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The curse of dimensionality is a common phenomenon which affects analysis of datasets characterized by large numbers of variables associated with each point. Problematic scenarios of this type frequently arise in classification algorithms which are heavily dependent upon distances between points, such as nearest-neighbor and k-means clustering. Given that contributing variables follow Gaussian distributions, this research derives the probability distribution that describes the distances between randomly generated points in  $n$ -space. A priori understanding of this distribution may help quantify the effect of additional dimensions on the accuracy of statistical learning for some classification problems. The theoretical results are extended to examine additional properties of the distribution as the dimension becomes arbitrarily large. (Received September 16, 2014)