ALGORITHMIC CANONICAL STRATIFICATIONS OF SIMPLICIAL COMPLEXES

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Simplicial complexes are mathematical structures of primary significance within topological data analysis, being a model for (nice) topological spaces that can be represented and manipulated on a computer. For the purposes of TDA, we seek computationally accessible invariants of simplicial complexes. In this talk, I will describe one such invariant deriving from the theory of stratified spaces, which is the coarsest stratification of a simplicial complex such that the strata are homology manifolds, and describe an efficient algorithm for calculating this "canonical" stratification. More precisely, given the poset P of simplices of a finite abstract simplicial complex K, we may algorithmically determine the map of posets $\pi : P \to [\dim(P)]$ such that for each fiber $P_{\pi=i} \subset P$, $P_{\pi=i}$ is maximal among all open subposets $U \subset \overline{P_{\pi=i}}$ in its closure such that the restriction of the local $\mathbb{Z}$-homology sheaf of $\overline{P_{\pi=i}}$ to U is locally constant. The main new idea is to iteratively constrain the stable homotopy types of the links of simplices via Poincaré duality. This is joint work with Ryo Asai.

References

[1] R. Asai and J. Shah: *Algorithmic canonical stratifications of simplicial complexes*, arXiv preprint 1808.06568

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