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HYPOTHESES

RESEARCH METHODOLOGY

RESULTS & DISCUSSION

FINDINGS

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AN APPROACH ON PREPROCESSING OF DATA STREAMS

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ABSTRACT

The recent advances in hardware and software have enabled the capture of different measurements of data in a wide range of fields. These measurements are generated continuously and in a very high fluctuating data rates. Examples include sensor networks, web logs, and computer network traffic. The storage, querying and mining of such data sets are highly computationally challenging tasks. Mining data streams is concerned with extracting knowledge structures represented in models and patterns in non stopping streams of information. The research in data stream mining has gained a high attraction due to the importance of its applications and the increasing generation of streaming information. Applications of data stream analysis can vary from critical scientific and astronomical applications to important business and financial ones. Algorithms, systems and frameworks that address streaming challenges have been developed over the past three years. In this review paper, we present the state of- the-art in this growing vital field.

KEYWORDS
component, data stream, VFDT.

INTRODUCTION

The intelligent data analysis has passed through a number of stages. Each stage addresses novel research issues that have arisen. Statistical exploratory data analysis represents the first stage. The goal was to explore the available data in order to test a specific hypothesis. With the advances in computing power, machine learning field has arisen. The objective is to find computationally efficient solutions to data analysis problems. Along with the progress in machine learning research, new data analysis problems have been addressed. Due to the increase in database sizes, new algorithms have been proposed to deal with the scalability issue. Moreover machine learning and statistical analysis techniques have been adopted and modified in order to address the problem of very large databases. Data mining is that interdisciplinary field of study that can extract models and patterns from large amounts of information stored in data repositories.

Recently, the data generation rates in some data sources become faster than ever before. This rapid generation of continuous streams of information has challenged our storage, computation and communication capabilities in computing systems. Systems, models and techniques have been proposed and developed over the past few years to address these challenges.

In this paper, we review the theoretical foundations of data stream analysis, mining data stream systems, techniques are critically reviewed. Finally, we outline and discuss research problems in streaming mining field of study. These research issues should be addressed in order to realize robust systems that are capable of fulfilling the needs of data stream mining applications. The paper is organized as follows. Section 2 presents the theoretical background of data stream analysis. In sections 3 and 4 mining data stream techniques and systems are reviewed respectively. Open and addressed research issues in this growing field are discussed in section 5. Finally section 6 summarizes this review paper. section 7 enlist the references.

THEORETICAL FOUNDATIONS

Research problems and challenges that have been arisen in mining data streams have its solutions using well established statistical and computational approaches. We can categorize these solutions to data-based and task-based ones. In data-based solutions, the idea is to examine only a subset of the whole dataset or to transform the data vertically or horizontally to an approximate smaller size data representation. At the other hand, in task-based solutions, techniques from computational theory have been adopted to achieve time and space efficient solutions. In this section we review these theoretical foundations

DATA-BASED TECHNIQUES

Data-based techniques refer to summarizing the whole dataset or choosing a subset of the incoming stream to be analyzed. Sampling, load shedding and sketching techniques represent the former one. Synopsis data structures and aggregation represent the later one. Here is an outline of the basics of these techniques with pointers to its applications in the context of data stream analysis.

Sampling : Sampling refers to the process of probabilistic choice of a data item to be processed or not.

Load Shedding: ItLoad shedding refers to the process of dropping a sequence of data streams.

Sketching: Sketching is the process of randomly project a subset of the features.

Synopsis Data Structures: Creating synopsis of data refers to the process of applying summarization techniques that are capable of summarizing the incoming stream for further analysis.

Aggregation: Aggregation is the process of computing statistical measures such as means and variance that summarize the incoming stream.

TASK-BASED TECHNIQUES

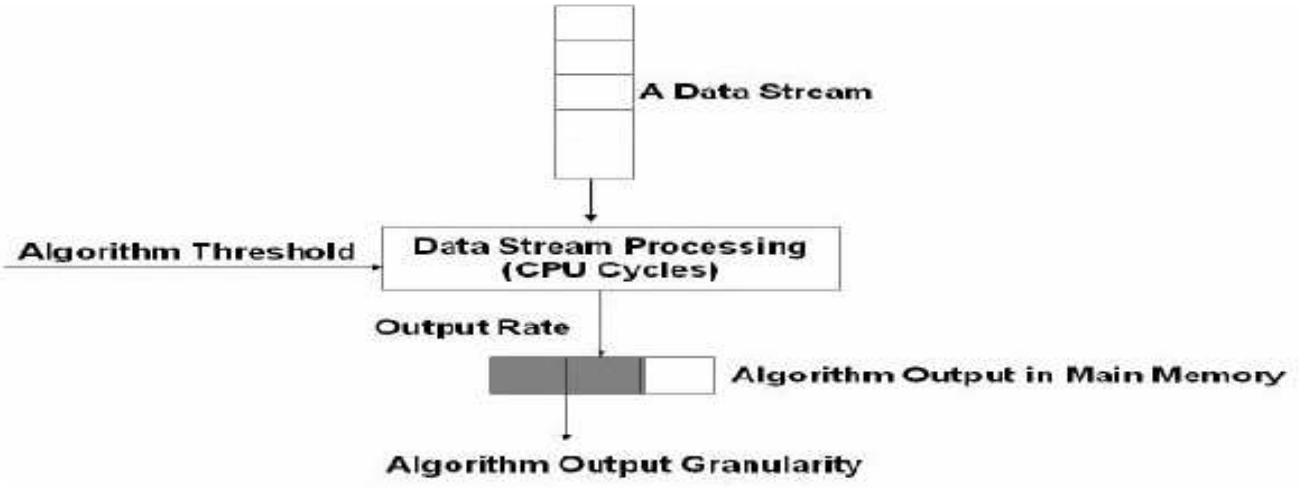
Task-based techniques are those methods that modify existing techniques or invent new ones in order to address the computational challenges of data stream processing. Approximation algorithms, sliding window and algorithm output granularity represent this category. In the following subsections, we examine each of these techniques and its application in the context of data stream analysis.

Approximation algorithms – they have their roots in algorithm design. It is concerned with design algorithms for computationally hard problems.

Sliding Window - The inspiration behind sliding window is that the user is more concerned with the analysis of most recent data streams.

Algorithm Output Granularity -The algorithm output granularity (AOG) introduces the first resource-aware data analysis approach that can cope with fluctuating very high data rates according to the available memory and the processing speed represented in time constraints.

FIG. 1: THE AOG ALGORITHM



MINING TECHNIQUES

Mining data streams has attracted the attention of data mining community for the last three years. Number of algorithms has been proposed for extracting knowledge from streaming information. In this section, we review clustering, classification, frequency counting and time series analysis techniques.

Clustering*:* Clustering can be considered the most important unsupervised learning problem; so, as every other problem of this kind, it deals with finding a structure in a collection of unlabeled data.A loose definition of clustering could be "the process of organizing objects into groups whose members are similar in some way".A cluster is therefore a collection of objects which are "similar" between them and are "dissimilar" to the objects belonging to other clusters.

Classification: GEMM algorithm accepts a class of models and an incremental model maintenance algorithm for the unrestricted window option, and outputs a model maintenance algorithm for both window-independent and window dependent block selection sequence. Domingos et al. have developed VFDT. It is a decision tree learning systems based on Hoeffding trees.

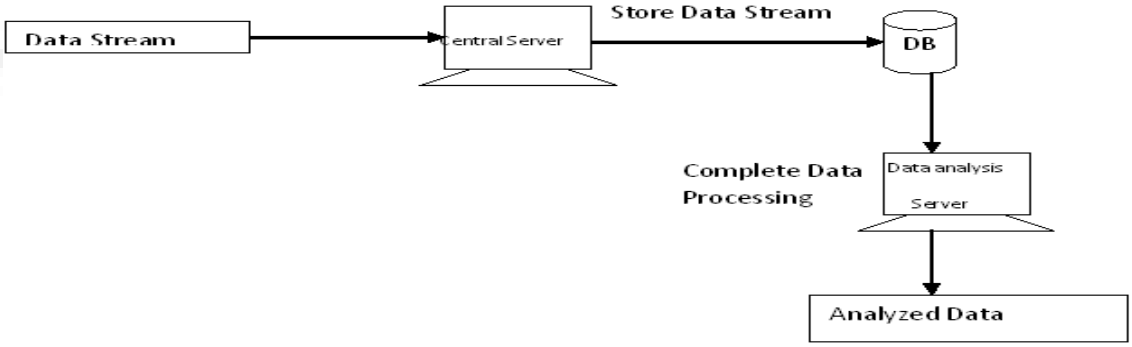
1. **FrequencyCounting**: Lightweight frequency counting LWF. It has the ability to find an approximate solution to the most frequent items in the incoming stream using adaptation and releasing the least frequent items regularly in order to count the more frequent ones.
2. **Time Series Analysis**: This representation allows dimensionality/numerosity reduction. They have demonstrated the applicability of the proposed representation by applying it to clustering, classification, indexing and anomaly detection. The approach has two main stages. The first one is the transformation of time series data to Piecewise Aggregate Approximation followed by transforming the output to discrete string symbols in the second stage

EXISTING SYSTEMS

In many scientific domains, especially those using sensors, the data is generated as a data stream, that is, the data arrives in sequential order in an infinitely long stream. As this data indicates the state of the system, we are interested in on-line, any-time algorithms which can analyze the data as it is being collected to determine if there are any anomalous events in the data.

Data stream mining is the process of extracting knowledge structure form continuous, rapid data records. Recent years, the researchers in data stream mining have received attention due to the importance of its applications and the increasing generation of streaming information. A variety of systems, models and technique have been proposed and developed to address the challenges in data stream mining.

FIG. 2: TRADITIONAL DATA STREAM ANALYSIS SYSTEM



Above fig. shows the existing data analysis processing system. In above system, data is analyzed statically. First, data stream from various sources are temporarily stored in central database server and then complete data is send to data analysis server, which perform all data-based technique on that data. After completing analyzing data is stored in another server.

RESEARCH ISSUES

Data stream mining is a stimulating field of study that has raised challenges and research issues to be addressed by the database and data mining communities. The following is a discussion of both addressed and open research issues. The following is a brief discussion of previously addressed issues is as follows:

1. Unbounded memory requirements due to the continuous flow of data streams.
2. Required result accuracy.
3. Transferring data mining results over a wireless network with a limited bandwidth.
4. Modeling changes of mining results over time.
5. Developing algorithms for mining results' changes
6. Visualization of data mining results on small screens of mobile devices.
7. Interactive mining environment to satisfy user requirements.
8. The integration between data stream management systems and the ubiquitous data stream.
9. Mining approaches.
10. The needs of real world applications.
11. Data stream pre-processing.
12. Model over fitting.
13. Data stream mining technology
14. The formalization of real-time accuracy evaluation.

RESULTS AND DISCUSSION

These techniques are used for reduction of large data set into small datasets. Sampling and sketching for the different data sets gives different output.
For Ex: Given dataset consist of D records. If we implemented Sampling and Sketching on this dataset then it gives following output:

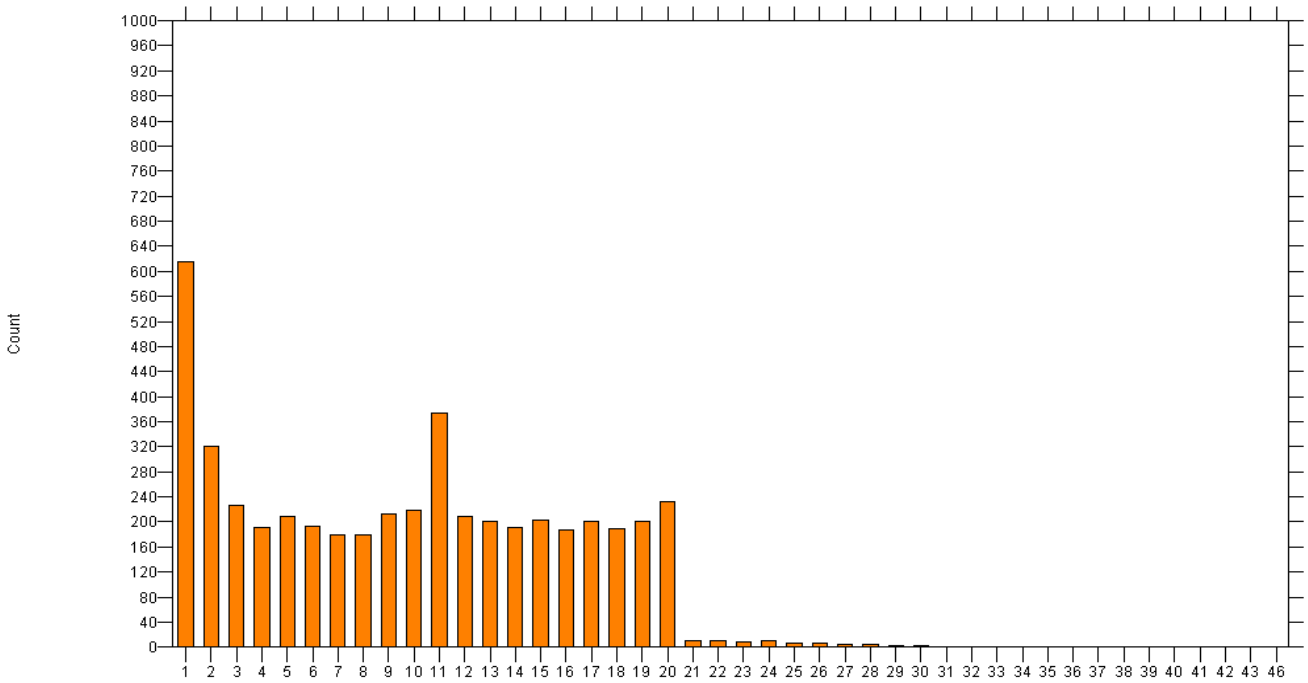
SAMPLING

1) **Nth Sampling**: In this method, we skipped number of record as per the value of N. If N is 'n' then output in record for above dataset is D/n. It means it will reduce the data (100-(D/n))%.
2) **Random Sampling**: In this method, we skipped number of record randomly. Random number is selected by this method and it will reduce the data It will skip the data on that random number. It will reduce the data approximately 50%. Reduction is depend upon the random number.
3) **Strata Sampling**: In this method, we skipped number of record depending upon the even and odd numbers. It generate random cluster and select even or odd cluster as per user decide. It will reduce the data approximately 60%.
4) **Biased-L2 Sampling**: In this method, we use sampling rate and penalty function. This penalty function is generated by random cluster. Penalty function reduces the constant number of record and useful for error reduction. It will reduce the data approximately 60%.

SKETCHING

Sketching is the process of randomly project a subset of the features. It is the process of vertically sample the incoming stream. Sketching has been applied in comparing different data streams and in aggregate queries. It gives the frequency of key attribute in whole data stream.

FIG. 3: HISTOGRAM FOR SKETCHING



We use KDD data set with 10000 records. Key attribute is srv_count. Graph shows the frequency of different values of server count (srv_count) for the given dataset.

CONCLUSIONS

The objective behind designing this tool was to make easy and familiar the concept of data analysis in data mining. We have successfully able to implement data based technique for data stream analysis. We have able to implement sampling, sketching and load shedding technique on data stream. In sampling, we have implemented four algorithms named Nth sampling, random sampling, Strata sampling and Deterministic Biased-L2 sampling. The main aim of our software is to analysis of data stream dynamically. When the data is dynamically analyzed then we don't need to store it in any intermediate server. We also increase the

efficiency of algorithms so that it will take less time to analyze the data. We use the queue which holds the 1000 records at a time. User can change the size of the queue.

SCOPE FOR FUTURE RESEARCH

We have successfully implemented two techniques of statistical model that is sampling and sketching. In future, user can implement remaining three techniques. We have implemented these techniques dynamically with higher efficiency.

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