Optimisation of pure and combined search strategies in case of sparsely distributed targets

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The Lévy flight hypothesis states that the scale-free Lévy flight (LF) motion represents the most successful strategy for foraging and blind target search. Since its appearance the hypothesis was discussed widely in the literature with both arguments for and against it. In this talk we contribute to this discussion by addressing the generic problem of search for point-like targets on a line. The measures of succesful search are introduced, namely, the search reliability and the search efficiency. The framework of fractional Fokker-Planck equation with sink terms allows us to compute these measures for scale-free search strategies. We discuss a range of factors, which affect the success of a search strategy under different conditions. Several scenarios are considered in particular. We start with a discussion of whether Brownian motion or Lévy flights are a better choice for a single target location in presence of a bias and without. Then the approach is generalised for combined strategies, which include either Brownian and scale-free motion or two types of LFs. After that we address the question how the presence of a few targets affects an optimal strategy. From the problem settings studied here some common patterns are deduced. In cases when the search proceeds along the bias or targets are close to the searcher, i.e. the search is “easy”, Brownian strategies outperform scale-free motions. On the contrary for against-the-bias search or a search for remote targets LFs and combined strategies excel.