# ANALYZING SPHERE PACKINGS WITH HIGHER ORDER PERSISTENCE.

GEORG OSANG

Persistent homology has become a popular tool to analyse various kinds of data, in particular in material sciences. Specifically, persistence of discrete point sets has recently been used to analyse sphere packing data, to shed light on structures arising in sphere packings at different packing densities. [1] We generalize this notion and introduce higher-order persistence of discrete point sets. [2] We briefly address computational challenges, and then show how this notion can deal with noisy point samples. In the setting of sphere packings we show that this notion can also capture a wider variety of local structures, and in particular can distinguish between the hexagonal close packing and the face centered cubic lattice packing, two structures know to have optimal packing density in 3 dimensions.

## References

[1] M. Saadatfar, H. Takeuchi, V. Robins, N. Francois, and Y. Hiraoka. Pore configuration landscape of granular crystallization. Nature communications, 8 (2017), 15082.

[2] H. Edelsbrunner, and G. Osang. The Multi-cover Persistence of Euclidean Balls. In LIPIcs-Leibniz International Proceedings in Informatics, vol. 99. Schloss Dagstuhl-Leibniz-Zentrum fuer Informatik, 2018.

(Georg Osang) Institute for Science and Technology Austria
*E-mail address*: georg.osang@ist.ac.at

*Date*: October 15, 2018.