

Previous Reviews

August 11, 2018

A previous version of this paper was submitted to IEEE VAST 2018. While the full text of the reviews is attached, we would like to overview the changes made, leveraging the summary review:

- Evaluation: no evaluation of the proposed clustering methods (R3), the details of the domain expert interview are missing. (R1, R3)

Comment:

We did not introduce a new clustering method. The original paper contains such evaluations, we added that explicitly on the text. All the communication with the experts is included, verbatim, in the supplementary material, with the exception of Patrick Adler, which is a member of the Urban Genome Project, but did not collaborate directly in this work.

- Design: the consideration and final choice of design are not clearly discussed. Specially, the color usage is confusing. (R2, R3, R4).
- Motivation: the authors fail to clearly demonstrate the motivation of their work, probably due to their writing style. (R2, R4)
- Presentation: no technical contribution clearly stated, writing style not qualified as a good research paper, paper organization can be improved (R2, R4)

1 Reviewer 1 - score 4/5

- **Paper type**

Application

- **Expertise**

Expert

- **Overall Rating**

4 - Accept

The paper should be accepted with some minor revisions.

Once these have been completed it will meet the quality standard.

- **Supplemental Materials**

Acceptable

- **Justification**

the paper presents an interesting work on visualizing demographic evolution using geographically inconsistent census data. The strength of this paper is putting all the interesting pieces to present something an application that does show some useful insights into the data across time. The weakness of this paper is lack of anything new in particular and focused on a very specific type of demographic region (CT).

- **The Review**

the paper presents an interesting work on visualizing demographic evolution using geographically inconsistent census data.

Overall the paper reads well and it is easy to read and follow all the technical work. Most of the diagrams are useful. The paper tackles on a difficult problem of visualizing temporal data where each temporal piece may not be consistent with other pieces.

The strength of this paper is putting all the interesting pieces to present something an application that does show some useful insights into the data across time. The weakness of this paper is lack of anything new in particular and focused on a very specific type of demographic region (CT). In summary, the work uses a spatio-temporal graph based approach and perform clustering based on the attributes of each node where each node represents a CT for a given year. The edges are added based on neighboring CT's or if they are same CT's but different years. This approach seems reasonable and has been adopted to model such problems in the past. The authors then perform clustering an introduce trajectories which all seems useful to the end-uses. Overall, the work seems useful to the community as it put together many ideas in the same application and it seems to work well with specific datasets and problem in hand.

The weakness of the paper is very limited evaluation as mostly it was feedback from experts and the user-study lacked details. Also, most of the work is performed using CT as the region in census data, it would have been nice to see if this work is also applicable to other census regions as well.

Comment:

The specific region used for the analysis is irrelevant to the method, we could have used mixed regions for instance. We adopted CTs because it is the most finely grained data available including more than population count. Additionally, other census areas do not change as frequently as CTs.

Revision Required: Figure 2: while useful could use more detail and better explanation of the algorithm, it could do a better job in showing clustering and explaining the diagram since this is the figure that explains the entire paper.

2 Reviewer 2 - score 2/5

- **Paper type**

Application

- **Expertise**

Knowledgeable

- **Overall Rating**

2 - Reject

The paper is not ready for publication in VAST / TVCG.

The work may have some value but the paper requires major revisions or additional work that are beyond the scope of the conference review cycle to meet the quality standard. Without this I am not going to be able to return a score of '4 - Accept'.

- **Supplemental Materials**

Acceptable

- **Justification**

In this paper, the authors propose a method for longitudinal data analysis that avoids the geographical harmonization. The paper focuses on an interesting topic. The weakness of the paper is that the motivation and design requirements are not clearly demonstrated, and the design process is not justified.

- **The Review**

In this paper, the authors propose a method for longitudinal data analysis that avoids the geographical harmonization. Specifically, they adopt an improved clustering algorithm and a graph based visualization to help users identify clusters and the demographical details of each cluster. Though this paper is interesting to read, it still has several issues to be addressed. The authors fail to clearly demonstrate the motivation and the design requirements of the proposed work. A number of important details are also missing such as the discussion about design choices. In addition, the paper is not easy to follow in many sections such as the description of the teaser. I feel these issues can be hardly fully addressed in a minor revision and I suggest the authors to keep improving the work.

My first concern is that the authors fail to clearly demonstrate the motivation of their work. The authors mentioned that longitudinal analysis of census data is missing and its first step is geographical harmonization that is difficult. Therefore, they propose a method that analyze geographical data without the need of geographical harmonization. However, they fail to demonstrate that why the longitudinal analysis of census data is needed and important. In addition, they also fail to illustrate why it is important and challenging for omitting the process of geographical harmonization in the data analysis. The authors need to explicitly describe the motivation of the proposed work.

In addition, the authors are suggested to clearly discuss about the design considerations. For example, Details of the changes is not clear enough. Many questions can be asked: What kind of information the authors want to address for the changes? The geographic information or the content information or both? The authors need to clearly describe the design considerations.

Moreover, the design choices are also not discussed. The authors need to discuss how they make the final design decisions and if there are any alternative design choices. For example, the authors use stacked bar charts to encode the information of each aspect, in which the rectangle width represents the percentage of the corresponding variable. Many questions can be asked: Why the author choose the stacked bar charts? Do they consider other design choices such as pie charts? Why they use the length of rectangle to represent percentage? Do they consider color saturation or hue? The authors need to clearly discuss the reasons they finalize the current design.

The writings are hard to follow sometimes. For example, the description of the teaser is really difficult to understand. Many questions can be asked: What does each part represent in the figure? How to tell While the whole city follows this trend? What regions are these regions? What are the relevant clusters and why they are visible? The authors need to clearly explain the figures and improve the writing.

In summary, the authors are suggested to revised the paper and improve their work to address the above issues.

3 Reviewer 3 - score 3/5

- **Paper type**

Application

- **Expertise**

Expert

- **Overall Rating**

3.5 - Between Possible Accept and Accept

- **Supplemental Materials**

Acceptable with minor revisions (specify revisions in The Review section)

- **Justification**

This paper targets an interesting research question on analyzing the evolution of geographically inconsistent data. The major technical contributions of this paper are

1. A graph based spatio-temporal clustering method;
2. an enhanced box plot visualization to better support comparison;
3. the heatmap-like map view showing the spatial information of clusters.

Another big bonus is that the authors provided an interactive demo online. Still, there are several issues on

1. the lack of evaluation of the proposed clustering method;
2. the design choice, mainly for the color usage;
3. the lack of details of expert review process.

Detailed reviews can be found in the review section.

- **The Review**

In this paper, the authors proposed a visual analytics system to explore and analyze the evolution of geographically inconsistent data. Several visualization techniques, such as enhanced box plots, Sankey diagram, heatmap-like map visualization with small multiple settings, are used in the system. In general, the author tackles on an interesting and not easy research question, and the paper is well written and easy to follow. The case studies and expert interviews have clearly shown its usefulness and effectiveness.

The major contributions have been mentioned above in justification section, here list the details of the major concerns.

1. There is no proper evaluation of the proposed clustering methods.

In Section 4.2, the authors proposed a graph based geographic content clustering, which considers spatial, temporal, and similarity information among regions. Here, it will be worth to conducting comparisons with some traditional methods, for example, k-means purely based on histogram distances or weighted distance by considering spatio-temporal information (specific for the first one, since I think there is a high correlation of spatio-temporal information with the histogram distance).

Comment:
TODO

2. The color usage for the whole visual analytic system is sometimes confusing.

In the application, the authors use colors in different ways across visualizations. In the Sankey graph, the color is used to encode the categories. In the map view, additional opacity is used here (and blending is optionally used) together with the same color encoding as the one in the Sankey graph. From the right figure in Figure 6, it is clear that the color is not distinguishable (this is also related to the clustering itself since the three clusters are too small compared to the others). What makes it worse is the color usage in the box plot view to encode the relevance, which is very confusing even with the legend shown on top since there is some color overlap with the categorical encoding (e.g., the green and grape color).

Comment:
Colour assignment was indeed challenge for this work, mostly because it needs to be used, but there isn't a definitive way to actually do it. That was also the reason for artificially limiting the maximum number of clusters to eight. There is indeed overlap between the colours used for relevance and the clusters, mostly because the clusters used virtually all of the colour space. However, we believe that their different meanings are clear, since none of the experts, nor the other reviewers, mentioned any confusion in this specific aspect. It is not ideal, but we believe it is a acceptable approximation.

3. The details of the domain expert interview is missing in the paper. I really appreciate that the authors attached the detailed expert review comments and the online demo is available. However, in the main paper, there is a very little description of how the expert interviews were conducted. Since there are still plenty of space, I would suggest the authors to add more details in Section 6.

Minor issue: The demo video can be improved by providing a more comprehensive walk-through of a case study instead of fragmented videos to explain the functionalities.

4 Reviewer 4 - score 2/5

- **Paper type**
Technique
- **Expertise**
Expert

- **Overall Rating**

2 - Reject

The paper is not ready for publication in VAST / TVCG.

The work may have some value but the paper requires major revisions or additional work that are beyond the scope of the conference review cycle to meet the quality standard. Without this I am not going to be able to return a score of '4 - Accept'.

- **Supplemental Materials**

Acceptable with minor revisions (specify revisions in The Review section)

- **Justification**

This paper introduces a combined graph clustering and geospatial visualization technique to illustrate the city census data that is potentially inconsistent over the space dimension. The technique is generally OK, though not entirely new, and can be said as appropriate for the problem attacked. The major strength is the detailed case studies on two north American cities and it is appreciated that the authors attach a full record of their expert study. On the other hand, the paper in its current shape suffers significantly from presentation issues, i.e., beyond minor grammar errors, most technical content would benefit from a thorough re-written. There is no explicit contribution statement. It seems the contribution on visualization is rather limited. The authors are also encouraged to re-submit to a GIS venue.

- **The Review**

This paper proposed a framework to visualize the spatiotemporal population clusters detected from the census data. A graph representation is built where the nodes are fine-grained census tracts (CT) and edges are computed from the similarity of census attributes of related CTs. The graph is clustered by an existing watershed cut algorithm and then undergo a minor refinement. The derived spatiotemporal clusters are displayed on a geospatial map and their dynamics over time are visualized in a standard Sankey diagram. The work is well evaluated with census data in LA and Toronto. The feedbacks from five experts are also reported. While the technical side of this work does have some merit, there are at least two major flaws or technical incompleteness in the current presentation.

First, I missed the technical contribution in this paper. In the first paragraph of Sec. 4, it is said “beyond the main contributions”, what are these contributions? In fact, I see rather limited contribution in the visualization side. Besides the map design, the only ingredient of information visualization seems to be the Sankey diagram. I look at this diagram multiple times and could not sense what is different from a basic D3 example available on the website. The analytics part is similar, the SMM algorithm is not new, and the graph representation and clustering seems straightforward. There are little details discussed (in fact, should be some!). For example, why to connect the adjacent or overlapping CTs under different time affinities, how the clustering parameter is chosen? What are the nature of the resulting clusters? To this end, what is the specialized design for inconsistent census data?

Comment:

Following the guidelines, an application paper doesn't need to include new techniques. Indeed, the objective of this work was to leverage "commonplace" VIS methods to provide a more efficient solution to a common issue in another field. Indeed, we provide a viable alternative to time consuming and challenging problem that was believed to be unavoidable.

Second, the writing style and paper organization is hardly a qualified research paper on visualization. Many key technical content are missing. The introduction and related work are fairly short, thus do not motivate this work well. For example, in the intro, I would like to see, what is the research problem, what are the challenges, and how you solve it with exquisite designs and/or algorithms. The authors only write one plain sentence there: "We use a graph based spatio- temporal representation, combined with an improved clustering algorithm", could be used for 100+ papers on the similar topic. The related work cites an appropriate number of literature, but fails to discuss their pros and cons in order to position this work. The entire cluster of work by Andrienko et al. are missing while it is said: "it is reasonable to argue that the availability and quality of the dataset provided by the Taxi and Limousine Commission of New York contributed to its centrality in this field". The most related work on visualizing census data is also missing. In the visualization design part (Section 4), the authors spend several paragraphs on the coloring choice, which is good. Only one sentence is used to describe the Sankey diagram, which might be the only information visualization design applied in this work. Note that the graph representation has been the highlight of this work. No design rationale is discussed here. For example, what if I use a simple alternative of multiple/stacked line charts to represent the dynamics of spatiotemporal clusters? In the evaluation part, while I appreciate the detailed case study on LA and Toronto, the user feedback seems to be problematic given that the users are only given the video, not the interactive tool to try themselves! From the preview video, it is hard to imagine a real system exists for this work.

Comment:

Unfortunately the reviewer doesn't mention which is the "most related work". I did review some works from Andrienko's group, after all they are fairly known for this, but some were not included because they are not relevant to the current problem. TODO I included more text expliciting exactly what was accomplished in this work, which hopefully will make that distinction clearer.

As the others reviewers mentioned, the tool was available not only for the experts, but for the reviewers as well, on an anonymous site.

There are some other minor issues which the authors can address in any later versions.

- The design consideration of M1 & M2 are too general, could be said for most urban visual analytics methods
- Last paragraph of Section 4.2, why augment two edges, any quantitative evident/support from data?
- Figure 4 could be put at page 4 for better viewing experience
- Section 4.6, Sect. to Sect., on top left to on the top left
- It will be helpful to put a sample census data in the paper, e.g., a table

- The Sankey diagram in Figure 6 is cluttered, any solution?

Overall, the authors have studied a valid problem with an appropriate solution and well-conducted case study, but the contribution on visualization is vague and many key technical content is missing. The writing quality and depth still have much room to improve. For these reasons, I return a reject score for now. A last point, if there is little new contribution on visualization, would this paper fit better to a GIS venue?

Comment:

We considered a GIS venue for this work, but the technical part is fairly advanced to a general public, requiring significant tangents to explain all the involved concepts. Further publications on applied geography and demographics venues are planned in the scope of the Urban Genome Project, which will cite this publication for the technical details.

4.1 The Summary Review

Summary Rating

Possible Accept

The paper is not acceptable in its current state, but might be made acceptable with significant revisions within the conference review cycle.

If the specified revisions are addressed fully and effectively I may be able to return a score of '4 - Accept'.

5 The Summary Review

The reviewers have divided opinions on this paper.

On the positive side, all reviewers recognize that the authors studied an interesting research problem and proposed appropriate/valid solutions to that problem (R1, R2, R3, R4). Some finds the proposed techniques to have enough contribution (R3), while some others comment these techniques as lack of novelty (R1, R4). Most reviewers are convinced on the usefulness of the approach as demonstrated in the application of the case studies (R1, R3, R4). R3 especially likes the released online demo which helps to grasp the main functionality of the technique.

On the negative side, several concerns are raised and suggestions for revision are made, which the authors must address within the conference cycle if the paper is conditionally accepted.

- Evaluation: no evaluation of the proposed clustering methods (R3), the details of the domain expert interview are missing. (R1, R3)
- Design: the consideration and final choice of design are not clearly discussed. Specially, the color usage is confusing. (R2, R3, R4)
- Motivation: the authors fail to clearly demonstrate the motivation of their work, probably due to their writing style. (R2, R4)
- Presentation: no technical contribution clearly stated, writing style not qualified as a good research paper, paper organization can be improved (R2, R4)

More detailed comments can be found below.

After discussion, we conclude that a borderline summary rating is appropriate. We do hope the authors can address all of our concerns in the conference cycle through significant efforts.