Title: Near-equivalence of the Restricted Isometry Property and the Johnson-Lindenstrauss Lemma
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Abstract: The Johnson-Lindenstrauss Lemma states that any set of p points in high-dimensional Euclidean space can be embedded into O(log(p)/d^2) dimensions, without distorting the distance between any two points by more than a factor of 1 - d and 1 + d. We establish a "near-equivalence" between Johnson-Lindenstrauss embeddings and the Restricted Isometry Property (RIP), a well-known concept in the theory of compressed sensing often used for showing success of l1-minimization.

Consequently, matrices satisfying the Restricted Isometry Property of optimal order provide optimal Johnson-Lindenstrauss embeddings up to a logarithmic factor in the ambient dimension of the data. Moreover, our results yield the best-known bounds on the necessary embedding dimension for a wide class of structured random matrices, resulting in improved bounds for "fast" Johnson-Lindenstrauss transforms.

We also discuss implications of our results in the area of compressed sensing.

This is joint work with Felix Krahmer.