

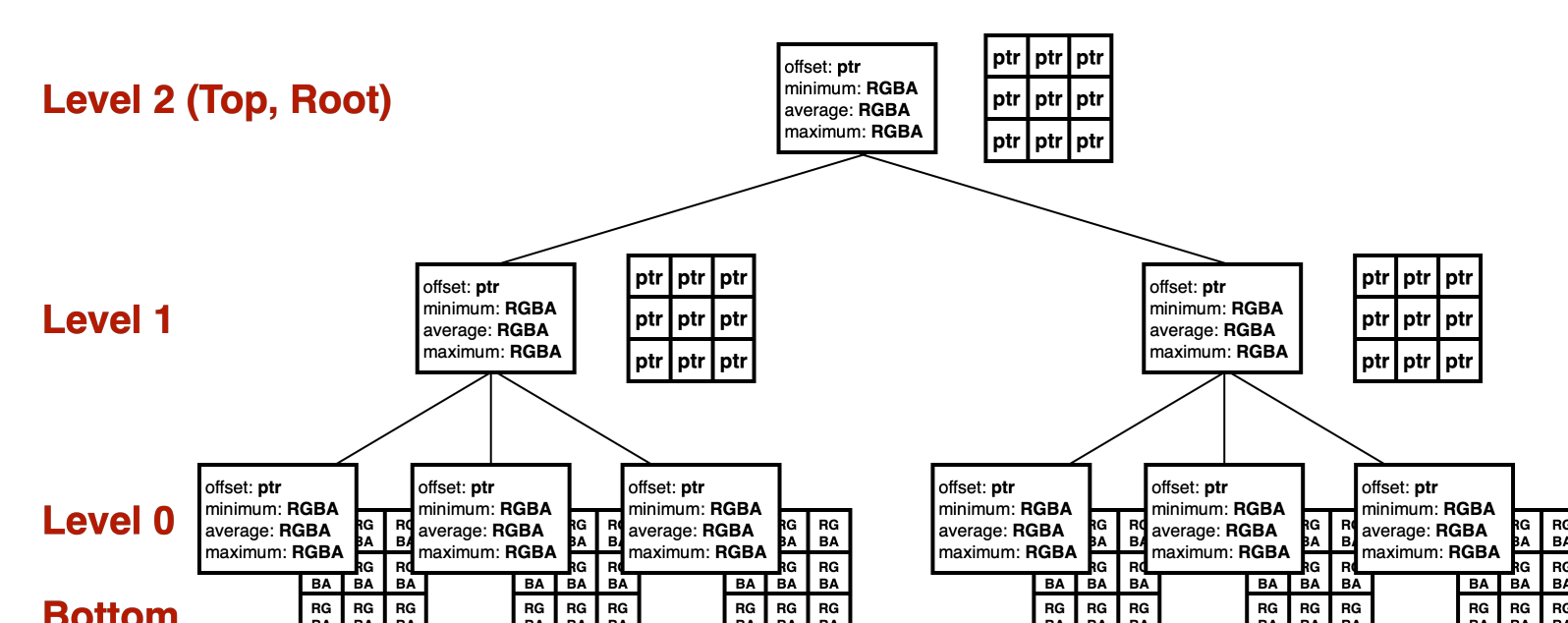
# COMPRESSION AND INTERACTIVE VISUALIZATION OF TERABYTE SCALE VOLUMETRIC RGBA DATA WITH VOXEL-SCALE DETAILS

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## ABSTRACT

We present a compressed volumetric data structure and traversal algorithm that interactively visualizes complete terabyte-scale scientific data. Previous methods rely on heavy approximation and do not provide individual sample-level representation when going beyond gigabytes. We develop an extensible pipeline that makes the data streamable on GPU using compact pointers and a compression algorithm based on wavelet transform. The resulting approach renders high-resolution captures under varying sampling characteristics in real-time.

## METHOD

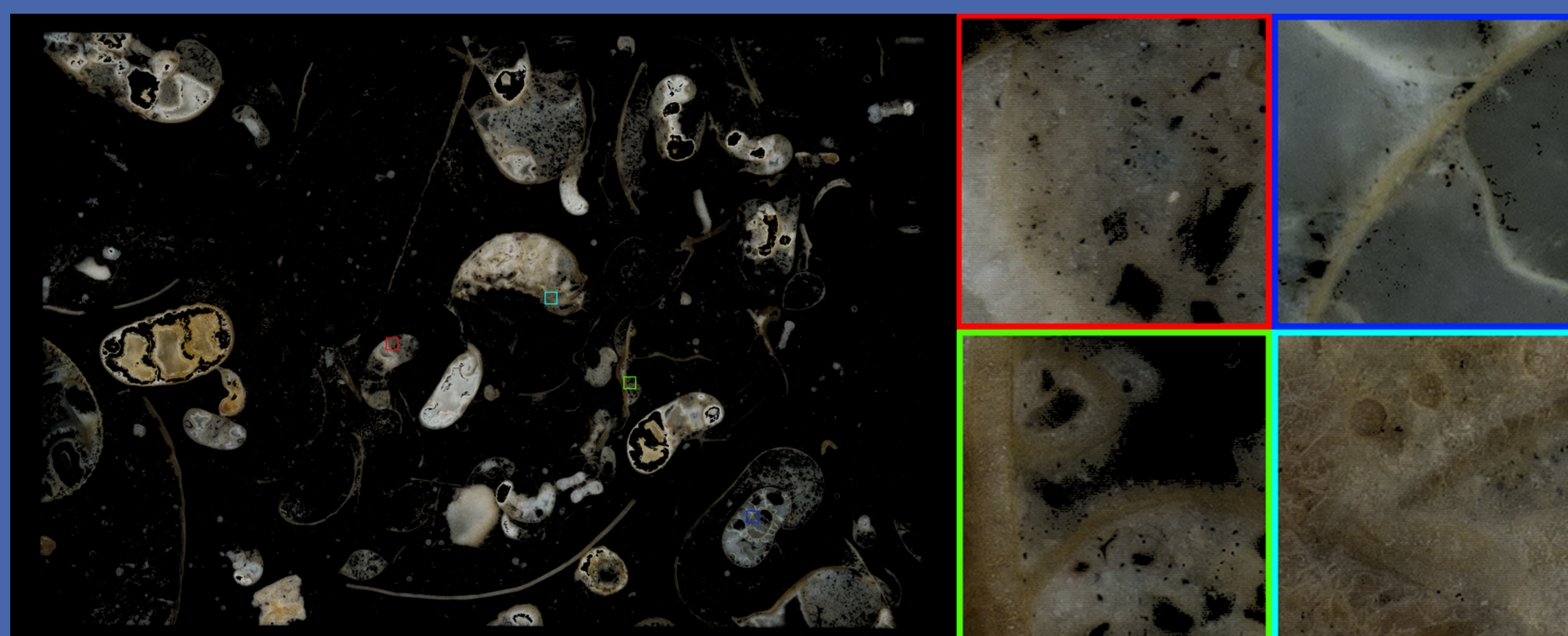


## FUTURE

In future, we would like to explore ray-tracing hardware in higher levels of the tree for traversal, subgroups and workgroup shared memory for data movement, directed acyclic graphs, frequency-domain transformations, and neural methods for compression, and new web APIs with alternative streaming methods for mobile.



# VISUALIZE TERABYTES OF DATA IN REAL-TIME ON GPU USING A FAST TRAVERSAL ALGORITHM WITH A WAVELET-COMPRESSED TREE REPRESENTATION.



## YOUR APPROACH

Our method builds a more tight-fit tree structure that captures sparsity and compresses through wavelet transform, resulting in a compact representation. We find that it works interactively with recent hardware while relying on generic system memory streaming methods to render on GPU. We also show that it is possible to exploit the hierarchical nature of this data structure to accelerate traversal.

## REFERENCES

Mitko Aleksandrov, Sisi Zlatanova, and David J. Heslop. 2021. Voxelisation Algorithms and Data Structures: A Review. *Sensors* (Basel, Switzerland) 21 (2021).

Alejandro Graciano, Antonio J. Rueda-Ruiz, Adam Pospíšil, Jiří Bittner, and Bedrich Benes. 2021. QuadStack: An Efficient Representation and Direct Rendering of Layered Datasets. *IEEE Transactions on Visualization and Computer Graphics* 27 (2021), 3733–3744.

Ken Museth. 2021. NanoVDB: A GPU-Friendly and Portable VDB Data Structure For Real-Time Rendering And Simulation. *ACM SIGGRAPH 2021 Talks* (2021).

Ingo Wald, Gregory P. Johnson, Jefferson Amstutz, Carson Brownlee, Aaron Knoll, J. Jeffers, Johannes Günther, and Paul A. Navrátil. 2017. OSPRay - A CPU Ray Tracing Framework for Scientific Visualization. *IEEE Transactions on Visualization and Computer Graphics* 23 (2017), 931–940.

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