

# HOMOGENIZATION OF SGD IN HIGH-DIMENSIONS

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We develop a stochastic differential equation, called homogenized SGD, for analyzing the dynamics of stochastic gradient descent (SGD) on a high-dimensional random generalized linear models. We show that homogenized SGD is the high-dimensional equivalence of SGD— for any  $C^3$ - statistic (e.g., population risk), the statistic under the iterates of SGD converges to the statistic under homogenized SGD when the number of samples  $n$  and number of features  $d$  are polynomially related ( $d^c \leq n \leq d^{1/c}$  for some  $c \geq 0$ ). Several motivating applications are provided including phase retrieval, least-squares, and logistic regression.

*Joint work with Elliot Paquette (McGill University), Inbar Seroussi (Tel-Aviv University) and Elizabeth Collins-Woodfin (McGill University).*