

# Kunal Dutta

University of Warsaw

## UNIFORM BRACKETS, CONTAINERS AND COMBINATORIAL MACBEATH REGIONS

We study connections between three seemingly different combinatorial structures – *uniform brackets* in statistics and probability theory, *containers* in online and distributed learning theory, and *combinatorial Macbeath regions*, or *Mnets* in discrete and computational geometry. We show that these three concepts are manifestations of a single combinatorial property that can be expressed under a unified framework along the lines of Vapnik-Chervonenkis type theory for uniform convergence. These new connections help us to bring tools from discrete and computational geometry to prove improved bounds for these objects. Our improved bounds help to get an optimal algorithm for distributed learning of halfspaces, an improved algorithm for the distributed convex set disjointness problem, and improved regret bounds for online algorithms against  $\sigma$ -smoothed adversary for a large class of semi-algebraic threshold functions.

This is joint work with Arijit Ghosh and Shay Moran.

## References

- [1] K. Dutta, A. Ghosh, S. Moran: *Uniform Brackets, Containers and Combinatorial Macbeath Regions*, 13th Innovations in Theoretical Computer Science Conference, LIPIcs 215, 2022, pp. 59-1–59-10.