

# A Minimally Constrained Optimization Algorithm for Table Cartograms

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## What is a Table Cartogram?

Table cartograms are a form of data visualization that renders *tabular data* as a grid of quadrilateral cells, whose areas are changed to fit the data.

*Like a heatmap that has been area-ed rather than colored.*

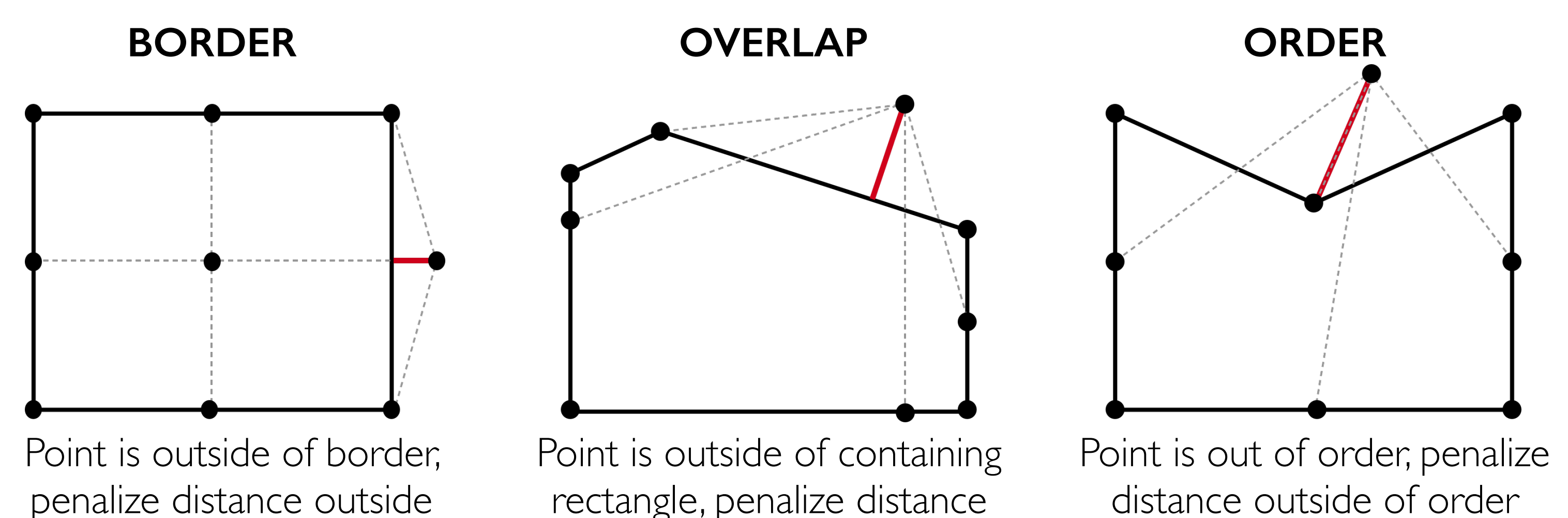
### PROPERTIES

- 1 They possess an **Accurate Embedding of Data** as area.
- 2 They have a **Planar Grid-like Topology** that is constrained to a rectangle

## How to efficiently & expressively compute Table Cartograms?

We contribute a web-ready algorithm for constructing Table Cartograms based on imposing a minimal collection of constraints. This enables creative control of the output.

### CONSTRAINTS



$$\mathcal{C}(\vec{x}) = \sum_{v_i \in \vec{x}} \lambda_1 \text{border}(v_i) + \lambda_2 \text{order}(v_i) + \lambda_3 \text{overlap}(v_i)$$

### LOSS

$$\mathcal{E} = \frac{1}{\text{num cells}} \sum_{\text{cell} \in \text{table}} \frac{\left( \text{cell value} - \frac{\text{cell area}}{\text{table area}} \sum_{\text{value} \in \text{table}} \right)^2}{(\text{cell value})^2}$$

### OBJECTIVE

$$\text{obj}(\vec{x}) = \mathcal{E}(\vec{x}) + \mathcal{C}(\vec{x})$$

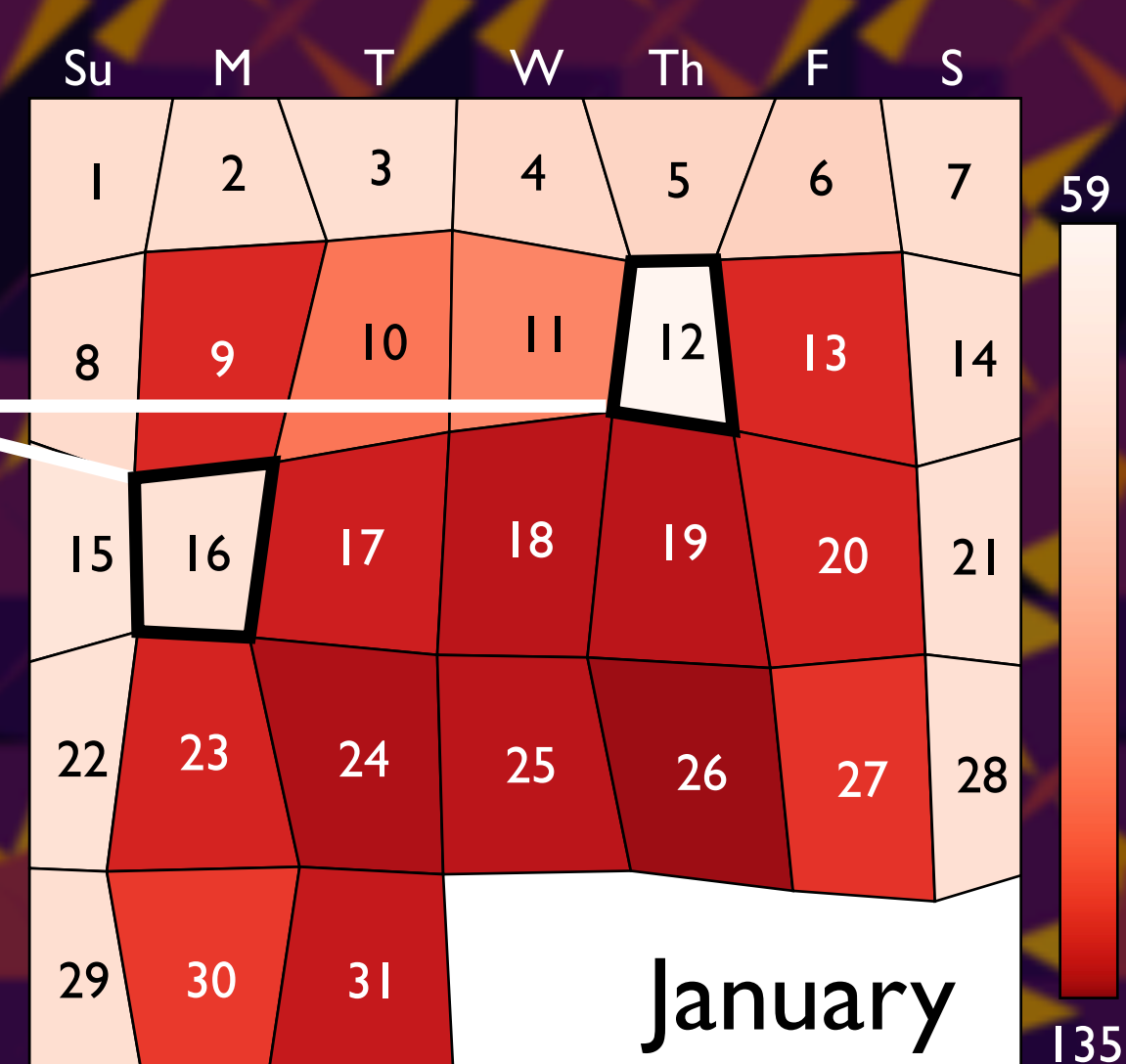
This formulation is continuous & differentiable, which works agreeably with adaptive SGD and performs well in the browser.

Find out more at [mcnutt.in/#/research/table-cartogram](http://mcnutt.in/#/research/table-cartogram)

### CONCRETE EXAMPLE

#### Speed Camera Violations In Chicago 2017

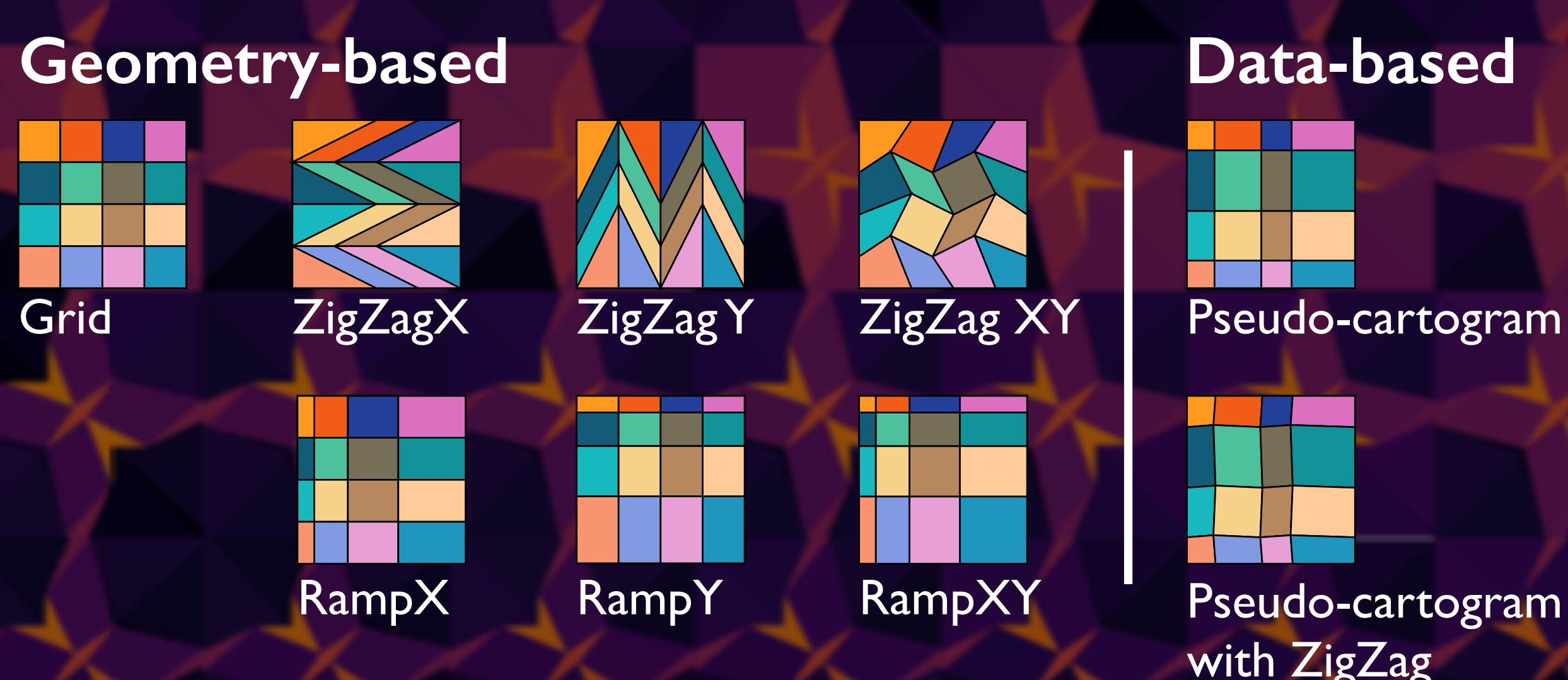
Outliers are highlighted as warps to the “fabric” of the chart. Here we see the effect of a school holiday (1/16) and an outlier of unknown origin.



### CHECKERBOARD EXAMPLES



### LIBRARY OF INITIALIZATIONS



The background shows a checkerboard table cartogram (such as those shown in the example transformations) converging. Yellow is high error; black is no error