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Density theorems for anisotropic point configurations

Several mathematical areas search for patterns in large, but otherwise arbitrary structures. Euclidean density theorems seek for dilated, rotated, and translated copies of a fixed finite point configuration within a "large" subset of the Euclidean space of appropriate dimension, where "largeness" is then defined as having a strictly positive (appropriately defined) density. Of particular interest are results that identify the configuration dilated by all sufficiently large scales; a line of research proving such results extends back to the 1980s and, so far, all results of this type discussed linear isotropic dilates of a fixed point configuration. We will report on the beginnings of the study of analogous density theorems for families of point configurations generated by anisotropic dilations, i.e., families with power-type dependence on a single parameter interpreted as their size. At the same time, we will single out anisotropic multilinear singular integral operators associated with these combinatorial problems, as they are interesting on their own. We will also mention related author's joint work with P. Durcik, K. Falconer, L. Rimanić, and A. Yavicoli.