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A random walk model to evaluate autism

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Abstract

A common test administered during neurological examination in children is the analysis of their social communication and interaction across multiple contexts, including repetitive patterns of behavior. Poor performance may be associated with neurological conditions characterized by impairments in executive function, such as the so-called pervasive developmental disorders (PDDs), a particular condition of the autism spectrum disorders (ASDs). Inspired in these diagnosis tools, mainly those related to repetitive movements and behaviors, we studied here how the diffusion regimes of two discrete-time random walkers, mimicking the lack of social interaction and restricted interests developed for children with PDDs, are affected. Our model, which is based on the so-called elephant random walk (ERW) approach, consider that one of the random walker can learn and imitate the microscopic behavior of the other with probability f ($1-f$ otherwise). The diffusion regimes, measured by the Hurst exponent (H), is then obtained, whose changes may indicate a different degree of autism.

Keywords: Autism, Non-Markovian processes, Anomalous diffusion.

1. Introduction

Recently, many random walk models were proposed considering that one of the walker can remember each decision made at all time of the process history. A model proposed by Schütz and Trimper, the so-called elephant random walk (ERW) model, a non-Markovian discrete-time random walk with unbounded memory, whose random increments at each time step depend on the whole history of the process [1]. The feature of saving a record for each decision of the random walk history gives to it the aspect of a non-Markovian process [2, 3]. Others cases of non-Markovian processes, for example, can be found in the continuous-time random walk theory (CTRW) introduced by Montroll and Weiss [4]. The ERW model is able to remember each decision according to

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