A Versatile Collage Visualization Technique

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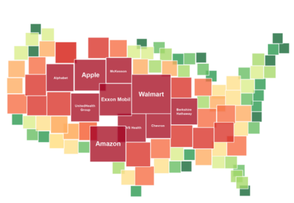
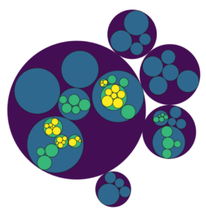
PROBLEM

Collage techniques are commonly used in visualization to organize a collection of geometric shapes, facilitating the representation of visual features holistically, as seen in word clouds or circular packing diagrams. Typically, packing methods rely on object-space optimization techniques, which often necessitate customizing the optimization process to suit the complexity of geometric primitives and the specific application requirements.
We introduce a versatile image-space collage technique designed to pack geometric elements into a given shape.

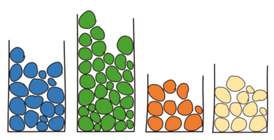

Square Map


Circular Diagram


Text Themeriver


Word Cloud


Pie Chart


Bubble Barchart

BACKGROUND

Current methodologies often focus on optimizing object placements within these spaces, using tailored geometric descriptors and loss functions[1][2]. However, these approaches have limitations: optimization techniques may not generalize across different applications due to shape diversity and layout requirements[3]; complex shapes necessitate diverse descriptors[4]; and constraints exist with shapes that have curvature or open boundaries. To address these challenges, we propose a paradigm shift to image-space optimization using differential rendering[5].

REFERENCES

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[3] Itoh, Takayuki, et al. "Hierarchical data visualization using a fast rectangle-packing algorithm." IEEE Transactions on Visualization and Computer Graphics 10.3 (2004): 302-313.

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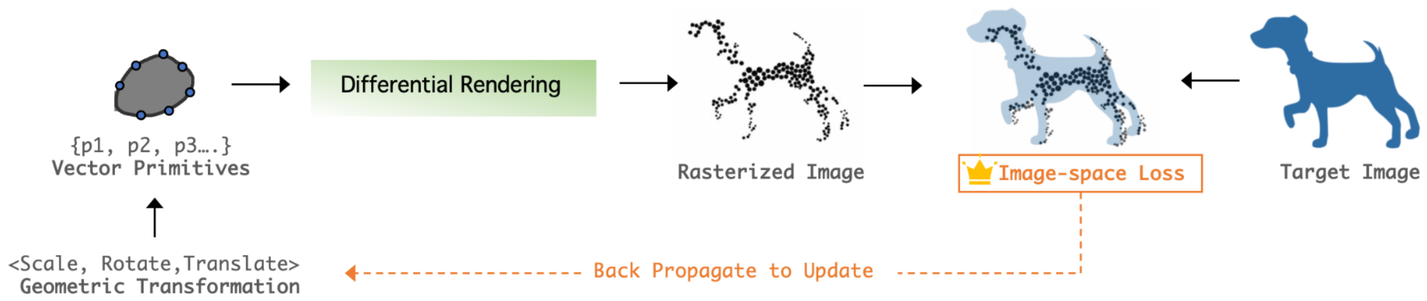
PIPELINE

Geometric Transformation
To maintain data encoding fidelity in collage visualization, we optimize geometric transformations (scaling, translation, rotation) of visual primitives, ensuring their shape and size remain stable

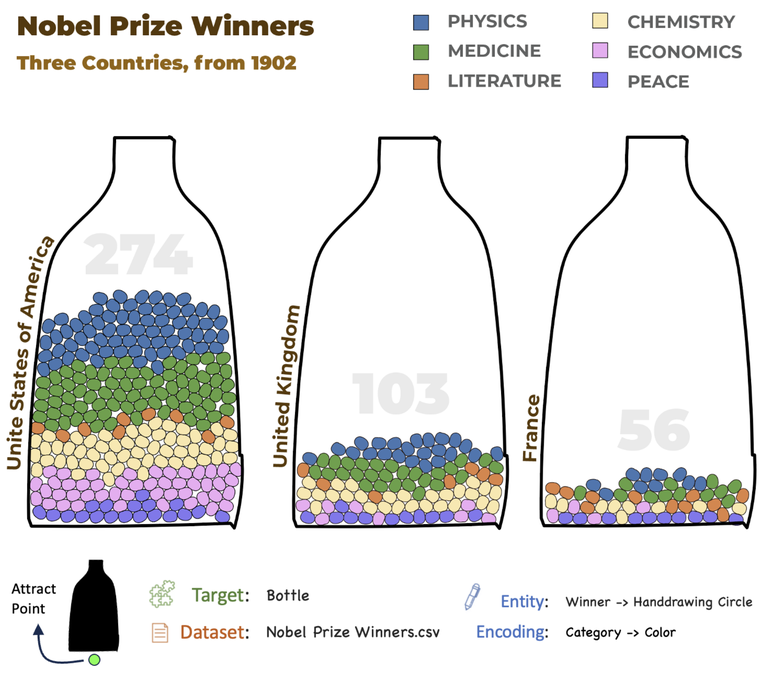
Project Homepage

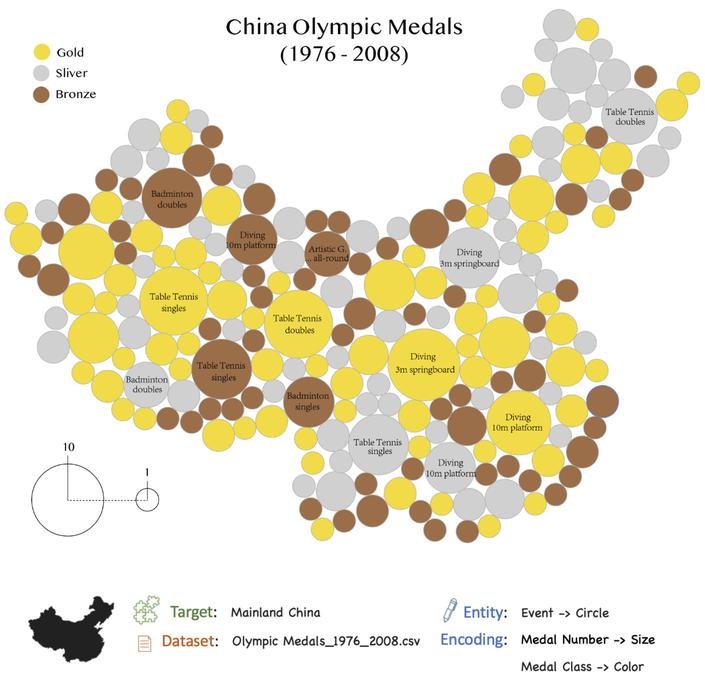
Position Initialization
Proper initial placement of visual primitives using the Medial Axis Transform (MAT) ensures effective optimization by evenly distributing primitives within the target shape, reducing iterations and improving quality.

Loss Functions
Our framework uses image-space loss functions (Boundary Fitness, Primitive Overlap, Data Fidelity, Force Attraction) to optimize visual primitives' arrangement, enhancing fit, reducing overlap, and maintaining data fidelity during optimization.



RESULTS





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