The Majority Vote Process with Unbalanced Noise

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The majority vote process was one of the earliest models in the field of interacting particle systems. It shares certain features with the stochastic Ising model, but its equilibria do not admit an explicit expression in contrast to the stochastic Ising model. Because of the difficulties of obtaining results, relatively little work has been done on the majority vote process.

We consider here the continuous time majority vote process on connected graphs G, with every $x \in G$ having two possible opinions: 0 and 1, and being assigned a voting neighborhood $M(x)$. At rate ε_0 (ε_1), the opinion of x is updated to 0 (1) irrespective of the opinions in $M(x)$. At rate 1, the opinion of x aligns with the absolute majority opinion in $M(x)$.

We study the equilibrium behavior when $\varepsilon_0 + \varepsilon_1$ is small and show contrasting behavior for different voting neighborhoods: Under general assumptions on G, when one of ε_0 and ε_1 is significantly smaller than the other, the majority vote process will be ergodic, i.e., there exists only one equilibrium. When these general assumptions on G are not satisfied, the majority vote process need not be ergodic.

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