 2)

One skilled in the art will recognise that selection of factors 1 and/or 2 is dependent on the duration of factors 1 and 2 leading up to the selected key event. This means that factors 1 and/or 2 are selected only if they are within a certain period of time leading up to the selected key event and the selection of the factors to remove is left to those skilled in the art.

Process 700 then stores the quantitative information such as window period, impact curve, time lagging value, impact duration and score gathered by the analysis in step 730. In step 735, process 700 determines if there are any more events to be analysed. If there is another event to be analysed, process 700 proceeds to step 740 to select the next event and repeat from process 700 from step 720. Otherwise, process 700 ends.

Figure 8 illustrates a flow diagram of process 800 performed by a system in computer system 201 in accordance with an embodiment of this invention. Process 800 is an embodiment of a process for performing step 720 in process 700. Process 800 begins in step 805 by selecting a window period, n. The window period, n, can be a week, a month, or interval of 3 months, etc. One skilled in the art will recognise that n may vary and is dependent on the

amount of data available in the historical data and the exact window period is left to those skilled in the art.

Process 800 then determines correlation coefficient value, r_{xy} in step 810 with the following expression:

$$r_{xy} = \frac{\sum_{i=0}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=0}^{n}(x_i - \bar{x})^2 (y_i - \bar{y})^2}}$$

Where x is the price and y is the changes due to the selected key event such as change in oil price, inflation, GDP, etc. n is the window size, $\bar{x}$ is the average value of x within the window period, $\bar{y}$ is the average value of y within the window period. The correlation coefficient is a measurement of correlation between the price and the effect of the key event.

Figure 10a and 10b illustrate an example of the changes in price of product A with respect to the inflation from year 2007 to year 2011. Line 1010 refers to the changes in price of product A. Line 1020 refers to the inflation. Line 1030 refers to the year to year percentage changes in price of product A. Line 1040 refers to the year to year percentage change of inflation. The correlation coefficient is determined based on the changes in product A and inflation.

The correlation coefficient value is compared with a threshold value in step 820. Process 800 then determines the window period, impact curve, time lagging value and the duration as follows. The impact duration is determined whereby the correlation coefficient value is below the threshold. A typical value is below 70%, or correlation coefficient of 0.7. If the correlation coefficient is less than 0.7, it is deemed that the impact duration has ended One skilled in the art will recognise that other threshold value may be used without departing from the invention and the exact threshold value is left as a choice to those skilled in the art.

An impact curve is the best fit curve that follows the changes in price due to the key event. Supposing there is a new tax implemented in Jan 2012, the system will search the database for a similar tax that was previously implemented. The impact curve is a non-linear function in general. However, for fast processing applications, the impact curve may be linear which is a

straight line with the y-intercept and gradient as parameters.

An example of a straight line impact curve is shown in figure 11. The effect on the cost of product A due to the tax implementation is as follows:

Month	Price of product A	Percentage change
Jan 2005	20	
February 2005	20	0%
March 2005	19	-5% of price in Jan 2005
April 2005	19.4	-3% of price in Jan 2005
May 2005	19.8	-1% of price in Jan 2005

Figure 11 shows a tax implemented on February 2005 with a window period of 4 months (i.e. February–May 2005). The impact duration is 3 months as the price of product A experience changes in March, April and May of 2005. In the impact duration, the impact curve is a straight line as shown between 1110 and 1120. The time lagging value is 1 month as there is no change in price of product A in February 2005.

An example of a polynomial impact curve is shown in figure 12. The effect on the cost of product A due to the tax implementation is as follows:

Month	Price of product A	Percentage change
Jan 2005	20	
February 2005	20	0%
March 2005	18.4	-8% of price in Jan 2005
April 2005	19.2	-4% of price in Jan 2005
May 2005	19.6	-2% of price in Jan 2005

Figure 12 shows a tax implemented on February 2005 with a window period of 4 months ((i.e. February–May 2005). The impact duration is 3 months as the price of product A experience changes in March, April and May of 2005. In the impact duration, the impact curve is polynomial. The time lagging value is 1 month as there is no change in price of product A in February 2005. A polynomial impact curve can be determined with the following expression:

$$\int(x) = a_n x^n + a_{n-1}x^{n-1} + \cdots + a_2 x^2 + a_1 x^1 + a_0$$

Where x is the number of argument, n is a non-negative integer and a_0, a_1, a_2... a_n are constant coefficients.

An example of a horizontal impact curve is shown in figure 13. The effect on the cost of product A due to the tax implementation is as follows:

Month	Price of product A	Percentage change
Jan 2005	20	
February 2005	20	0%
March 2005	20	0%
April 2005	20	0%
May 2005	19	-5% of price in Jan 2005
June 2005	19	-5% of price in Jan 2005
July 2005	19	-5% of price in Jan 2005

Figure 13 shows a tax implemented on February 2005 with a window period of 6 months ((i.e. February–July 2005). The impact duration is 3 months as the price of product A experience changes in May, June and July of 2005. In the impact duration, the impact curve is horizontal. The time lagging value is 3 months as there is no change in price of product A in February, March and April of 2005.

Process 800 then updates the database with the window period, impact curve, time lagging value and impact duration in step 830. Process 800 ends after step 830

Figure 14 illustrates a flow diagram of process 1400 performed by a system in computer system 201 in accordance with an embodiment of this invention. Process 1400 is an embodiment of a process after process 800. Process 1400 begins in step 1405 to retrieve the quantitative information from database associated to the key event input from the user. The quantitative information contains the window period, impact curve, time lagging value and duration of the key event. Process 1400 then determines a score based on the quantitative

information retrieved in step 1410.

Any mathematical combination of the impact curve, window period, time lagging value and duration of the key event may be used to determine a score. One method of determining a score is based on the change in price over the duration of the key event. The method may be determined with the following expression.

Percentage change = (Price – Price') * 100%

Where Price is the price at the beginning of the duration of the key event and Price' is the price at the end of the duration of the key event.

The Percentage change is then converted to a score in a range of 1-5. On the assumption that the Percentage change will vary from -10% to 10%, the score are converted as follows:

Score is 1, if Percentage change is between -10% to -7%
Score is 2, if Percentage change is between -6% to -3%
Score is 3, if Percentage change is between -2% to 2%
Score is 4, if Percentage change is between 3% to 6%
Score is 5, if Percentage change is between 7% to 10%

One skilled in the art will recognise that other ranges of value may be use without departing from the invention. For example, a wider range may be used to increase the accuracy of the change in percentage of price or demand. Further, one skilled in the art will recognise that the allocation of the score according to the range of change of percentage change may also be changed and the exact range of percentage change allocated to the score is left as a design choice for those skilled in the art.

In step 1415, the score associated to the key event is appended to the quantitative information. Process 1400 ends after step 1415.

The above is a description of embodiments of a system and method in accordance with this invention. It is envisioned that others can and will design alternative methods and systems

as set forth in the following claims based upon this disclosure.

What is claimed is:

1. A system for predicting a value in a next interval of a time period in a historical data which contains actual values over said time period comprising:

a processing unit;

a media readable by said processing unit;

instructions stored by said media for directing said processing unit to:

read a score from each of a plurality of contributor groups stored in said media;

determine a qualitative score based on said score of each of said plurality of contributor groups read from said media;

receive a key event input from a user;

determine a quantitative information based on said key event received comprising:

read a historical data in said media, said historical data being a data structure that contains previous prices or demand on a certain product;

identify events occurred in said historical data;

select a one of said identified events;

determine said quantitative information by analysing changes in said historical data due to said selected one of said identified event comprising:

select a window period,

determine a correlation coefficient by the expression:

$$r_{xy} = \frac{\sum_{i=0}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=0}^{n}(x_i - \bar{x})^2 (y_i - \bar{y})^2}}$$

where x is a price or demand in said historical data, y is a change due to said key event, n is said window period, $\bar{x}$ is an average value of x within said window period, $\bar{y}$ is an average value of y within said window period;

compare said correlation coefficient with a predetermined correlation coefficient value; and

determine said quantitative information in response to said correlation coefficient being more than said predetermined correlation coefficient value;

remove changes due to said selected one of said identified event from said historical data;

determine a predicted value in said next interval of a time period based on said

qualitative scores and quantitative information;

store said predicted value in said media; and

determine a confidence level of said predicted value.

2. The system according to claim 1 wherein said quantitative information comprises an impact curve, a window period, a time lagging value, an impact duration and a score associated to said key event.

3. The system according to claim 2 wherein said confidence level is given by the expression, Confidence level = (score of said qualitative score / score associated to said key event) * 100%, in response to said score associated to said key event is equal to or greater than said qualitative score.

4. The system according to claim 2 wherein said confidence level is given by the expression, Confidence level = (score associated to said key event / score of said qualitative score) * 100%, in response to said score associated to said key event is smaller than said qualitative score.

5. The system according to claim 1 wherein said instructions to read said score from each of said plurality of contributor groups comprise:

instructions for directing said processing unit to:

obtain inputs from a number of contributors for each of said plurality of contributor groups;

determine said score for each of said plurality of contributor groups from said inputs; and

store said score for each of said plurality of contributor groups in said media.

6. The system according to claim 5 wherein said score is in a range of 1 to 5.

7. The system according to claim 6 wherein said score being a value of 1 indicates a decrease by 10%, said score being a value of 2 indicates a decrease of 5%, said score being a value of 3 indicates 0%, said score being a value of 4 indicates an increase of 5%, and said score being a value of 5 indicates an increase of 10%.

8. The system according to claim 5 wherein said instructions to determine said qualitative score comprise:

instructions for directing said processing unit to:

read said inputs;

determine an accuracy index for each of said inputs;

store said accuracy index in said media;

compare said accuracy index for each of said inputs with a predetermined amount; and

remove said one of said inputs from said media in response to said input having an accuracy index which is less than said predetermined amount.

9. The system according to claim 8 wherein said instructions to determine said accuracy index comprise:

instructions for directing said processing unit to:

determine a median from said inputs;

determine said accuracy index wherein said accuracy index is given by the expression:

$$accuracy\ index = \frac{value\ of\ a\ contributor}{base\ value}\ x\ 100\%$$

where $value\ of\ a\ contributor$ is one of said inputs, and $base\ value$ is said median.

10. The system according to claim 8 wherein said instructions to determine said accuracy index comprise:

instructions for directing said processing unit to:

determine a mean from said inputs wherein said mean is given by the expression:

$$\text{mean} = \frac{\Sigma x}{n}$$

where Σx is the sum of all inputs, and n is the value of x;

determine said accuracy index wherein said accuracy index is given by the expression:

$$accuracy\ index = \frac{value\ of\ a\ contributor}{base\ value}\ x\ 100\%$$

where $value\ of\ a\ contributor$ is one of said inputs, and $base\ value$ is said mean.

11. The system according to claim 8 wherein said instructions to determine said accuracy index comprise:

instructions for directing said processing unit to:

determine a mode from said inputs;

determine said accuracy index wherein said accuracy index is given by the expression:

$$accuracy\ index = \frac{value\ of\ a\ contributor}{base\ value}\ x\ 100\%$$

where $value\ of\ a\ contributor$ is one of said inputs, and $base\ value$ is said mode.

12. The system according to claim 8 wherein said instructions to determine said score for each of said plurality of contributor groups from said inputs comprise:

instructions for directing said processing unit to:

read a previous accuracy index of each of said contributors in said media;

assign a weightage to each of said contributors based on said previous accuracy index of each of said contributors;

adjust the value of said inputs based on said weightage of each of said contributors; and

determine said score based on said adjusted value.

13. The system according to claim 12 wherein said instructions to determine said score based on said adjusted value comprise:

instructions for directing said processing unit to:

determine the average of said adjusted value of said inputs.

14. The system according to claim 1 wherein said predetermined correlation coefficient value is 0.7.

15. The system according to claim 1 wherein said quantitative information comprises said window period, an impact curve, a time lagging value and an impact duration.

16. The system according to claim 15 said instructions to determine said quantitative

information further comprises:

instructions for directing said processing unit to:

update said media with said quantitative information.

17. The system according to claim 16 wherein said instruction to determine said quantitative information further comprises:

instructions for directing said processing unit to:

determine a score associated to said key event; and

append said score to said quantitative information.

18. The system according to claim 17 wherein said instructions to determine said score associated to said key event comprise:

instructions for directing said processing unit to:

determine a percentage change in value over said impact duration in said key event by the expression:

Percentage change = (Price – Price') * 100%

where Price is a value at a beginning of said impact duration, Price' is a value at an end of said impact duration;

determine a score based on said percentage change.

19. The system according to claim 18 wherein said score is in a range of 1 to 5.

20. The system according to claim 18 wherein said instructions to determine said score based on said percentage change comprise:

instructions for directing said processing unit to:

indicate said score as 1 if percentage change is between -10% to -7%;

indicate said score as 2 if percentage change is between -6% to -3%;

indicate said score as 3 if percentage change is between -2% to 2%;

indicate said score as 4 if percentage change is between 3% to 6%; and

indicate said score as 5 if percentage change is between 7% to 10%.

21. A method for predicting a value in a next interval of a time period in a historical data which contains actual values over said time period comprising:

reading a score from each of a plurality of contributor groups stored in a media;

determining a qualitative score based on said score of each of said plurality of contributor groups read from said media;

receiving a key event input from a user;

determining a quantitative information based on said key event received comprising:

reading a historical data in said media, said historical data being a data structure that contains previous prices or demand on a certain product;

identifying events occurred in said historical data;

selecting a one of said identified events;

determining said quantitative information by analysing changes in said historical data due to said selected one of said identified event comprising:

selecting a window period,

determining a correlation coefficient by the expression:

$$r_{xy} = \frac{\sum_{i=0}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=0}^{n}(x_i - \bar{x})^2 (y_i - \bar{y})^2}}$$

where x is a price or demand in said historical data, y is a change due to said key event, n is said window period, $\bar{x}$ is an average value of x within said window period, $\bar{y}$ is an average value of y within said window period;

comparing said correlation coefficient with a predetermined correlation coefficient value; and

determining said quantitative information in response to said correlation coefficient being more than said predetermined correlation coefficient value;

storing said quantitative information in said media; and

removing said changes due to said selected one of said identified event from said historical data;

determining a predicted value in said next interval of a time period based on said qualitative scores and quantitative information;

storing said predicted value in said media; and

determining a confidence level of said predicted value.

22. The method according to claim 21 wherein said quantitative information comprises an impact curve, a window period, a time lagging value, an impact duration and a score associated

to said key event.

23. The method according to claim 22 wherein said confidence level is given by the expression, Confidence level = (score of said qualitative score / score associated to said key event) * 100%, in response to said score associated to said key event is equal to or greater than said qualitative score.

24. The method according to claim 22 wherein said confidence level is given by the expression, Confidence level = (score associated to said key event / score of said qualitative score) * 100%, in response to said score associated to said key event is smaller than said qualitative score.

25. The method according to claim 21 wherein said step of reading said score from each of said plurality of contributor groups comprise:

obtaining inputs from a number of contributors for each of said plurality of contributor groups;

determining said score for each of said plurality of contributor groups from said inputs; and

storing said score for each of said plurality of contributor groups in said media.

26. The method according to claim 25 wherein said score is in a range of 1 to 5.

27. The method according to claim 26 wherein said score being a value of 1 indicates a decrease by 10%, said score being a value of 2 indicates a decrease of 5%, said score being a value of 3 indicates 0%, said score being a value of 4 indicates an increase of 5%, and said score being a value of 5 indicates an increase of 10%.

28. The method according to claim 25 wherein said step of determining said qualitative score comprise:

reading said inputs;

determining an accuracy index for each of said inputs;

storing said accuracy index in said media;

comparing said accuracy index for each of said inputs with a predetermined amount; and

removing said one of said inputs from said media in response to said input having an accuracy index which is less than said predetermined amount.

29. The method according to claim 28 wherein said step of determining said accuracy index comprise:

determining a median from said inputs;

determining said accuracy index wherein said accuracy index is given by the expression:

$$accuracy\ index = \frac{value\ of\ a\ contributor}{base\ value}\ x\ 100\%$$

where $value\ of\ a\ contributor$ is one of said inputs, and $base\ value$ is said median.

30. The method according to claim 28 wherein said step of determining said accuracy index comprise:

determining a mean from said inputs wherein said mean is given by the expression:

$$\text{mean} = \frac{\Sigma x}{n}$$

where Σx is the sum of all inputs, and n is the value of x; and

determining said accuracy index wherein said accuracy index is given by the expression:

$$accuracy\ index = \frac{value\ of\ a\ contributor}{base\ value}\ x\ 100\%$$

where $value\ of\ a\ contributor$ is one of said inputs, and $base\ value$ is said mean.

31. The method according to claim 28 wherein said step of determining said accuracy index comprise:

determining a mode from said inputs;

determining said accuracy index wherein said accuracy index is given by the expression:

$$accuracy\ index = \frac{value\ of\ a\ contributor}{base\ value}\ x\ 100\%$$

where $value\ of\ a\ contributor$ is one of said inputs, and $base\ value$ is said mode.

32. The method according to claim 28 wherein said step of determining said score for each of said plurality of contributor groups from said inputs comprise:

reading a previous accuracy index of each of said contributors in said media;

assigning a weightage to each of said contributors based on said previous accuracy index of each of said contributors;

adjusting the value of said inputs based on said weightage of each of said contributors; and

determining said score based on said adjusted value.

33. The method according to claim 32 wherein said step of determining said score based on said adjusted value comprise:

determining the average of said adjusted value of said inputs.

34. The method according to claim 21 wherein said predetermined correlation coefficient value is 0.7.

35. The method according to claim 21 wherein said quantitative information comprises said window period, an impact curve, a time lagging value and an impact duration.

36. The method according to claim 35 said step of determining said quantitative information further comprises:

updating said media with said quantitative information.

37. The method according to claim 36 wherein said step of determining said quantitative information further comprises:

determining a score associated to said key event; and

appending said score to said quantitative information.

38. The method according to claim 37 wherein said step of determining said score associated to said key event comprise:

determining a percentage change in value over said impact duration in said key event by the expression:

$$\text{Percentage change} = (\text{Price} - \text{Price'}) * 100\%$$

where Price is a value at a beginning of said impact duration, Price' is a value at an end of said impact duration; and

determining a score based on said percentage change.

39. The method according to claim 38 wherein said score is in a range of 1 to 5.

40. The method according to claim 38 wherein said step of determining said score based on said percentage change comprise:

indicating said score as 1 if percentage change is between -10% to -7%;

indicating said score as 2 if percentage change is between -6% to -3%;

indicating said score as 3 if percentage change is between -2% to 2%;

indicating said score as 4 if percentage change is between 3% to 6%; and

indicating said score as 5 if percentage change is between 7% to 10%.