

**van der Maaten, Laurens****Accelerating  $t$ -SNE using tree-based algorithms.** (English) Zbl 1319.62134  
J. Mach. Learn. Res. 15, 3221-3245 (2014).

Summary: The paper investigates the acceleration of  $t$ -SNE—an embedding technique that is commonly used for the visualization of high-dimensional data in scatter plots – using two tree-based algorithms. In particular, the paper develops variants of the Barnes-Hut algorithm and of the dual-tree algorithm that approximate the gradient used for learning  $t$ -SNE embeddings in  $\mathcal{O}(N \log N)$ . Our experiments show that the resulting algorithms substantially accelerate  $t$ -SNE, and that they make it possible to learn embeddings of data sets with millions of objects. Somewhat counterintuitively, the Barnes-Hut variant of  $t$ -SNE appears to outperform the dual-tree variant.

**MSC:**

**62H30** Classification and discrimination; cluster analysis (statistical aspects)  
**62A09** Graphical methods in statistics

Cited in **20** Documents**Keywords:**

embedding; multidimensional scaling;  $t$ -SNE; space-partitioning trees; Barnes-Hut algorithm; dual-tree algorithm

**Full Text:** [Link](#)