Computational Science 2

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Seminar
Exercises

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Exercise 7 (12.06.2014):

Models of opinion formation

from ***An Introduction to Computer Simulation Methods***,
Chapter 14, Problem 14.23

a) *The voter model.* On a regular lattice assign each site the value ± 1. Choose a site (the voter) at random. The voter then adopts the same value as a randomly chosen neighbor. These two steps continue until all sites have the same value, that is, when they have reached consensus. Compute the probability of achieving a consensus of $+1$ given that the initial density of $+1$ sites is ρ_0. Use a 10×10 square lattice and make at least 20 runs at each density. Also compute the time to reach consensus as a function of the lattice size. In two dimensions this time scales as $N \ln N$, where N is the number of sites. How does the consensus time scale with N in $d = 1$ and $d = 3$ dimensions? How does it scale on a preferential attachment network?

b) *The relative agreement interaction model.* N individuals are initially assigned an opinion that takes on a value between 0 and 1. Choose two individuals, i and j, at random. Assume that the ith opinion, O_i is greater than the jth opinion, O_j . If their opinions differ by less than the parameter ϵ, then increase O_j by $(m/2)(O_i - O_j)$ and decrease O_i by the same amount, where m is another parameter. This model implements the idea that two people will influence each other only if their opinions are sufficiently close. Write a program to simulate this model. Use a `LatticeFrame` for which each cell can take on one of 256 values. The approximation of the continuum by 256 values is for visualization purposes only, and the 256 values should be sufficiently large to approximate a continuum of values. Choose $\epsilon = 10, 50$ and 100, and $m = 0.3$ and 0.6. Choose $N \geq 2500$, begin with a random set of opinions, and discuss whether a single opinion emerges and the magnitude of the fluctuations.