Enhancement of Density Visualization using Dot Density Maps

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Density visualization of a phenomenon throughout a space is one of the usages of maps. Color coded heatmaps are a popular approach to visualize density. However, heatmaps do not give a quantitative view to the user and it is not possible to estimate quantitative values from their colors. Dot density maps are considered and adapted as an alternative in order to enhance the density visualization to overcome these issues.

Two algorithms were developed using Python to make a conventional dot map and a graduated dot map.

OBJECTIVES

1. Overcoming the two main issues of KDE heatmaps, including lack of a quantitative estimation from color coded classes and no perception of the actual value of a phenomenon from a cryptic density value.
2. Development of two algorithms to create a conventional and a graduated dot map from two datasets.
3. A comparison of the dot maps with heatmaps

METHODLOGY

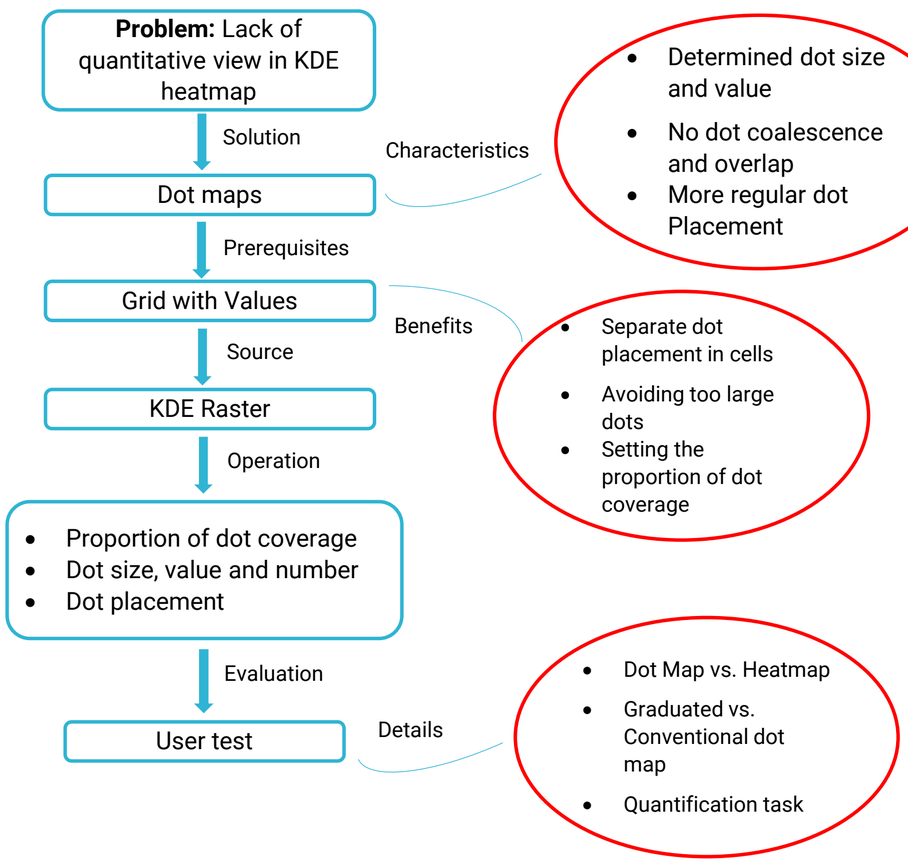

Fig. 1 Flowchart of the proposed approach

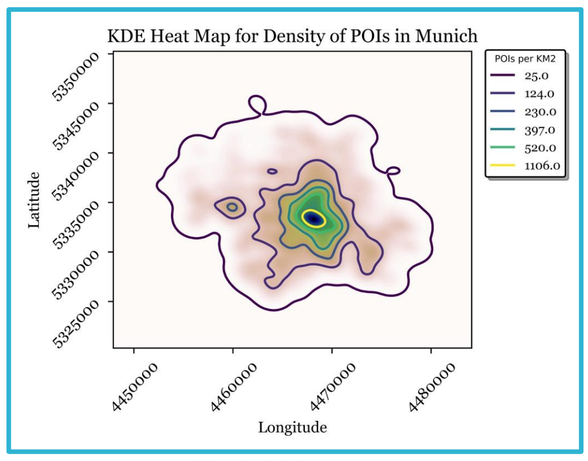

Fig. 2 A Heatmap

STUDY AREA

The first dataset was the Points of Interest (POIs) data of Munich city in Germany, which contains 29,232 POIs. The second dataset was tweets about the traditional Bavarian festival, called Oktoberfest, obtained through Twitter API. This dataset contains 2,745 tweets with Oktoberfest relevant keywords.

RESULTS

1. The results of the execution of the conventional dot mapping algorithm were five maps (Fig. 3 & 5) for the POI dataset and three maps for the Twitter dataset.
2. The results of the execution of the graduated dot mapping algorithm were four maps (Fig. 4 & 6) for the POI dataset and three maps for the Twitter dataset.

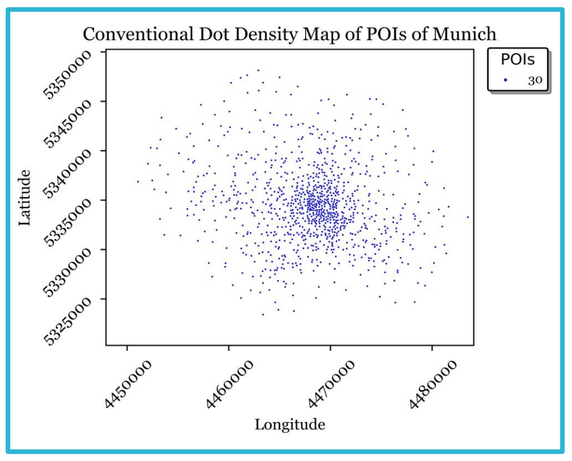

Fig. 3 A Conventional Dot Map

3. A heatmap (Fig. 2) was created as a benchmark to compare with the dot maps to evaluate the results of the algorithms

CONCLUSION

1. Enhanced dot density maps are suggested as a better method than heatmaps both to get an overview of the density and quantification of the density. The statistics of the user test show a definitive dominance of the proposed dot maps over heatmaps which is a common map type to show density.
2. Giving a better quantitative view from different parts of a region is the main reason for the superiority of dot maps. Dot maps help users to quantify the number of points of a phenomenon in any favorable region on the dot map.
3. There is no definite advantage between graduated and conventional dot maps. Their dominance depends on the user's objective and the data. Randomness of dot placement, number of parameters, calculation time, desired level of detail in estimation, etc. are a number of effective parameters in the superiority of different types of dot maps.

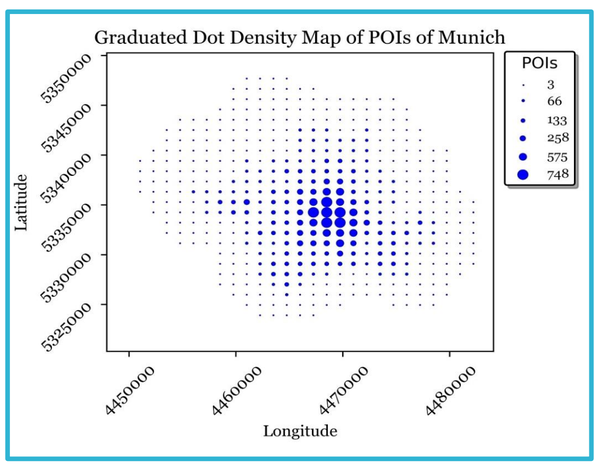

Fig. 4 A Graduated Dot Map

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KEYWORDS

Density, Heatmap, Conventional dot map, Graduated dot map, Quantitative view, Enhancement

PROJECT LINK

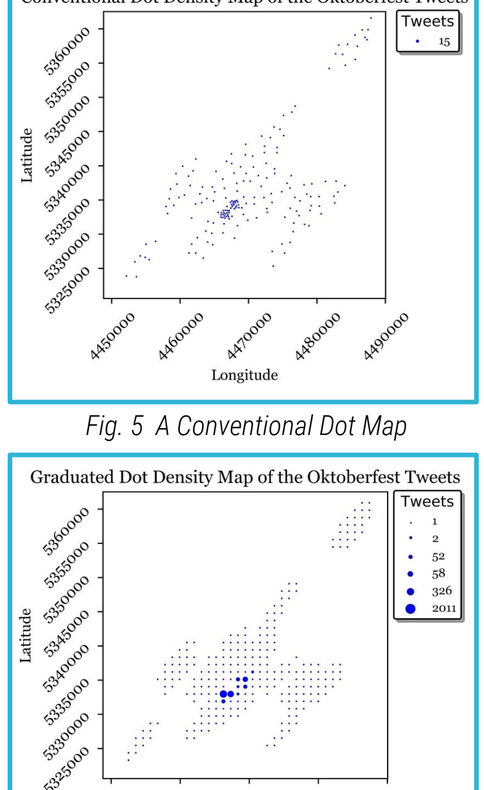

Fig. 5 A Conventional Dot Map

Fig. 6 A Graduated Dot Map

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