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IMAGE ACQUISTION AND PROCESSING FOR FINANCIAL ANALYSIS

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Introduction

Financial assets (such as stocks) are frequently mispriced due to inaccurate market expectations. These inaccurate expectations are due to a range of factors, but include infrequent (quarterly) reporting, and lack of insight into a company's operations. There is a lack of timely, granular, and (in some cases) accurate reporting.

Summary

Satellite image acquisition is well known in the art. Many companies provide commercial satellite imagery. Existing imaging systems also allow the determination of polygons representing places on Earth from satellite and other imagery. Utilization of such imagery to detect key indicators of a company's performance and activity can better inform investors of a target company's activity. For example, vehicle counts can inform retail sales, inventory levels might inform margin assessments, and commodity levels might inform futures prices.

Detailed Description

Described are systems, methods, computer programs, and user interfaces for image location, acquisition, analysis, and data correlation. Results obtained via image analysis are correlated to non-spatial information useful for commerce and trade. Financial analysts make money (at least in theory) by allocating capital to where it will be most productive. Predictions of future earnings are based off of present performance. When present performance exceeds or falls short of market expectations, the value of the corresponding financial instrument (stocks, bonds, options, etc.) adjusts as well. The market typically only receives these updates on a quarterly basis. Imagery could be used to better predict sales and/or production numbers for certain types of publicly held companies. For example, images of regions of interest of the Earth can monitor vehicle activity at retail and/or production facilities to anticipate company performance and place profitable financial trades.

The geographical coordinates of features on Earth, for example a particular type of retail or production facility can be mapped to textual descriptions. From these mappings, a polygon of interest on the surface of the Earth is determined. The polygon of interest's dimensions and coordinates control an image acquisition system. This system finds relevant and timely images in an image database and/or controls devices to acquire new images of the area. With one or more images of the polygon of interest available, various image enhancement techniques can be performed. Image enhancements can be performed to increase human and/or machine perception and discrimination of items of interest from the background.

Enhanced images, can then be presented to human workers to perform the visual analysis. The resulting counts are processed by analytic and statistical processes. These processes incorporate the results from many different images, and/or many results from the same image counted by different workers. The processes may include filtering functions to improve the resulting data.

Results of the processing can be correlated with non-spatial data, for example economic activity data. Over time these correlations allow the results of this analysis to be used in predicting the non-spatial data. For example, utilization of imagery to detect vehicle counts can inform retail sales based on the number of customers visiting a retail location. Vehicle counts can also inform production activity based on the number of employees at a production facility.

In some embodiments of this system, feedback from the image acquisition, image analysis, and non-spatial correlation is used to improve the data collected. For example, feedback may be used to refine the dimensions of the polygons of interest, the quality of the imagery, and the accuracy of the image analysis.

FIG. 1 shows a block diagram of one example of an imaging system 100, according to one embodiment. Input control parameters 105 specify the operation of the system. These parameters include textual non-spatial descriptions of areas of interest on Earth. Examples of non-spatial descriptions include “Retail Location.” Other control parameters may include the type of data to be collected (e.g., vehicle counts), time and date ranges for image collection, the frequency of derived data measurement, or requirements for confidence scores of derived data.

The location search subsystem 110 determines polygons of features of interest on the Earth. The geographical coordinates of features on Earth, for example a particular retail or production location, are mapped to textual descriptions. The geographical coordinates may be obtained from geographical databases or prior imagery of the site, for example. The textual descriptions may, for example, be the Retail Location in Mountain View, California. From these mappings, a polygon of interest on the surface of the Earth is determined.

The location search subsystem 110 can also be configured to receive feedback 169 from the non-spatial correlation subsystem 140. This may be the case where the non-spatial correlation subsystem 140 determines that additional information needs to be obtained by the location search subsystem 110. For example, the non-spatial correlation subsystem 140 may determine that the correlation between the count at a given location and the relevant economic data is inconsistent, suggesting a need for more or different data that can be obtained by location search subsystem 110. The feedback provided to the location search subsystem 110 may include an updated search location, thereby resulting in different locations being searched for use in obtaining results.

The polygons of interest can be passed 115 to the image acquisition subsystem 120. The image acquisition subsystem 120 determines the quality and appropriateness of the polygons based on real images. For example, the image acquisition subsystem 120 may determine that a polygon is enlarged, shifted or refined relative to the real images. This polygon discrepancy information may be provided as feedback 167 to the location search subsystem 110 to improve the quality and appropriateness of polygons determined by the location search subsystem 110.

The image acquisition subsystem 120 can also use the spatial information describing the polygons of interest and the other control parameters to acquire an image, or set of images, that satisfy the control parameters for each polygon of interest. In some cases, image data is accessed from an existing image archive 150. Additionally, if needed, these images are sourced from image archives, including a social image archive. In other cases, image data is obtained from an image collection subsystem 160, such as a satellite or satellite network, array of security cameras, drones, or other purpose built image acquisition systems. Images may be acquired from either or both of the image archives 150 and image collection 160 depending on which images are the most economical and appropriate for the task.

In some cases, feedback information about the quality and alignment of the imagery is passed back 166 to the image acquisition subsystem 120. Based on this feedback, the image acquisition subsystem 120 can acquire more imagery. The image acquisition subsystem 110 is also configured to receive feedback 168 from the non-spatial correlation subsystem 140. The feedback may be used to alter the acquisition of images. For example the feedback may be used to change the frequency or time of day of image acquisition.

The acquired images can be sent 125 to the image analysis subsystem 130. The image analysis subsystem 130 evaluates the images, enhances and prepares the images, presents the images to the human workers with a task specific user interface, statistically processes the results, and passes those results 135 to the non-spatial correlation subsystem 140.

The image analysis subsystem 130 can include a number of methods for improving accuracy and throughput in image analysis. The capabilities of the image analysis subsystem 130 are described with respect to the example of determining vehicle counts at a given location. However, the principles discussed are general and can be applied to many different image analysis tasks. Image enhancement and analysis can be performed with automated systems and/or human-in-the-loop systems. In some cases, the image analysis subsystem 130 receives feedback information 165 about the accuracy and adequacy of its results from the non-spatial correlation subsystem 140. In these cases, the data is modified, or the image analysis is re-performed according to the feedback information.

The non-spatial correlation subsystem 140 can receive result data 135 from the image analysis subsystem 130, and calculate temporal correlation between that data and economic data of interest. For example, the vehicle count at a given location can inform sales at a retail location or production output at a production facility. By providing granular and timely transparency into sales or production output, such data can help traders predict future earnings

The non-spatial correlation subsystem 140 can collect correlation data over time. The collected data is used to create a prediction of future economic metrics based on previously collected correlations between image analysis data and economic data. For example, vehicle count can reduce the impact of “sales surprise.” For reference “sales surprise” refers to an event where a specific company exceeds or misses the consensus analyst expectations for the company. “Sales surprises” are a less commonly used metric in finance than “earnings surprises,” but are more relevant for the present purposes, since vehicle counts at retail location should correlate to sales, not necessarily to margins.

Figures

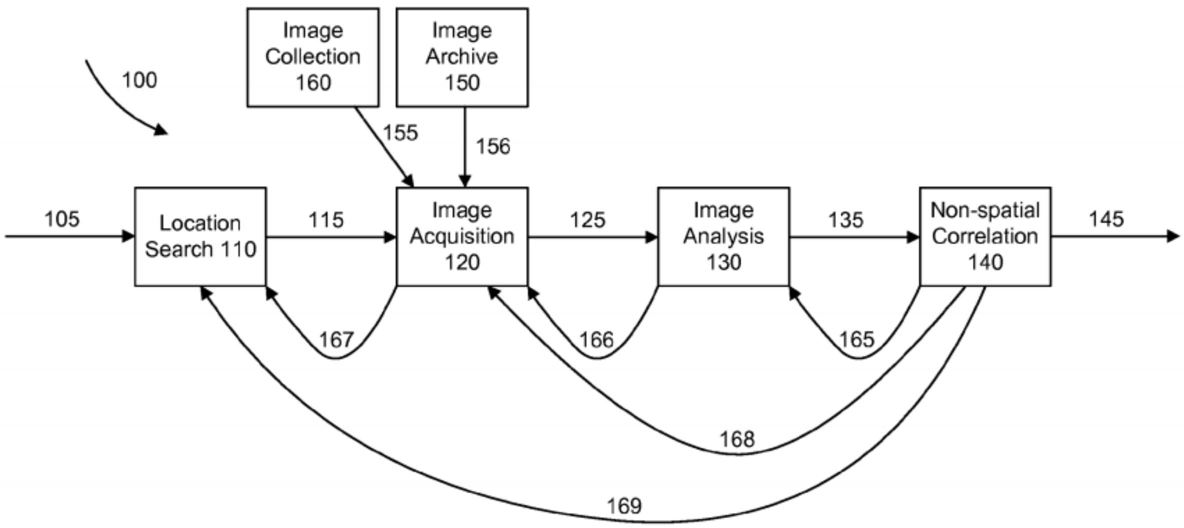

FIGURE 1

Abstract

Described are systems, methods, computer programs, and user interfaces for image location, acquisition, analysis, and data correlation. Results obtained via image analysis are correlated to non-spatial information useful for commerce and trade. Financial analysts make money (at least in theory) by allocating capital to where it will be most productive. Predictions of future earnings are based off of present performance. When present performance exceeds or falls short of market expectations, the value of the corresponding financial instrument (stocks, bonds, options, etc.) adjusts as well. The market typically only receives these updates on a quarterly basis. Imagery could be used to better predict sales and/or production numbers for certain types of publicly held companies. For example, images of regions of interest of the Earth can monitor vehicle activity at retail and/or production facilities to anticipate company performance and place profitable financial trades.

Keywords associated with the present disclosure include: image acquisition, satellite imagery drone imagery, vehicle count, car count.