Average Case Behavior of Random Search for the Maximum

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This paper is a study of the error in approximating the global maximum of a Brownian motion on the unit interval by observing the value at randomly chosen points. One point of view is to look at the error from random sampling for a given fixed Brownian sample path; another is to look at the error with both the path and observations random. In the first case we show that for almost all Brownian paths the error, normalized by multiplying by the square root of the number of observations, does not converge in distribution, while in the second case the normalized error does converge in distribution. We derive the limiting distribution of the normalized error averaged over all paths.