

incorporate new data. Updating the n-dimensional cube may involve recomputing the data points at each intersection of its dimensions. The recomputation may be even more burdensome when new dimensions are to be added to the n-dimensional cube. Accordingly, these types of n-dimensional cube structures are not well suited to dynamic data environments.

SUMMARY OF INVENTION

[0003a] According to a first aspect of the present invention, there is provided a system for performing data analytics, the system possessing improved scaling characteristics, the system comprising: a plurality of computing nodes comprising a first one or more computing nodes and a second one or more computing nodes, the plurality of computing nodes, when activated, maintaining a slice of an n-dimensional cube, the slice comprising a hierarchy of data points, the data points corresponding to intersections of one or more fixed dimensions and one or more variable dimensions; and one or more memories having stored thereon computer-readable instructions that, upon execution, cause the system at least to: maintain a first subset of the hierarchy of data points on the first one or more computing nodes, wherein data points are included in the first subset based at least in part on a data point of the hierarchy being associated with a first classification of computational demands; maintain a second subset of the hierarchy of data points on the second one or more computing nodes, wherein data points are included in the second subset based at least in part on a data point of the hierarchy being associated with a second classification of computational demands; and process a first request to access a data point of the hierarchy by processing the request on the first one or more computing nodes, wherein the first one or more computing nodes are configured with a scaling mechanism based at least in part on the first classification of computational demands.

[0003b] According to a second aspect of the present invention, there is provided a computer-implement method for maintaining an n-dimensional cube, the method comprising: identifying a subset of a hierarchy of data points in the n-dimensional cube, wherein the subset is identified based at least in part on a computational demand associated with a data point in the subset of the hierarchy; selecting a scaling mechanism based at least in part on the computational demand associated with the data point; and maintaining the subset of the hierarchy on at least a first computing node and a second computing node, wherein the subset of

the hierarchy is at least partitioned or replicated between the first computing node and the second computing node based on the selected scaling mechanism.

[0003c] According to a third aspect of the present invention, there is provided a system comprising: a processor; and a non-transitory computer-readable storage medium having stored thereon instructions that, upon execution by one or more computing devices, cause the one or more computing devices at least to: determine to store a hierarchy of data points on at least a first computing node and a second computing node; store a first subset of the hierarchy of data points on the first one or more computing nodes, wherein data points are included in the first subset based at least in part on a data point in the hierarchy being associated with a first classification of computational demands; and store a second subset of the hierarchy of data points on the second one or more computing nodes, wherein data points are included in the second subset based at least in part on a data point in the hierarchy being associated with a second classification of computational demands.

BRIEF DESCRIPTION OF DRAWINGS

[0004] The following detailed description may be better understood when read in conjunction with the appended drawings. For the purposes of illustration, various examples of aspects of the disclosure are shown in the drawings; however, the invention is not limited to the specific methods and instrumentalities disclosed.

[0005] FIG. 1A is a block diagram depicting an embodiment of a system for maintaining an n-dimensional cube usable in connection with cloud-based analytics.

[0006] FIG. 1B is a block diagram depicting the operation of an embodiment of a system for maintaining an n-dimensional cube usable in connection with cloud-based analytics, the operation pertaining to the addition of a new dimension observed in a real-time data stream.

[0007] FIG. 2A is a block diagram depicting the operation of an embodiment of a system for performing cloud-based analytics, the operation involving maintenance of a dependency graph upon the addition of a new dimension to an n-dimensional cube.

[0008] FIG. 2B is a block diagram depicting the operation of an embodiment of a system for performing cloud-based analytics, the operation involving the addition of an attribute to an n-dimensional cube.

[0009] FIG. 2C is a diagram depicting an embodiment of a scalable storage mechanism for hierarchy data contained within a slice.

[0010] FIG. 3A is a flowchart depicting an embodiment of a process for maintaining an n-dimensional cube adapted for cloud-based analytics.

[0011] FIG. 3B is a flowchart depicting an embodiment of a process for deferring computation of data points in an n-dimensional cube.

[0012] FIG. 4 is a flowchart depicting an embodiment of a process for performing deferred computations in an n-dimensional cube adapted for cloud-based analytics.

[0013] FIG. 5A is a block diagram depicting an embodiment of a system for providing hosted analytics services.

4. The system of claim 1, further comprising one or more memories having stored thereon computer-readable instructions that, upon execution, cause the system at least to:
 - classify a region of the hierarchy based at least in part on mapping between a dimension associated with the hierarchy and one or more computational demands associated with the dimension.
5. The system of claim 1, further comprising one or more memories having stored thereon computer-readable instructions that, upon execution, cause the system at least to:
 - identify a path in the hierarchy based at least in part on a frequency of access for data points in the path; and
 - maintain the data points associated with the path in main memory while the frequency of access is above a threshold level.
6. A computer-implement method for maintaining an n-dimensional cube, the method comprising:
 - identifying a subset of a hierarchy of data points in the n-dimensional cube, wherein the subset is identified based at least in part on a computational demand associated with a data point in the subset of the hierarchy;
 - selecting a scaling mechanism based at least in part on the computational demand associated with the data point; and
 - maintaining the subset of the hierarchy on at least a first computing node and a second computing node, wherein the subset of the hierarchy is at least partitioned or replicated between the first computing node and the second computing node based on the selected scaling mechanism.
7. The method of claim 6, wherein the scaling mechanism is selected based at least in part on write frequency being high relative to read frequency.
8. The method of claim 7, further comprising:
 - horizontally partitioning data points of the subset of the hierarchy between at least the first computing node and the second computing node.

9. The method of claim 6, wherein the scaling mechanism is selected based at least in part on read frequency being high relative to a capacity of the first computing node to respond to requests to read data in the subset of the hierarchy.
10. The method of claim 9, further comprising:
 - replicating at least a portion of the subset of the hierarchy on the second computing node, wherein the at least a portion of the subset of the hierarchy is maintained on the first computing node.
11. The method of claim 6, further comprising:
 - classifying a region of the hierarchy based at least in part on a mapping between a dimension associated with the hierarchy and a computational demand associated with the dimension.
12. The method of claim 6, further comprising:
 - identifying a path in the hierarchy based at least in part on a frequency of access for data points in the path; and
 - maintaining the data points associated with the path in main memory while the frequency of access is above a threshold level.
13. The method of claim 6, further comprising:
 - selecting a second scaling mechanism for an additional subset of the hierarchy, based at least in part on computational demands associated with data points in the additional subset.
14. A system comprising:
 - a processor; and
 - a non-transitory computer-readable storage medium having stored thereon instructions that, upon execution by one or more computing devices, cause the one or more computing devices at least to:
 - determine to store a hierarchy of data points on at least a first computing node and a second computing node;
 - store a first subset of the hierarchy of data points on the first one or more computing nodes, wherein data points are included in the first subset based at least in part on a data point in the hierarchy being associated with a first classification of computational demands; and