

# StreamDiv Project Report

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**Abstract**—Data mountains continue to grow in size, increasing the difficulty in retrieving useful analysis from them. In addition, generated data is frequently plagued by sameness; the data that is retrieved tends to follow the same pattern, helpful in prediction tasks or outlier detection, but not necessarily helpful in characterizing the data from a stream. Users tend to know in a general sense what they are searching for in their datasets and streams, but may not know the full space of relevant results. Diversity helps alleviate this problem, but faces its own challenges when combined with relevancy and recency in streaming contexts.

In our work, we explore different designs for a diversity operator in a stream processing environment. In addition, we factor in the impact of recency and user-defined relevancy by ranking incoming data. Users will specify a size for a representative top- $k$  set for the data seen from the stream. This top- $k$  set is maintained by the system and updated based on recency, relevancy, and diversity from continuous streaming data. We consider two types of tuple-replacement schemes, incremental and batch, for maintaining the top- $k$  set, and find CONCLUSION.

## I. INTRODUCTION

Data creation and collection only continues to increase, leaving a large burden on analysts to come up with a way to quickly and efficiently comb through the data to locate trends and correlations. There tends to be a focus on data-specific approaches with frameworks that work well for certain kinds of data (but not well on others CITATION NEEDED). There also is a need in data analysis to provide relevant but diverse data points as a digest of the full data set. Several offline versions have been created [1] CITATIONS NEEDED, but lack the speed to work in a streaming environment. We present StreamDiv, a streaming framework built on top of a previously developed diversity system for offline database systems, PrefDiv[1], to provide queriers of a data streaming systems a top- $k$  set that is most relevant and diverse, adding recency as a possible influence on the digested set.

The system model of our work is a stand-alone stream processing system, with a single stream of data as input. Processing is modeled as a pipeline of operators, which process incoming tuples and forward results to the next operator. The output is not a single result (as in the case of traditional databases), but periodical results that reflect the most sensible outcome (according to the algorithm) based on time-windows.

As far as different dimensions of the problem are concerned, ranking is considered as a set of user-defined properties that are either attached to incoming tuples (annotate), or are used for filtering out tuples. Turning to the diversity operator, we abstract it as a stateful operator, with time- based sliding windows. The operator's frequency of result production can

be one of the following: (i) a temporary snapshot of the most diverse tuples in the current time-window produced every time a tuple is received, (ii) a set of the most diverse tuples among all the tuples that have been received in a user-defined epoch. In the latter case, we consider how many tuples are replaced and which ones every time a new tuple arrives. For the former case, we consider a static approach (a pre-defined fraction  $p$  of the tuples are replaced after every epoch), and a dynamic one (the fraction  $p$  of the tuples replaced is proportional to the  $\delta$  in diversity gained compared to the replacement fraction of the previous epoch). As regards to replacement policy, we have the alternatives of random replacement, and least recently tuple received replacement.

## II. PRELIMINARIES

Elaborate more on diversity, relevance and recency, and possibly related work...

## III. PROBLEM DEFINITION

Formal definition of the problem...

## IV. STREAMDIV SCHEMES

Discuss the incremental and batch replacement algorithms here. Also explain how the recency and relevancy are combined.

## V. RESULTS

## VI. CONCLUSION

## ACKNOWLEDGMENT

The authors would like to thank...

## REFERENCES

- [1] X. Ge, P. K. Chrysanthis, and A. Labrinidis, "Preferential diversity," in *Proceedings of the Second International Workshop on Exploratory Search in Databases and the Web*, ser. ExploreDB '15. New York, NY, USA: ACM, 2015, pp. 9–14. [Online]. Available: <http://doi.acm.org/10.1145/2795218.2795224>