

SUPPLEMENTARY MATERIAL: THE IMPACT OF CHANGES IN RESOLUTION ON THE PERSISTENT HOMOLOGY OF IMAGES

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1. PERSISTENCE DIAGRAMS FROM MATERIAL SCIENCE EXAMPLES

Section V.B in [1] presents three material science examples: glass bead packing, a Castlegate sandstone sample and a sand packing sample. In Figures. 1, 2 and 3, we show the computed persistence diagrams for the 3D images on several resolutions for the bead packing, castlegate sandstone and sand packing, respectively.

As shown in [2], the percolation threshold, l_c , can be determined from the distribution of points in the zero dimensional persistence diagram. This threshold is the radius of the largest sphere that can pass through the pore space from one side of the image to the opposite and is an important physical parameter associated with porous materials.

In the three sets of examples shown in Figures 1-3, the distribution of points in $PD(0) D_n$ shows a clear signature of this critical length scale. This signature yields the same estimate for l_c for image resolutions $n = 512, 256, 128$ and even $n = 64$ in the three example materials.

REFERENCES

- [1] Teresa Heiss, Sarah Tymochko, Brittany Story, Adèle Garin, Hoa Bui, Bea Bleile, and Vanessa Robins. The impact of changes in resolution on the persistent homology of images. *In Submission*, 2021.
- [2] Vanessa Robins, Mohammad Saadatfar, Olaf Delgado-Friedrichs, and Adrian P. Sheppard. Percolating length scales from topological persistence analysis of micro-CT images of porous materials. *Water Resources Research*, 52(1):315–329, January 2016.

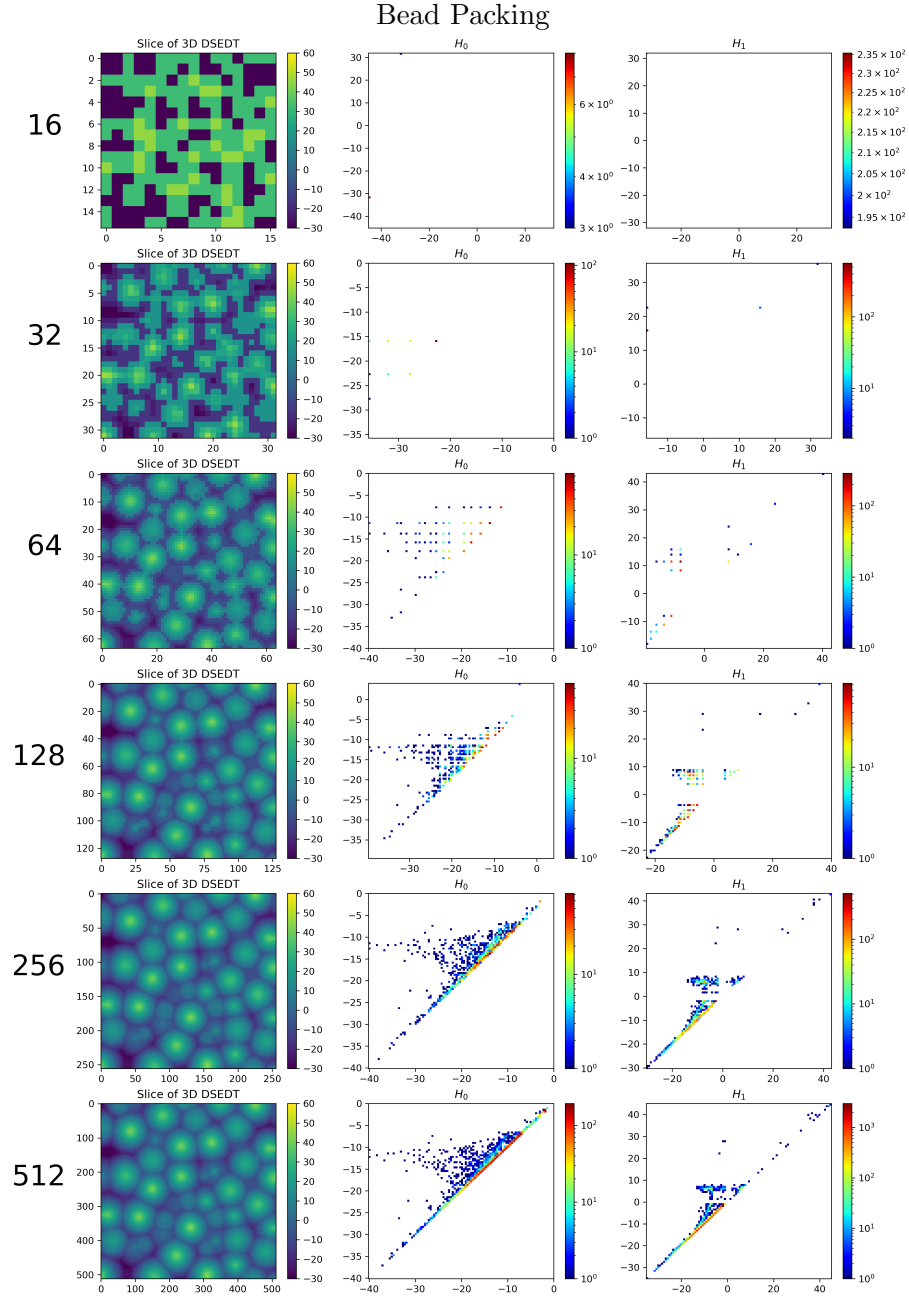


FIGURE 1. Each row shows a slice of the 3D SEDT, and the 0 and 1 dimensional persistence diagrams of the bead packing sample at many resolutions.

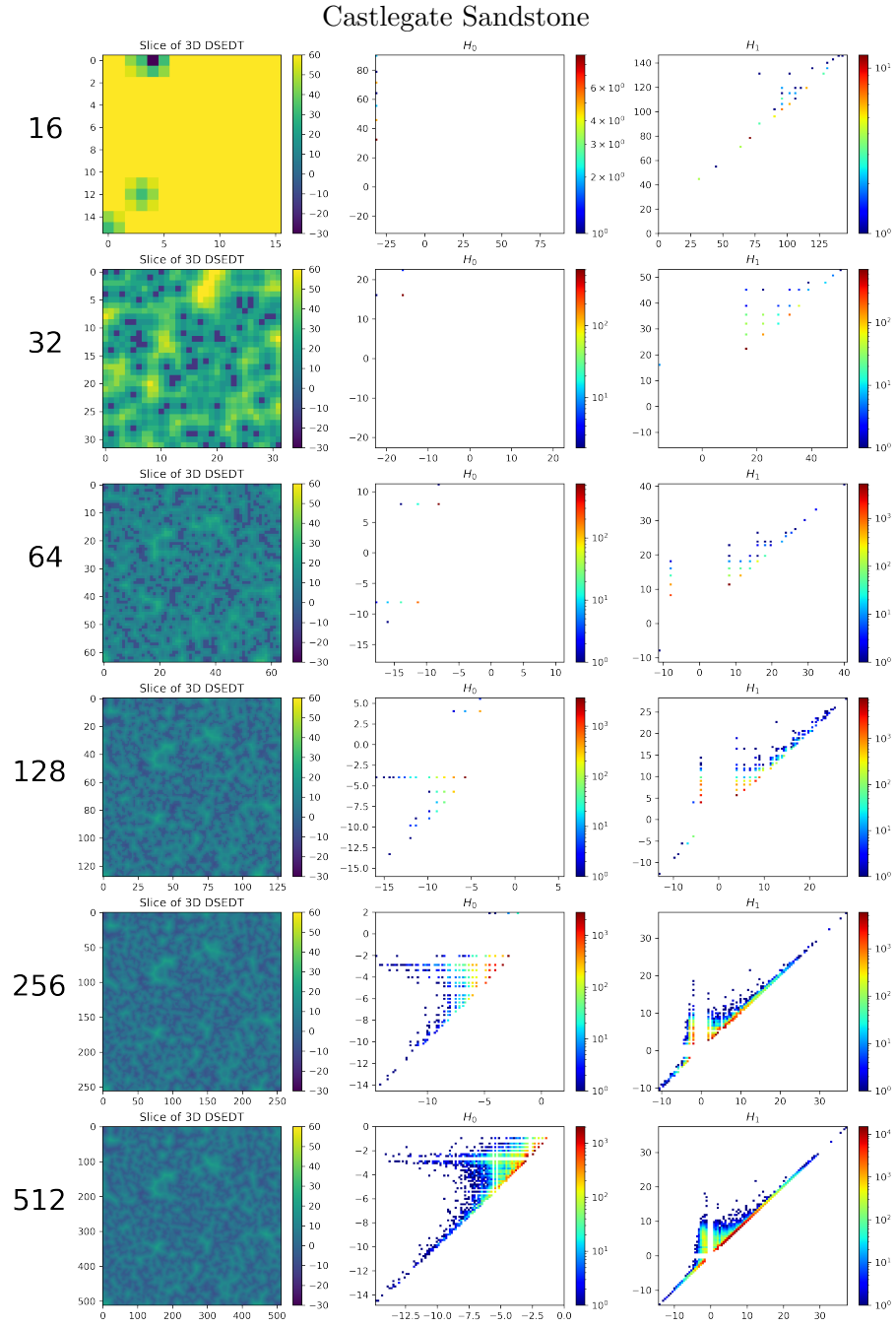


FIGURE 2. Each row shows a slice of the 3D SEDT, and the 0 and 1 dimensional persistence diagrams of the castlegate sandstone sample at many resolutions.

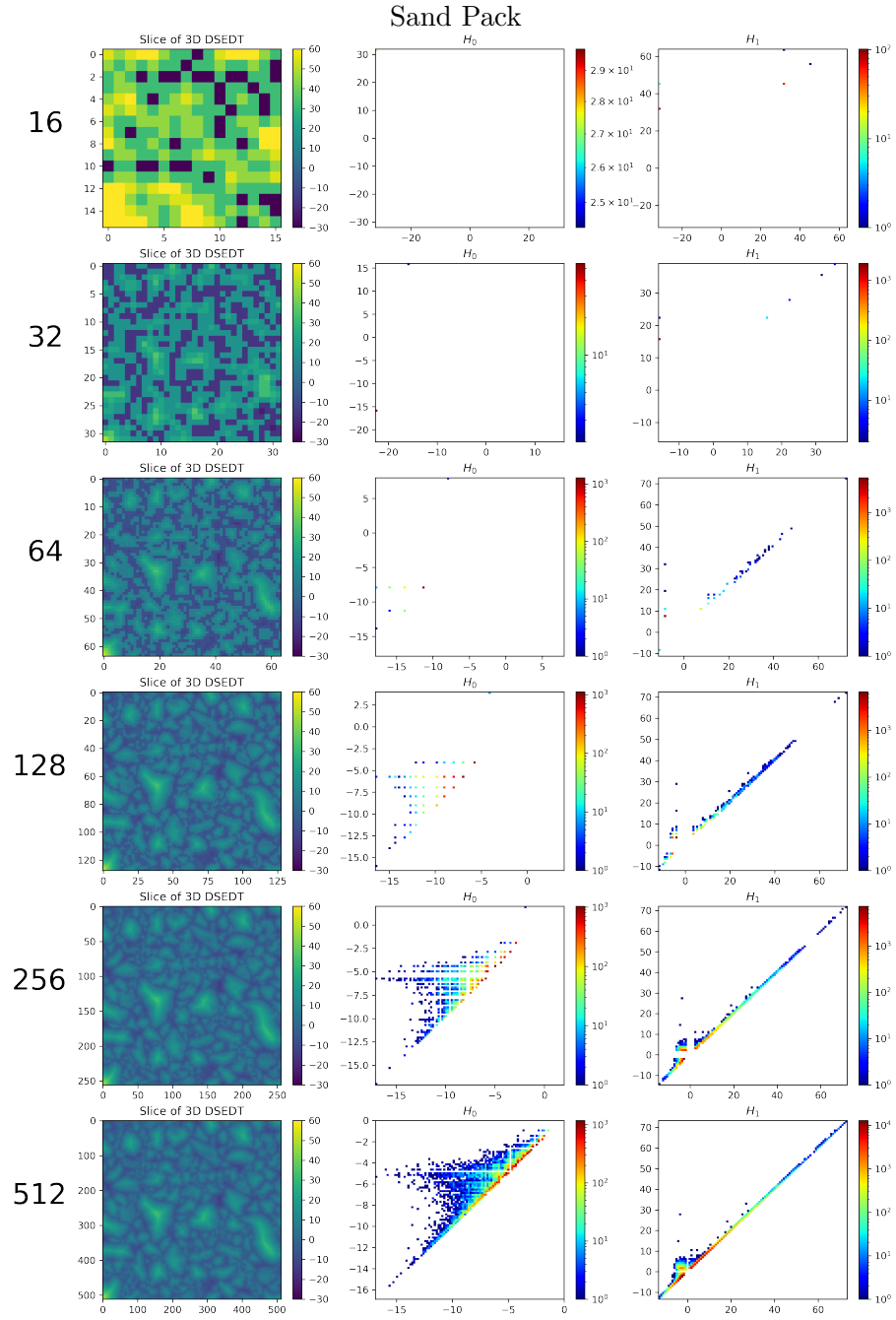


FIGURE 3. Each row shows a slice of the 3D SEDT, and the 0 and 1 dimensional persistence diagrams of the sand packing sample at many resolutions.