Lossless Medical Image Compression for Radiology

drainpipe.io™

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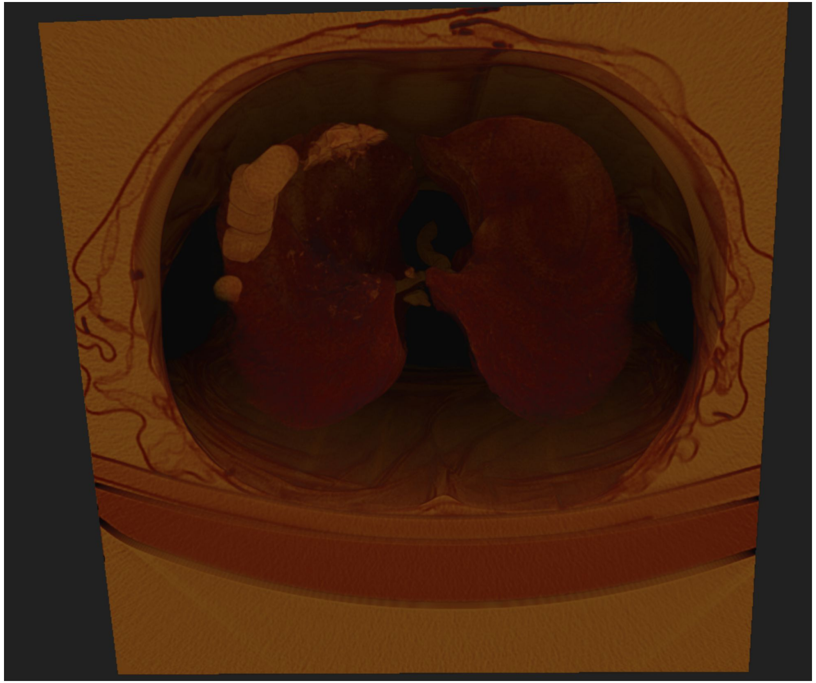
Research Team

Research commenced in January, 2020 to build a data warehouse for training artificial intelligence models using distributed computing techniques.

Dominick Romano - Founder, drainpipe.io
- Heterogeneous Hierarchical Ontologies
- Rendering systems for video games
- Massively Parallel Artificial Intelligence

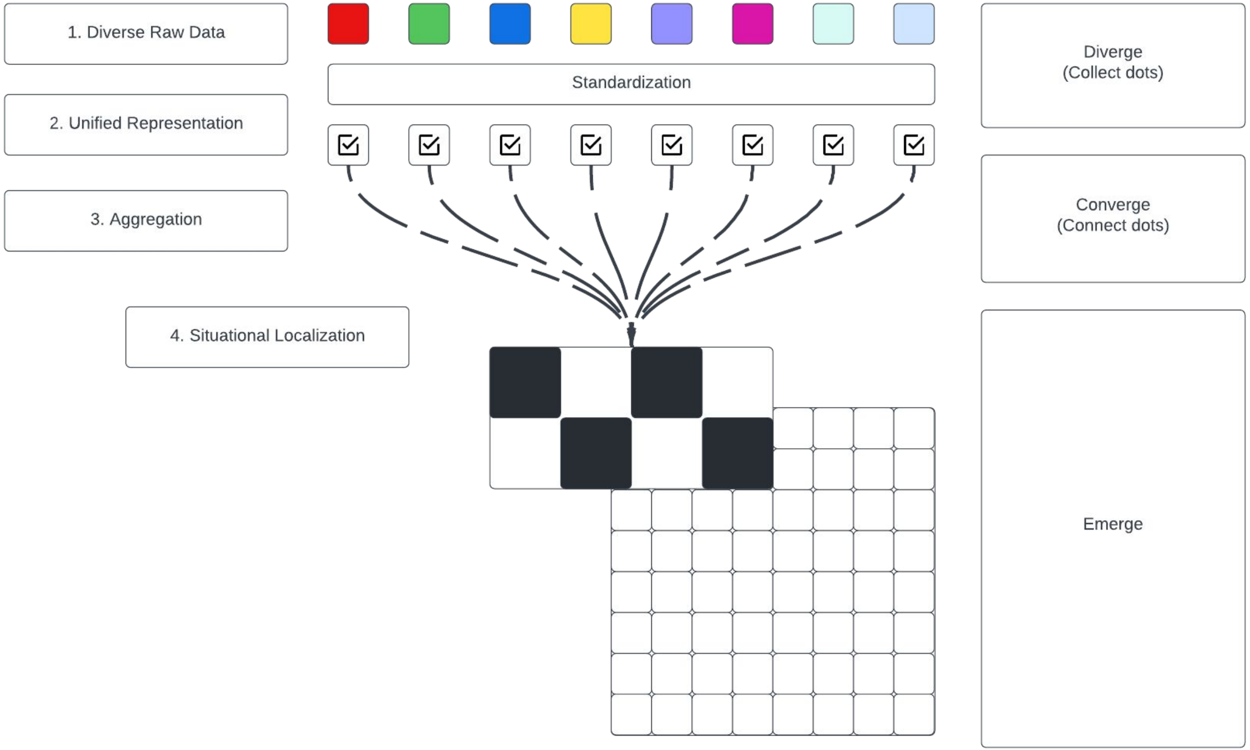
Felipe Carino, Jr. - Fmr. Chief Architect, Teradata
- Researcher in Distributed Computing & Databases
- US Patents - Awarded 8 U.S. Patents
- Validated work done at drainpipe as interim CTO

Introduction

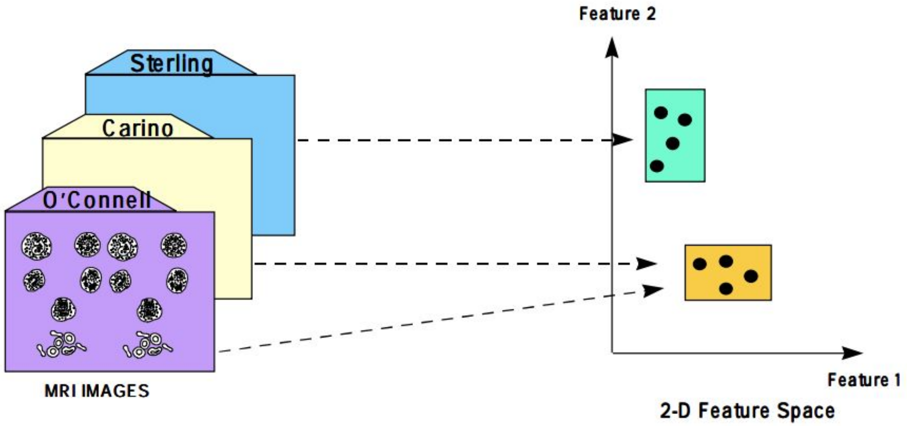


Loading, storing, and visualizing large Neuro Informatics files (NII) commonly used in CT and MRI is costly and time consuming. To load the media, and store it for long term is extremely costly. To process the files, and transfer across systems is extremely time consuming. As more medical samples are accumulated and used to train AI Models, we must rethink how we store and process these files.

Representation Phases



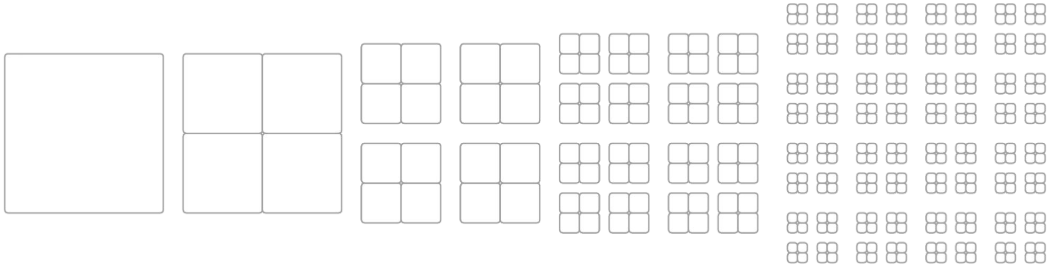
Vectorizing Medical Imagery

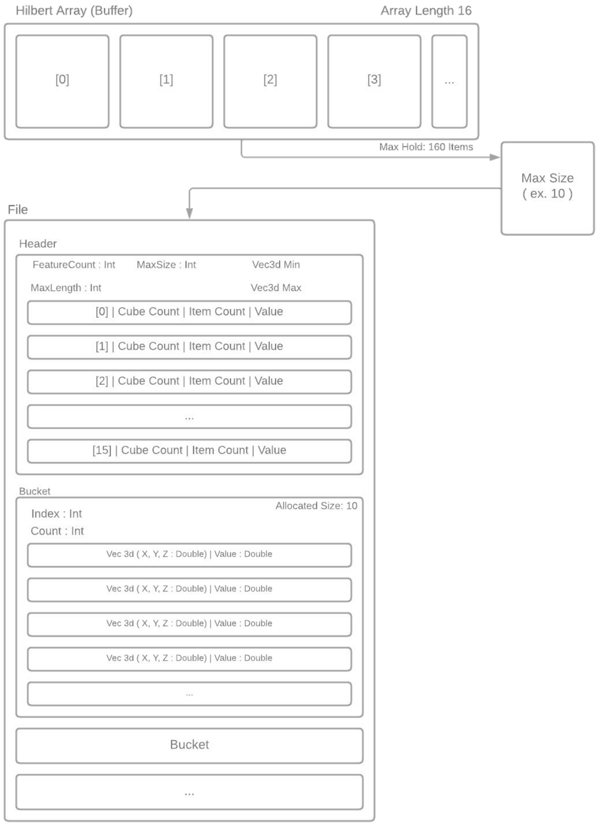


[1] F. Cariño and W. Sterling, Parallel Strategies and Concepts for a Petabyte Multimedia Database Computer, *IEEE Parallel Database Techniques*, 1998.

Hilbert Symbolics

Using symbolics generated from hilbert space for lossless medical imagery compression in parallel computing strategies





Hilbert segmented images are recursively processed, this is distributed across multiple threads and systems for each hilbert cube.

NIST Medical Databank

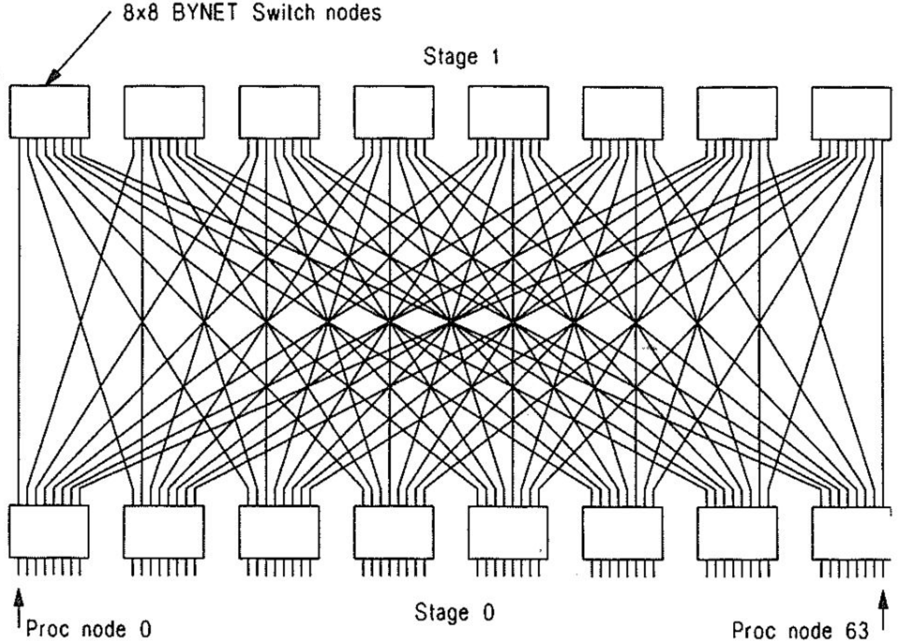


Figure 5. Bynet network topology.

8.4 INTERCONNECTION NETWORK TOPOLOGIES

The following illustrations and discussion[12,29,30,32] describe interconnection network topologies and performances. Figure 8 pictorially shows the topology for 2D-Mesh, Hypercube, Crossbar, BANYAN, and the Bynet.

Table 1 is a qualitative comparison of network topologies. Table 2 provides a quantitative practical comparison using 64 nodes as an example. SDC-OMEGA,[16] EDS-DELTA,[20,34] MESHNET,[35] and iPSC/860-PARAGON[36] are other interconnection networks that have been designed since the survey was written.[29] Our description above shows the thought processes and rationale behind the Bynet design choices.

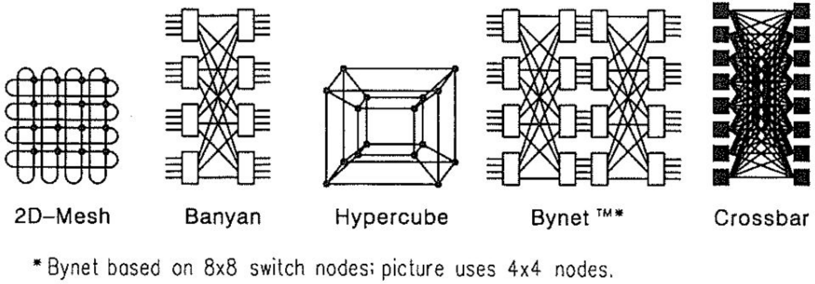
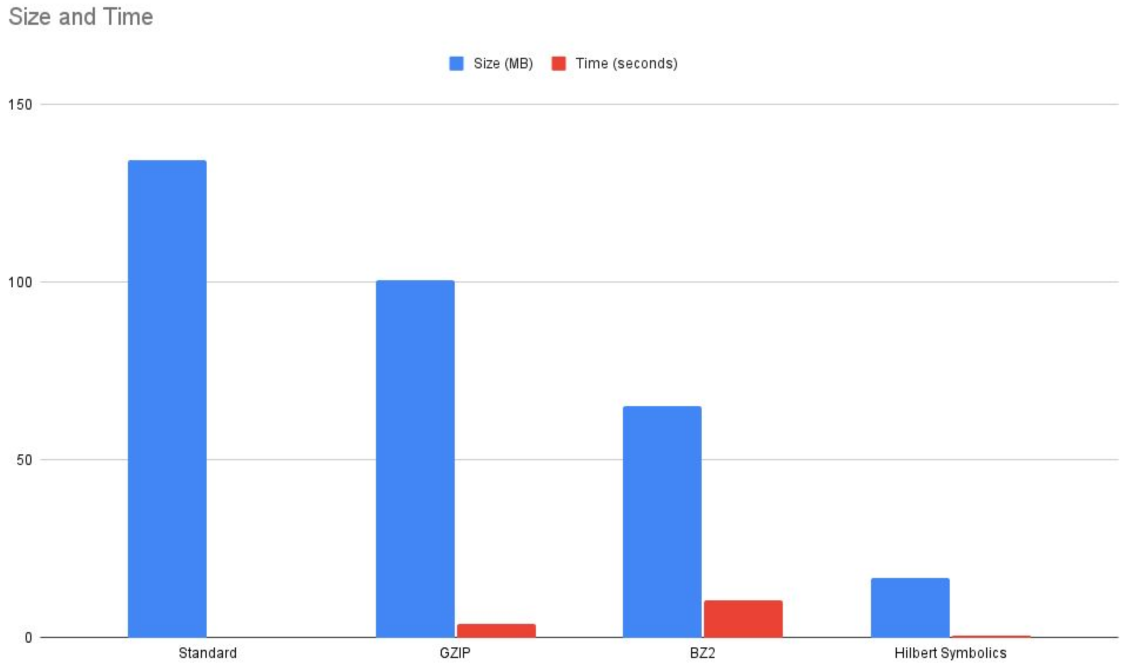


Figure 8. Interconnection network topologies.

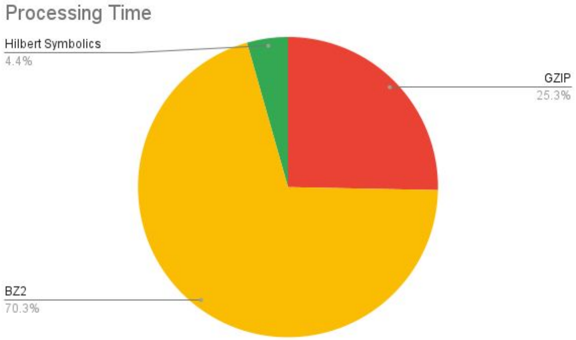
[2] Industrial Database Supercomputer Exegesis: The DBC/1012, The NCR 3700, The Ynet, and The Bynet, Chapter 8

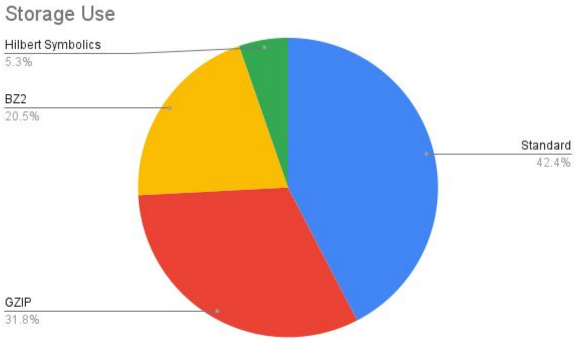
Performance Benchmarks

Standard NII format compressions vs Hilbert Symbolics



Standard	GZIP	BZ2	Hilbert Symbolics
134.2 MB	100.7 MB (24.9%)	65 MB (51.5%)	16.8 MB (87.4%)
	3.811 Seconds	10.578 Seconds	664.062 Milliseconds





References

[1] F. Cariño and W. Sterling, Parallel Strategies and Concepts for a Petabyte Multimedia Database Computer, *IEEE Parallel Database Techniques*, 1998.

[2] Felipe Cariño Jr., Warren Sterling, and Pekka Kostamaa, Industrial Database Supercomputer Exegesis: The DBC/1012, The NCR 3700, The Ynet, and The Bynet, Chapter 8, pp 9 11, PARLE Lecture Notes, 1992

Thank you

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