Minority Game: replication of the core results

Szymon Talaga

1 Overview

Here I reproduce core results (i.e. figures) from the Challet's thesis and the Physica A paper about Minority Game (MG).

1.1 Parameters

Simulation runs are parametrized with the following parameters:

- `N` : number of agents, which should be an odd positive integer. In most cases it will be set to 1001.
- `M` : agent memory size. Agents make decisions based on the history of `M` last winning sides. It can be a single positive integer (all agents have the same memory size) or a vector of sizes of length `N`.
- `S` : agent strategy bag size. Each agent uses `S` different strategies. It can be either a single value or a vector of `N` values.

2 Replication of the results from the thesis

2.1 Fig. 2.1.

Here we study the relationship between normalized fluctuations

$$\frac{\sigma^2}{N} = \frac{\langle A^2 \rangle}{N}$$

with respect to a controll parameter $\alpha = 2^M/N$.

As evident in the figure below, replicated the results reported as Fig. 2.1. in the PhD thesis of Damien Challet. We see qualitatively identical pattern of decreasing normalized fluctuation, which after the minimum for medium values of α start to increase (slightly) again and reach

normalized fluctuations of about 1, which is a value expected for random decisions. Thus, we observe the three different regimes as reported in the thesis.

There are, however, some minor numerical differences. In our resuls the curves are less bended downwards so the minima are less pronounced than in the results reported in the thesis. It is not clear whether these stems from some differences in terms of implementation details or just from using somewhat different parameters (i.e. the thesis does not specify the number of times steps). Nonetheless, irrespective of these numerical differences, the qualitative results are the same.

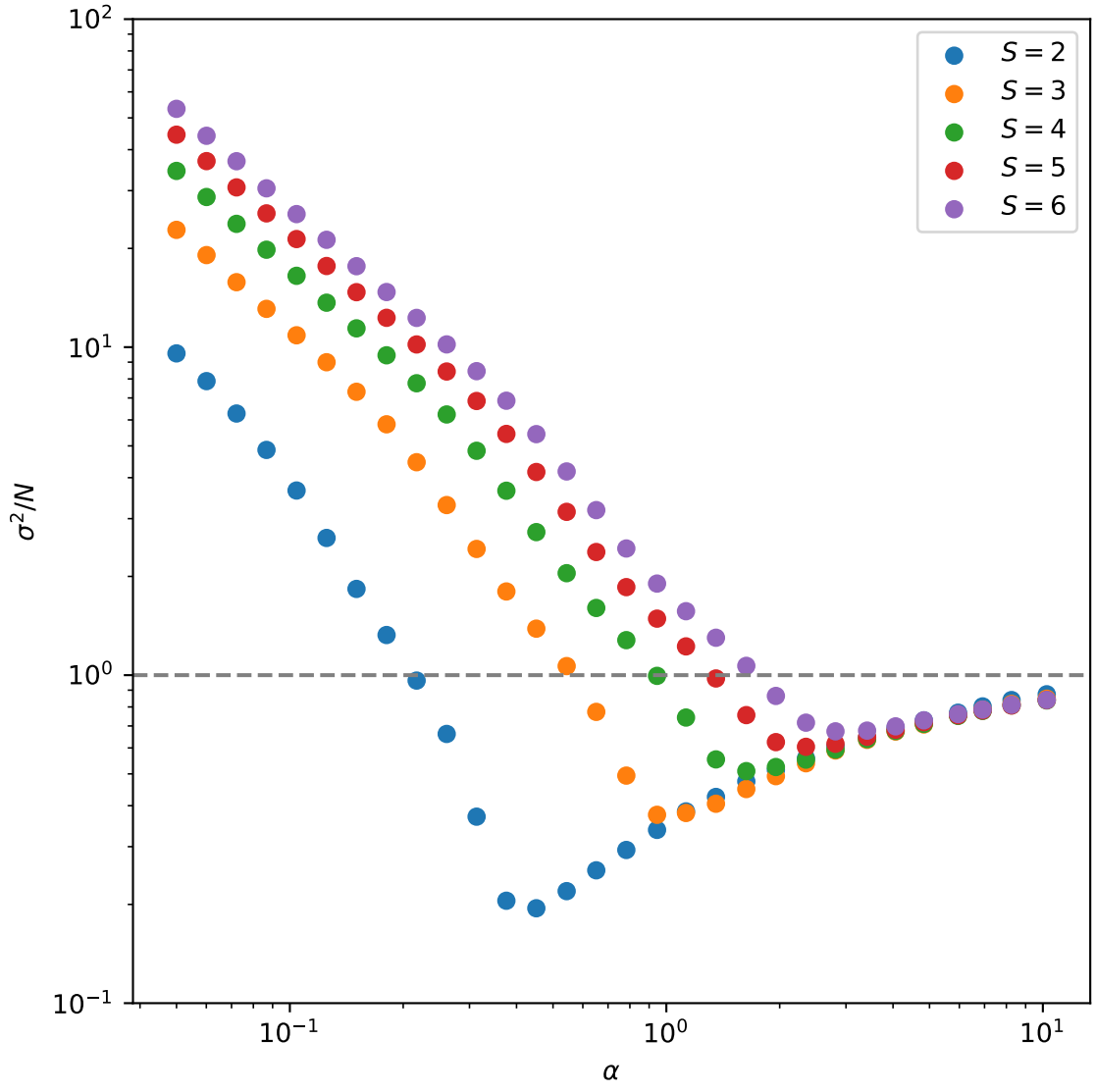

Figure 1: Normalized fluctuations with respect to $(M = 8, S = 2, ..., 6)$.

2.2 Fig. 2.2. (top)

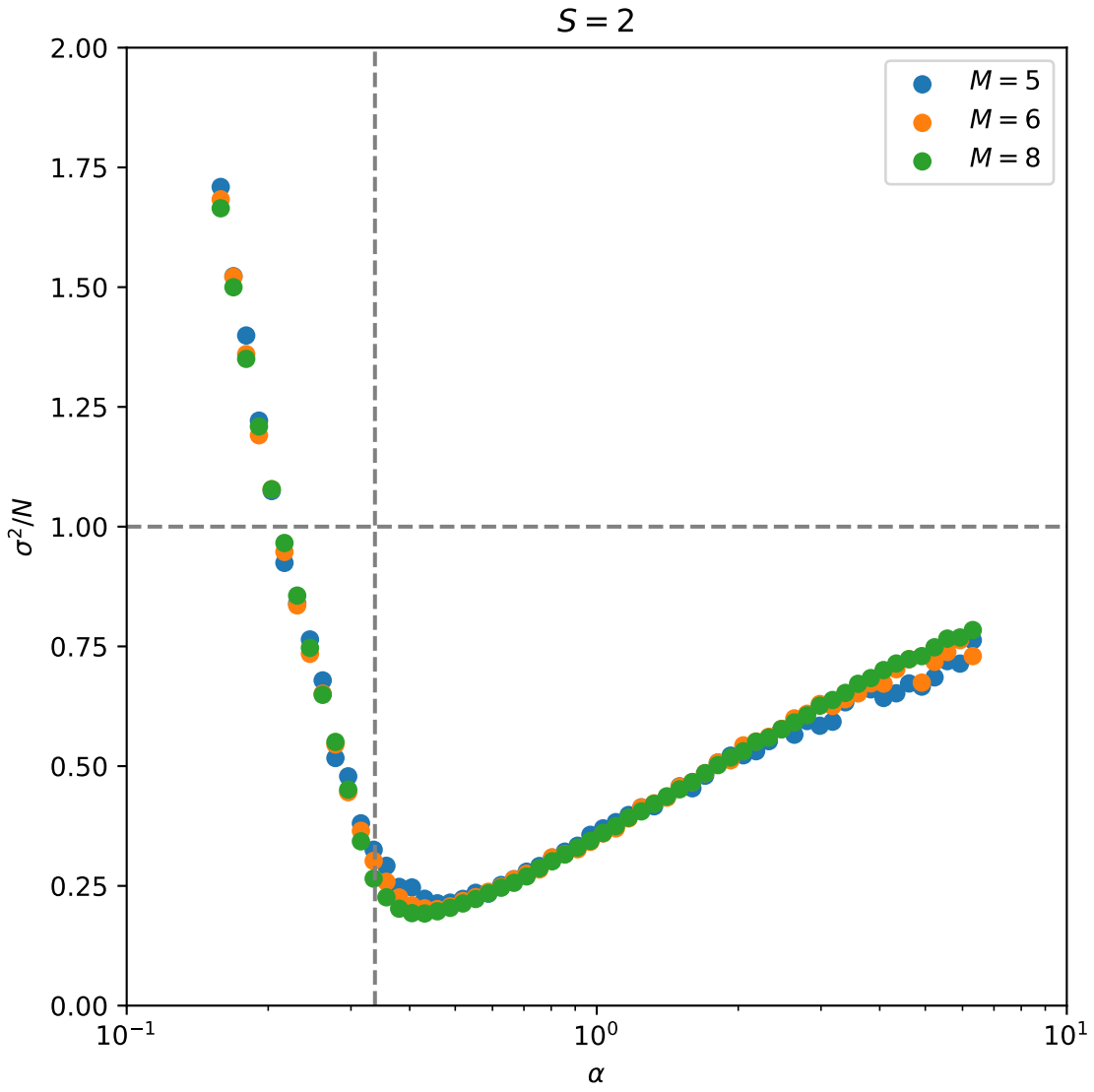

Figure 2: Normalized fluctuations with respect to $(M = 5, 6, 8, S = 2)$, $300 * 2^M$ iterations.