University of Wisconsin
SCHOOL OF MEDICINE
AND PUBLIC HEALTH

BMI/STAT-768 Statistical Methods for Medical Image Analysis

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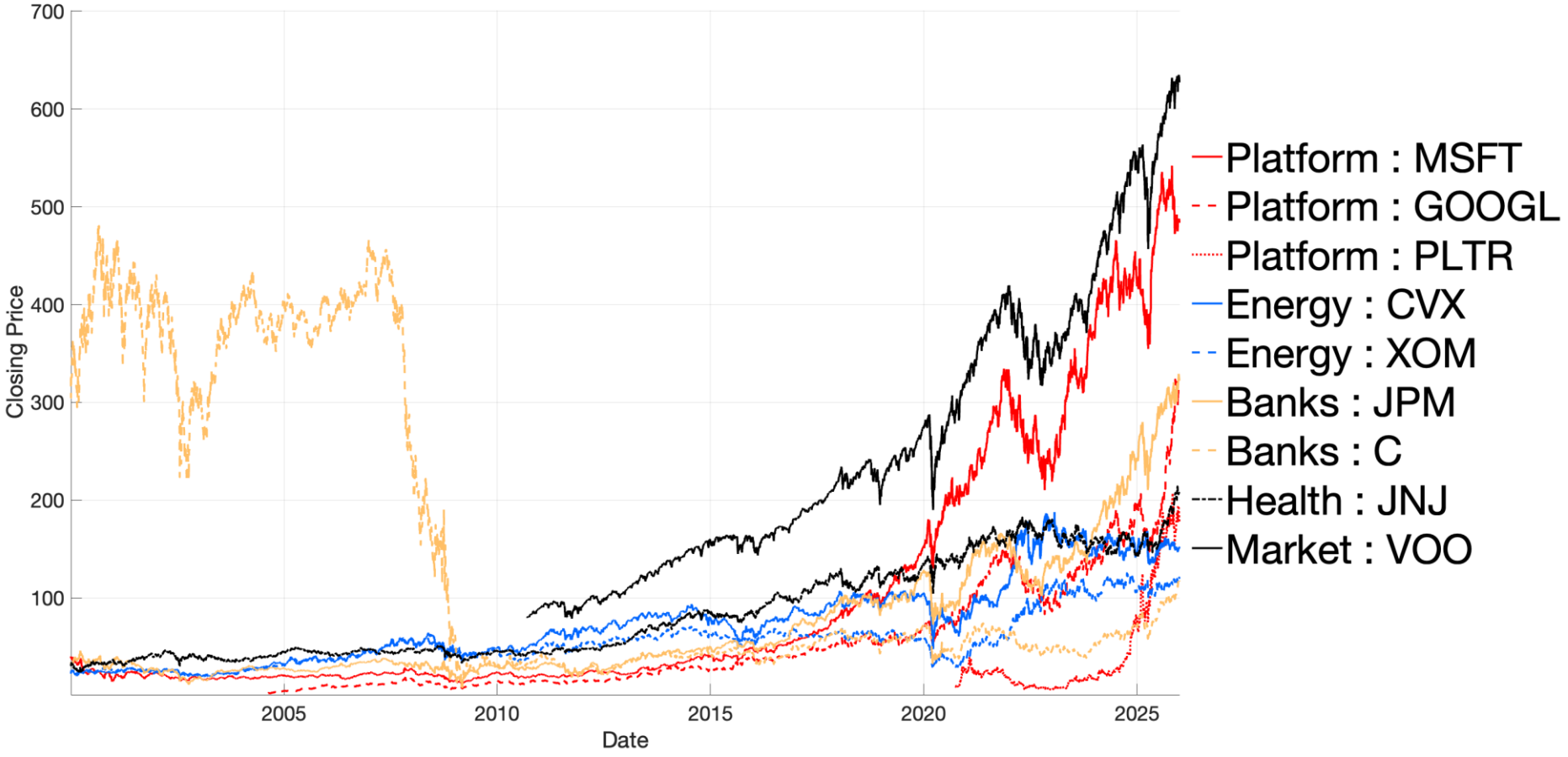
Multivariate time series data

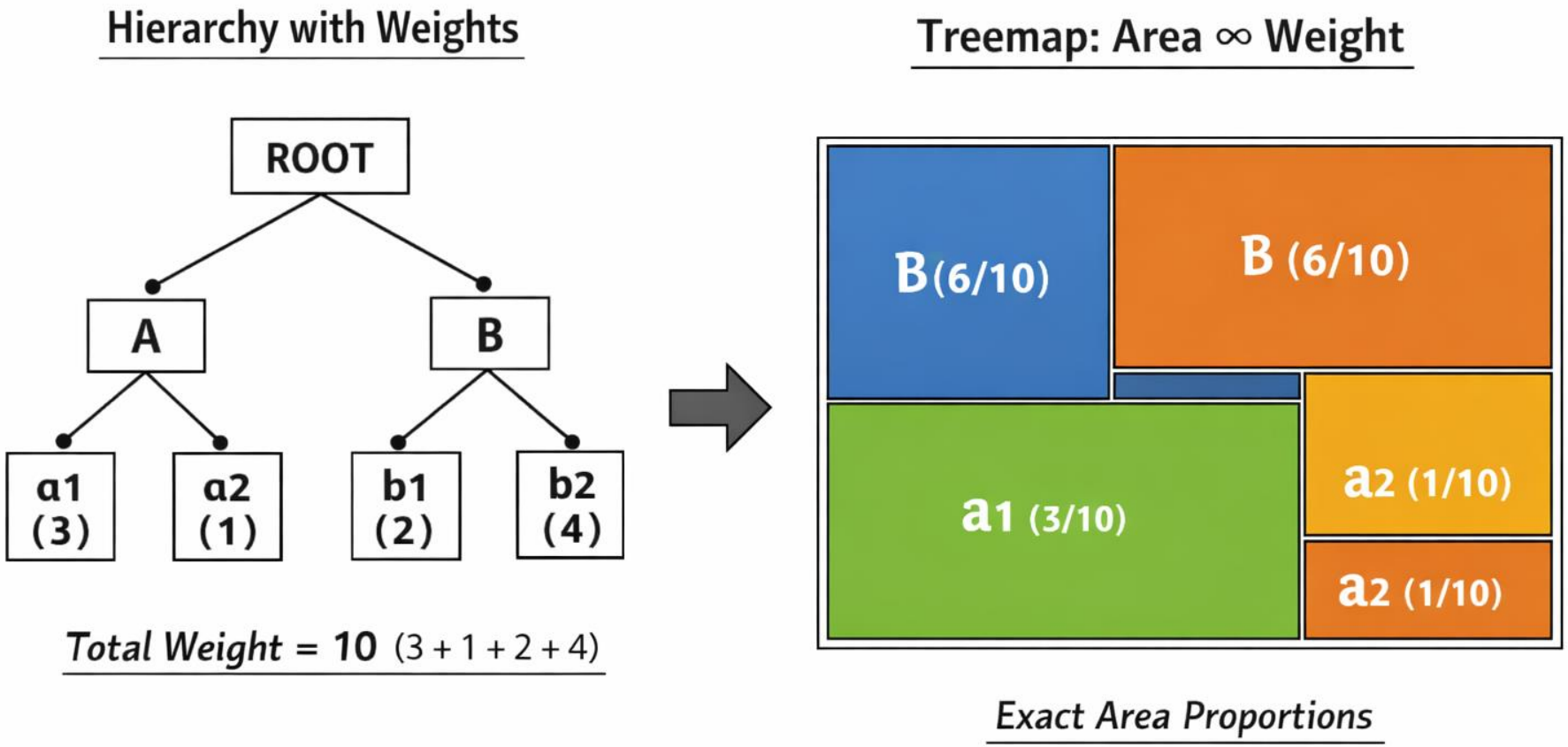
Colored each sector with different color



Tree Map - space-filling hierarchical visualization

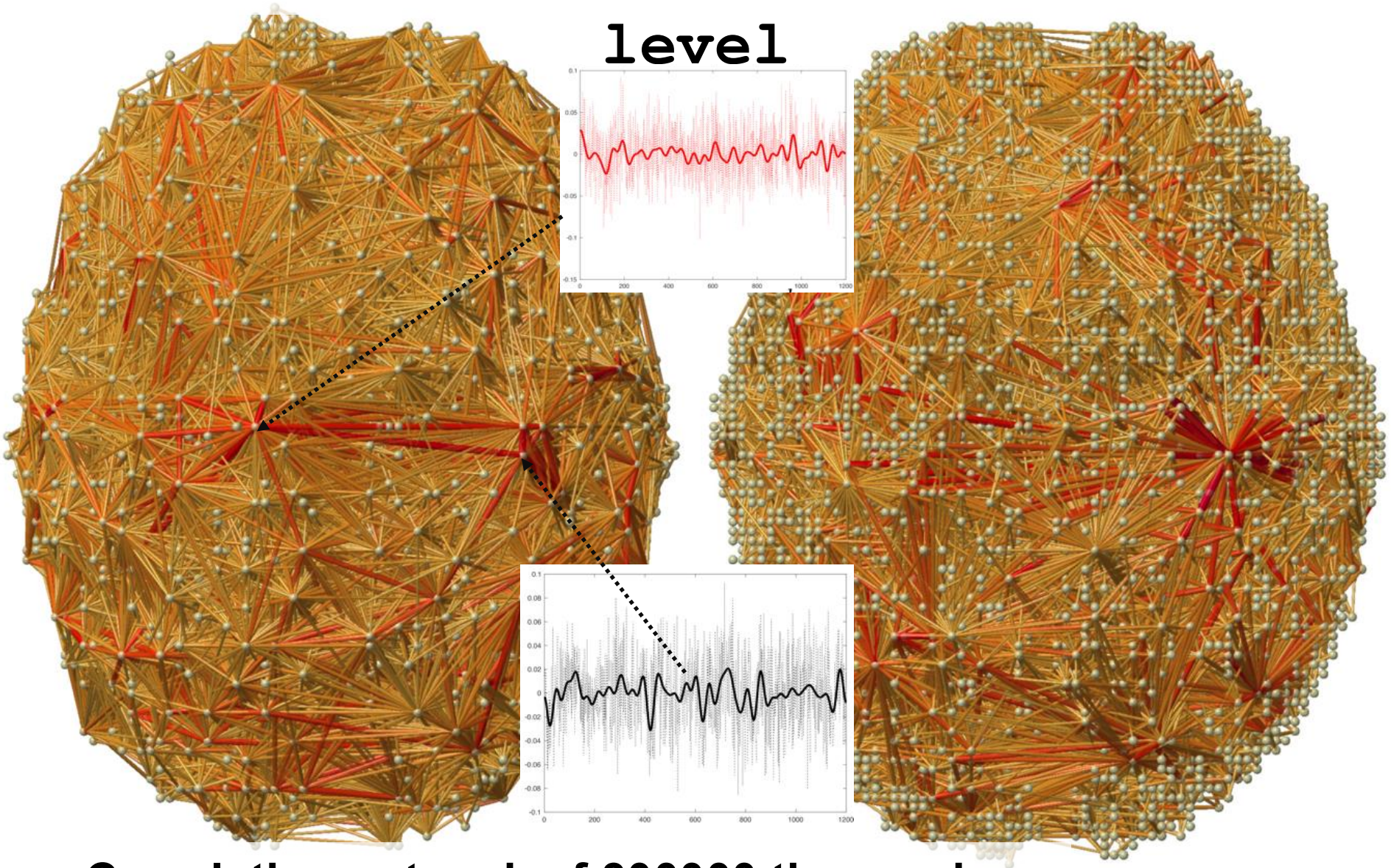
Tree Map - space-filling hierarchical visualization

Invented by University of Maryland, College Park CS-professor Ben Shneiderman in 1991



Greedy algorithm

Correlation brain network at voxel level

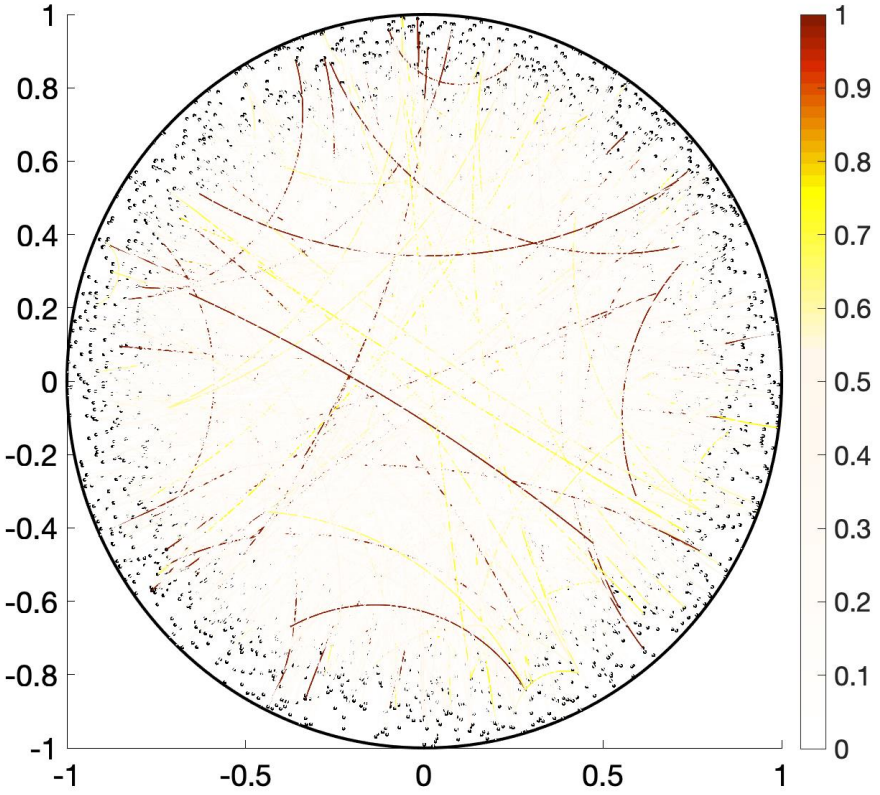


Correlation network of 300000 time series

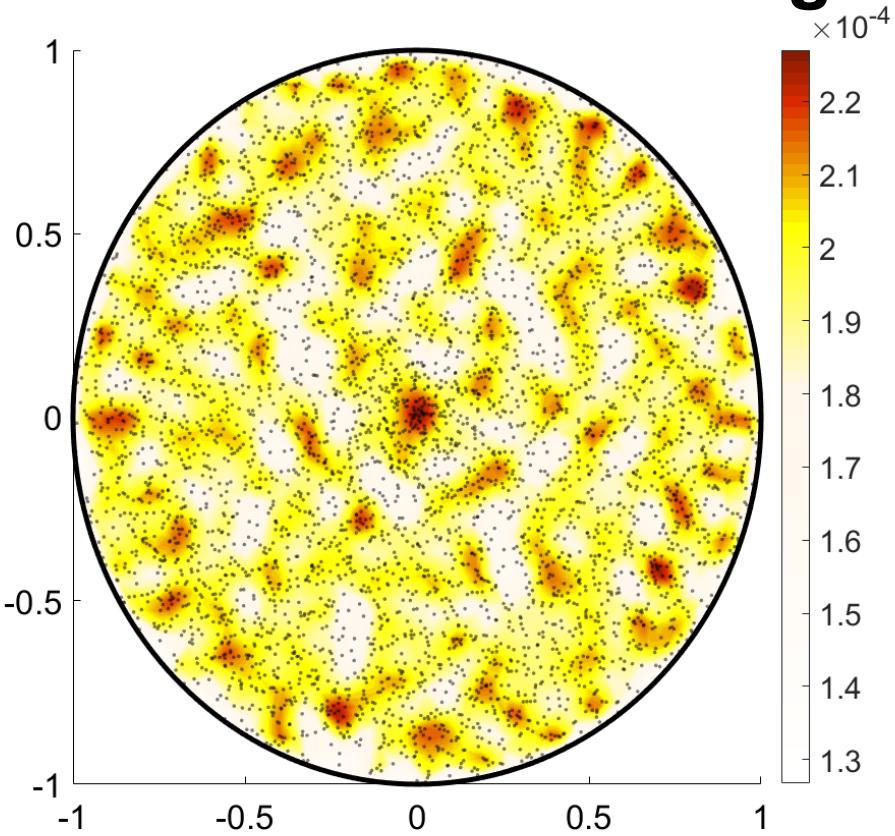
Complete graph with about $300000^2/2$ cycles.

Hyperbolic embedding – likely to be project

Maximum spanning tree



Heat kernel smoothing



Zijian Chen

Laplace Transform

Unit Objectives

1. Understand Laplace Transform and its relation to Differential Equation
2. Know how to compute it numerically
3. Understand how to use it to smooth time series data

Pierre-Simon Laplace

Laplace Transform – linear operator on a function

1D signal

$$\mathcal{L}\{f\}(s) = F(s) = \int_0^{\infty} e^{-st} f(t)\, dt, \qquad s \in \mathbb{R}.$$

Summary measure:

What frequencies are in a signal and whether they fade away or blow up over time.

Laplace Transform – linear operator on a function

1D signal

$$\mathcal{L}\{f\}(s) = F(s) = \int_0^{\infty} e^{-st} f(t)\, dt, \qquad s \in \mathbb{R}.$$

Summary measure:

Exponential weighting of signal over whole temporal domain

Unit Outcome

Self-assessment

Understand definition and its relation to differential equation

Knows how to compute it and apply to time series data