Dear Dr. Ma,

We have completed the review process of the above referenced paper that was submitted to the IEEE Transactions on Knowledge and Data Engineering.

Enclosed are your reviews. We hope that you will find the editor's and reviewers’ comments and suggestions helpful.

I regret to inform you that based on the reviewer feedback, we could not recommend publishing your paper. Final decisions on acceptance are based on the referees' reviews and such factors as restriction of space, topic, and the overall balance of articles.

We hope that this decision does not deter you from submitting to us again.

Please do not resubmit this paper or its revision to TKDE within the next 6 months.

Thank you for your interest in the IEEE Transactions on Knowledge and Data Engineering.

Sincerely,

Xuemin Lin

Editor-in-Chief

IEEE Transactions on Knowledge and Data Engineering [xueminlin.TKDE@gmail.com](mailto:xueminlin.TKDE@gmail.com)

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Editor Comments

Associate Editor

Comments to the Author:

The paper proposes two one-pass error bounded trajectory simplification algorithms (CISED-S and CISED-W) using the synchronous Euclidean distance, based on a spatio-temporal cone intersection technique, one for strong simplification and the other for weak simplification.Efficiency and effectiveness of the proposed algorithms are shown with real-world datasets.

The paper is largely well-written and the results look promising, but overall the main contribution of the paper seems incremental to be accepted for TKDE. Especially, I recommend authors make a clear and explicit distinction from the paper titled “One-pass error bounded trajectory simplification” [10]. While the paper is a good read, there are suggestions on the wiring as well with regard to readability and clarity. Please see below for more details.

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# Reviewer: 1

Recommendation: Reject

Comments:

In this paper, the authors propose two one-pass algorithms for the trajectory simplification problem with the synchronous Euclidean distance

(SED) as the error measurement, one for strong simplification and the other for weak simplification. The major idea is to scan the points of a given trajectory one by one during which process, it maintains the intersection some “sectors” constructed based on the points scanned, and to drop all those points for which the corresponding intersections are non-empty. The cost of scanning one point is O(1) and thus the overall cost of the algorithms is O(n) where n is the number of points of the trajectory.

Experiments based on real datasets were conducted which showed that the proposed algorithms provided a new and competitive trade-off among effectiveness (e.g., compression ratio), accuracy (e.g., error), and efficiency (e.g., running time).

Overall, this paper studies a well-known problem by adopting an error measurement which is more suitable and the proposed algorithms are sound and also verified by experiments on real datasets to provide some new and competitive trade-offs among common measures. Nevertheless, the main contribution of this paper is incremental (e.g., the main algorithms are simply adapted from those designed for the same problem with a different error measurement and the improvements over the algorithms for computing the intersection between two convex polygons are also heuristic-based), which the reviewer does not think enough for publication in TKDE.

Some more detailed comments are as follows.

D1. In Section 2.2, the part of introducing a sector wrt two points is not precise, e.g., the two cases of the directions of the two border lines of a sector do not cover all possible cases.

D2. The description of a "cone projection circle" in Section 3.1 is precise but might be difficult for a reader without much expertise in this field to follow. It is good a figure (i.e., Figure 5) is provided for better illustration, but the figure itself is not easy to read since too many texts are put in the figure.

D3. When a "cone projection circle" is defined, a parameter t\_c is used, but this parameter is not captured by the notation used to denote the "cone projection circle".

D4. In Proposition 4, "sed(P\_i, ) \le epsilon" should be "sed(P\_{s+i}, ) \le epsilon".

D5. Theorem 8 seems to be trivial and should be dropped, e.g., an algorithm that scans all the points (but does nothing else) and returns the original trajectory is a trivial one-pass error bounded algorithm using SED.

D6. The title of the reference [29] should be "Linear-time sleeve-fitting polyline simplification algorithms" instead of "Linear-time sleeve-fitting polyline".

**Additional Questions:**

1. Which category describes this manuscript?: Research/Technology

2. How relevant is this manuscript to the readers of this periodical? Please explain your rating under Public Comments below.: Relevant

1. Please explain how this manuscript advances this field of research and/or contributes something new to the literature.: One-pass algorithms are important for trajectory simplification in cases where points can only be processed once. Nevertheless, existing one-pass algorithms were designed based on some error measurements that do not consider the temporal information embedded in a trajectory and thus they are not suitable for trajectory data. This paper proposes two one-pass algorithms for trajectory simplification based on the synchronous Euclidean distance (SED) which is more suitable for trajectory data.

2. Is the manuscript technically sound? Please explain your answer under Public Comments below.: Yes

1. Are the title, abstract, and keywords appropriate? Please explain under Public Comments below.: Yes

2. Does the manuscript contain sufficient and appropriate references? Please explain under Public Comments below.: References are sufficient and appropriate

3. Does the introduction state the objectives of the manuscript in terms that encourage the reader to read on? Please explain your answer under Public Comments below.: Yes

4. How would you rate the organization of the manuscript? Is it focused? Is the length appropriate for the topic? Please explain under Public Comments

below.: Satisfactory

5. Please rate the readability of the manuscript. Explain your rating under Public Comments below.: Readable - but requires some effort to understand

6. Should the supplemental material be included? (Click on the Supplementary Files icon to view files): No, it should not be included at all

7. If yes to 6, should it be accepted:

Please rate the manuscript. Please explain your answer.: Fair

# Reviewer: 2

Recommendation: Author Should Prepare A Major Revision For A Second Review

Comments:

The paper is generally well written and there are three strong points.

Strong point 1: The algorithms are based on the error metric SED instead of PED. SED outperforms PED in many ways because trajectory data consist of both spatial and temporal information and it is necessary to bound the distance error at every time stamp.

Strong point 2: The one-pass algorithms are very efficient and is adaptable to resource-constrained devices.

Strong point 3: Both strong simplification and weak simplification algorithms are considered in the paper. The strong simplification algorithm generates more accurate results while the weak simplification algorithm achieves better compression ratio, so they meet different requirements.

However, some weak points are also observed.

Weak point 1: The most crucial weak point of the paper is that the algorithms proposed are not proved to be optimal though the effectiveness is shown by their better performance than DPSED and SQUISH-E in the experimental study. A good line simplification algorithm should generate fewest points to approximate an input polyline. Besides, whether the algorithm is one-pass or online is not as important as optimality.

There are optimal strong simplification algorithms for three dimensional data and optimal weak simplification algorithms for two dimensional data.

The experimental study should at least contain the performance comparison between CISED and the optimal algorithms.

Equilateral polygon approximation in CI also leads to deviation from optimal results but it is a good idea since it is hard to compute the intersection of circles efficiently. However, the algorithms still do not generate minimal polylines under the approximated cones restriction.

The authors are asked to develop optimal algorithms, or give rational analyses on difficulties of the problem and how CISED-S and CISED-W approximate to the optimal algorithms.

Weak point 2: There are too many notations and definitions in the paper.

These notations are useful in proofs but confusing in descriptions and discussions.

The subsection introducing intersection of convex polygons (2.3) is not necessary, since it is a basic problem in computational geometry.

Additional Questions:

1. Which category describes this manuscript?: Research/Technology

2. How relevant is this manuscript to the readers of this periodical? Please explain your rating under Public Comments below.: Very Relevant

1. Please explain how this manuscript advances this field of research and/or contributes something new to the literature.: Polyline simplification is one of the fundamental problems in computer geometry, which is associated with some important applications in Geometric Information System, such as trajectory compression, route planning and map generalization.

In this paper, the authors proposed two algorithms to compress spatiotemporal trajectories under certain Synchronous Euclidean Distance

(SED) restrictions. The algorithms are based on the concept of spatiotemporal Cone Intersection (CI), by extending the existing sector intersection methods. Whereas it takes O(nlogn) time to compute the intersection of n circles, which is not affordable in the trajectory compression problem, circles are replaced with regular polygons proximately.

Then the intersection of cones is computed within O(1) time in each iteration.

Afterwards both strong and weak polyline simplification algorithms based on SED are proposed. The strong simplification algorithm removes unnecessary points from the data to compress the trajectory, while the weak simplification may involve new data point to achieve better performance. The algorithms are efficient since they both take O(n) time to compress a trajectory. The effectiveness is shown in experiments, by comparing them with two other algorithms DPSED and SQUISH-E.

2. Is the manuscript technically sound? Please explain your answer under Public Comments below.: Appears to be - but didn't check completely

1. Are the title, abstract, and keywords appropriate? Please explain under Public Comments below.: Yes

2. Does the manuscript contain sufficient and appropriate references? Please explain under Public Comments below.: References are sufficient and appropriate

3. Does the introduction state the objectives of the manuscript in terms that encourage the reader to read on? Please explain your answer under Public Comments below.: Yes

4. How would you rate the organization of the manuscript? Is it focused? Is the length appropriate for the topic? Please explain under Public Comments

below.: Satisfactory

5. Please rate the readability of the manuscript. Explain your rating under Public Comments below.: Readable - but requires some effort to understand

6. Should the supplemental material be included? (Click on the Supplementary Files icon to view files): Does not apply, no supplementary files included

7. If yes to 6, should it be accepted:

Please rate the manuscript. Please explain your answer.: Good

# Reviewer: 3

Recommendation: Author Should Prepare A Minor Revision

Comments:

The paper describes a novel algorithm called CISED for one-pass trajectory simplification with guaranteed synchronzed-error. The main contributions

are:

1) the algorithm is one-pass and runs in O(N) time and O(1) space complexity, which indicate very low computational costs

2) the compression ratio is quite competitive to existing methods

3) the method is developed from a conventional origin, i.e. sector intersection-based methods. This makes the method easy to understand.

The algorithm extends the idea of Sector Intersection, and adopts it in a three dimentional setting that includes time. Instead of sections in the 2D case, here CISED forms a series of "cones" that enclose the areas where new points could be included in the compressed segment safely. The algorithm further improves the time complexity by reducing the projection circles into inscribed polygons with a fixed number of edges, so that the intersection computation achieves lower time complexity. The empirical results show that CISED general has a better compression ratio and lower running time than DPSED and SQUISH-E, which are state-of-the-art one-pass trajectory simplification algorithms with guaranteed synchronzed-error.

For the manuscript itself, I find it generally well-written. I have only a couple of minor comments regarding organization and references:

1) The preliminary section comes as a bit abrupt in my opinion. Somewhere between 2.1 and 2.2 reads may lose focus as purposes of these paragraphs are unclear. I suggest put a paragraph in the end of Introduction as a transitional passage to state the intent of the authors for the next few sections.

2) There are some missing references:

\* A Method for Online Trajectory Simplification by Enclosed Area Metric, Guangwen Liu , Masayuki Iwai and Kaoru Sezaki, ICMU 2012

\* A Novel Framework for Online Amnesic Trajectory Compression in Resource-constrained Environments, Jiajun Liu Shuo Shang, et. al, TKDE 2016

Minor issue:

\* Section 6 paragraph 6: "BQS [11] fast the" should read "BQS [11] fasts the"

I recommend a minor revision for its current form.

Additional Questions:

1. Which category describes this manuscript?: Research/Technology

2. How relevant is this manuscript to the readers of this periodical? Please explain your rating under Public Comments below.: Relevant

1. Please explain how this manuscript advances this field of research and/or contributes something new to the literature.: It advances research on trajectory simplification by proposing an one-pass algorithm with error guarantees for synchronized-error.

2. Is the manuscript technically sound? Please explain your answer under Public Comments below.: Appears to be - but didn't check completely

1. Are the title, abstract, and keywords appropriate? Please explain under Public Comments below.: Yes

2. Does the manuscript contain sufficient and appropriate references? Please explain under Public Comments below.: Important references are missing; more references are needed

3. Does the introduction state the objectives of the manuscript in terms that encourage the reader to read on? Please explain your answer under Public Comments below.: Could be improved

4. How would you rate the organization of the manuscript? Is it focused? Is the length appropriate for the topic? Please explain under Public Comments

below.: Could be improved

5. Please rate the readability of the manuscript. Explain your rating under Public Comments below.: Readable - but requires some effort to understand

6. Should the supplemental material be included? (Click on the Supplementary Files icon to view files): Does not apply, no supplementary files included

7. If yes to 6, should it be accepted: As is

Please rate the manuscript. Please explain your answer.: Good