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Modeling birds on wires[☆]

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Abstract

In this paper we introduce a mathematical model to study the group dynamics of birds resting on wires. The model is agent-based and postulates attraction-repulsion forces between the interacting birds: the interactions are “topological”, in the sense that they involve a given number of neighbors irrespective of their distance. The model is first mathematically analyzed and then simulated to study its main properties: we observe that the model predicts birds to be more widely spaced near the borders of each group. We compare the results from the model with experimental data, derived from the analysis of pictures of pigeons and starlings taken in New Jersey: two different image elaboration protocols allow us to establish a good agreement with the model and to quantify its main parameters. We also discuss the potential handedness of the birds, by analyzing the group organization features and the group dynamics at the arrival of new birds. Finally, we propose a more refined mathematical model that describes landing and departing birds by suitable stochastic processes.

Keywords: Birds on wire, Modeling birds behavior, Group behavior, Animal groups

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