MEASUREMENT MATRICES FOR COMPRESSIVE SENSING VIA COLUMN REPLACEMENT

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In order to support compressive sensing, it is useful to construct measurement matrices that support signal recovery by linear programming when the signals are 'sparse' with respect to a fixed basis. Earlier we developed a 'column replacement' technique that constructs large measurement matrices by using entries in a distributing hash family with k symbols to select columns from a (smaller) measurement matrix with k columns. One limitation of this method is that, although signals with many more coordinates are considered, the sparsity of the signal remains fixed. We review the column replacement technique used to establish our earlier construction, and make a surprising observation. By restricting the number of symbols used in the 'separations' that the hash family provides to be smaller than the desired sparsity, the smaller ingredient matrix from which columns are selected can itself have smaller sparsity than does the one resulting from column replacement.

This leads to an additional requirement for hash families, a *strengthening* requirement, that does not appear to have been studied previously. After motivating the need for strengthening hash families, we outline a randomized greedy algorithm for their construction. We also pose some questions about their existence.