

TANGRAM TREEMAPS

*An enclosure
geometrical
partitioning
method with
various
shapes*

Tangram Treemaps

*An enclosure geometrical partitioning
method with various shapes*

By

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In the

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CERTIFICATE OF AUTHORSHIP/ORIGINALITY

UNIVERSITY OF TECHNOLOGY SYDNEY

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SYMBOL LIST

R²: represents a two-dimensional plane in Euclidean geometry;

S: represents a subset of Euclidean space R^2 is compact if and only if it is closed and bounded.

N: indicates a node is the fundamental unit of which graphs are formed in graph theory. A subset of Nodes are presented by n_1, n_2, \dots, n_m , such as $N = \{n_1, n_2, \dots, n_i, \dots, n_j, \dots, n_m\}$. **m** indicates the Number of Values; **i, j** indicates the Number of Values.

P: a Polygon bounded by a closed path in a geometry shape. We map Node in tree structure into Polygon representation, e.g. for example, For the Node **N** is transferred as a Polygon **P (N)**

ℓ: Straight line segments which the polygon composed of. For example, a finite sequence of $L = \{\ell(v_1, v_2), \dots, \ell(v_{n-1}, v_n)\}$. $\ell(v_{e-1}, v_e)$: present The longest side.

V: In the polygon represents the points where two edges meet are the polygon's vertices. A set of vertices which a polygon composed of, are presented in a set of $V = \{v_1, v_2, \dots, v_i, \dots, v_j, \dots, v_n\}$,

v_s Initial vertex and $v_{s'}$ which is the point v_s transferred to the side after partitioning happened; v_c which is cutting vertex and $v_{c'}$ which is the point v_s transferred to the side after partitioning happened,

A: The Area size of polygon. The area size of a polygon equals the area size of a set of sub-polygons $A = \{a_1, a_2, \dots, a_i, \dots, a_j, \dots, a_n\}$.

W: A weight of a value associated with the property of a vertex. e.g., $W = \{w_1, w_2, \dots, w_i, \dots, w_j, \dots, w_n\}$. W_{g1}, W_{g2} present subgroups of **W**, e.g., $W = \{W_{g1}, W_{g2}\}$;

Θ : an interior angle formed by two sides of a polygon that share an endpoint. $\theta = \{ \theta_1, \theta_2, \dots, \theta_i, \dots, \theta_j, \dots, \theta_n \}$; θ_{\min} defines Minimum Angular resolution Constraint; α : partition angle

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ABSTRACT

In practices, analysts need to monitor multiple views and real time processes in one physical screen simultaneously regularly, due to the time demands or multi-task requirements. More often the visualization tool shares the screen space with other concurrent projects or process sessions. Although the traditional enclosure (or space-filling) tree approach can guarantee the maximization of space utilization in an isolated session display (that commonly occupies a single rectangular geometrical area), they however do not consider the maximization of display utilization of the whole computer screen, where a number of concurrent sessions are running in one screen.

This thesis proposes a new enclosure visualization method, named Tangram Treemaps that achieves the maximization of the computer screen utilization through the flexibility of display (or container) shapes. Breaking through the limitation of rectangular constraint, the new approach is able to partition various polygonal shapes. Furthermore, our algorithms also improve the efficiency of interactive tree visualization significantly, through the reduction of the computational cost.

Finally, we provide three case studies to demonstrate the commercial value of our method by using different datasets; we evaluate the method according to graph drawing and perceptual guidelines to show the advantage in scientific measurements; we conduct three user studies to compare the performance of our method with the traditional treemaps. Research results have proven that Tangram Treemaps could be adopted into a wider range of applications, taken in account its real-time performance and the quality of the visualization layouts.