Re-engineering the IDEALEM data compression software

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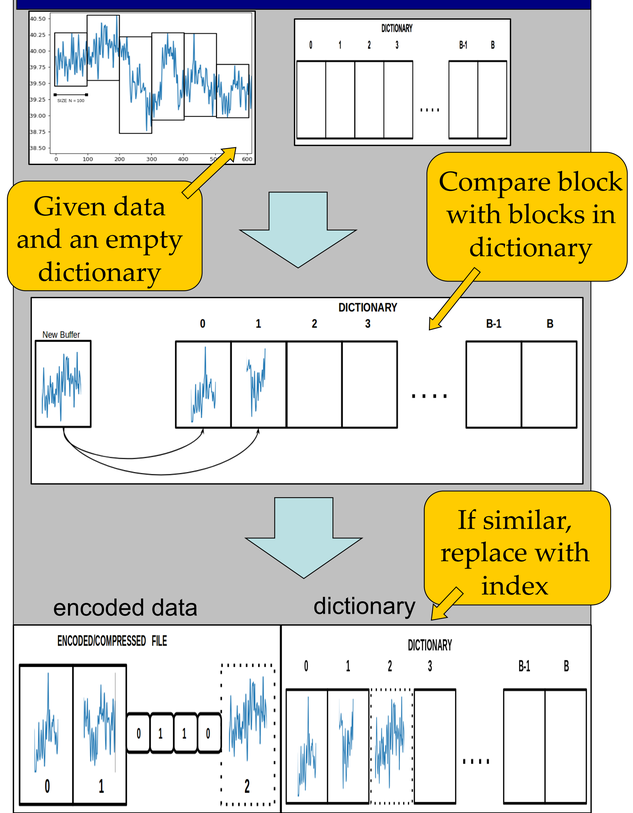
ABSTRACT

In a largely data driven world, lots of scientific fields are generating large amounts of data, far too much to analyze. Data compression has become more important than ever. IDEALEM is a lossy compression algorithm but preserves the important characteristics in the data. This work helps expand and generalize the software so it can be easily used by a wide variety of scientific groups.

BACKGROUND INFO



- Algorithm uses a similarity measure to compare data blocks with those saved in the dictionary.
- If data is similar, the index of the block from the dictionary. replaces the block in the data.
- Preserves fluctuating data but compresses stagnant data.

RESEARCH QUESTION

How do we expand the functionality of the IDEALEM software to increase the usability for the user?

LIMITATIONS

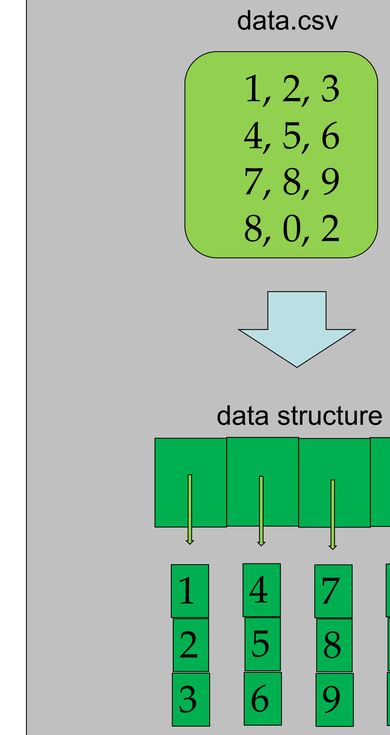
- Previously, software had limitations:
  - Only 1-D data could be inputted
  - Only one similarity measure could be chosen (KS test)
  - Only way to run algorithm was with command line arguments

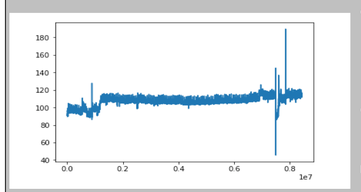
METHODS

- New similarity measures, such as MJC (minimum jumping cost) and DTW (dynamic time warp), are added, allowing the user to pick which one to use.
- API created so user can integrate algorithm into their software.
- The API also allows them to define and use their own similarity measure.
- User can simply call a function in the API that takes in a function pointer, and pass in a pointer to their similarity measure. The software will then use this new function as a similarity measure.
- Tested the API for custom function with user-defined MMD (maximum mean discrepancy) similarity measure.

RESULTS

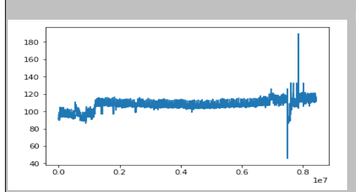
- Data inputted is now stored in this data structure to allow multivariable functionality:





Original data

Encoded data



Recovered data

- Electricity PowerGrid Data
- Size: 133.84 MB

- Parameters:
  - KS Test
  - Block Size: 16
  - Threshold: 0.05
  - History: 254
- Compressed Size: 710.71 KB
- Ratio: 188.32

- Recovered Data after compression
- Very similar to original data

CONCLUSION

- Adding new functionality can allow users for greater autonomy when using the product.
- More independence on how the user wants to use the algorithm and with what data.
- With more simplicity, there is a potential for more users to take advantage of the compression algorithm.

FUTURE WORK

- Using the algorithm to analyze time series data and detect deviations from expected patterns.
- Encoding parameters used to encode data inside the encoded data so that decoding can be done without remembering the parameters used.

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