

Exercise LS SR2 2021

Question 1

a) Could you explain the voter model and characterize its performance?

A voter i considers its neighbours' opinions o_j with $j \in N_i$ (without i) and picks a neighbour j at random and switches to its opinion.

Typically, the k -nearest neighbours are evaluated

- Very simple model
- High accuracy
- Slow convergence

↳ Could you also describe and characterize the majority rule?

Robot i considers its neighbourhood group G_i (including i) and counts the occurrence w_j of each opinion in \mathcal{O} . The robot then switches its opinion to the most frequent option O_k with $k = \operatorname{argmax}_j w_j$, that is, the majority within its group.

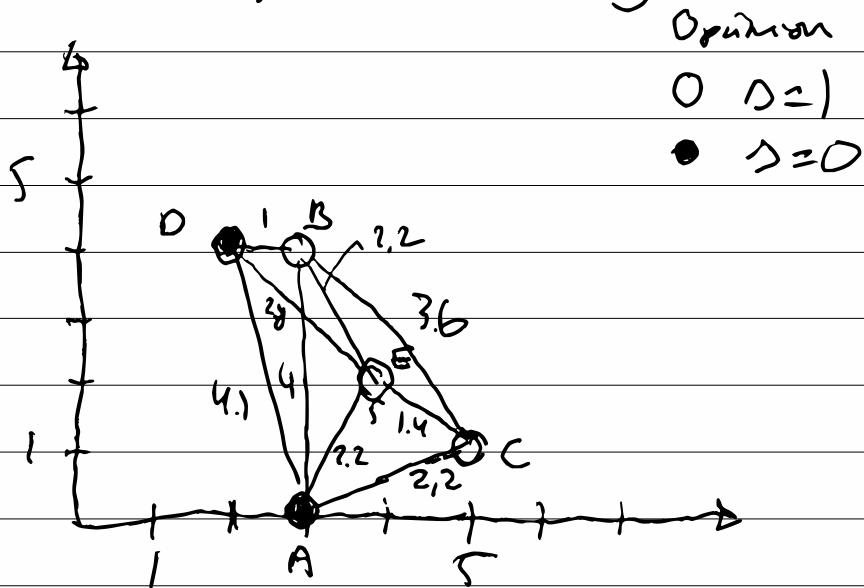
Also here, the k -nearest neighbours are typically evaluated.

- Fast convergence
- Less accurate than the voter model

Notes

- Accuracy is the probability of system converging to the majority of initial states or reproducing the initial frequencies?
- Convergence is the number of iterations in the consensus process or the complexity of algorithm in terms of big O-notation?
- Simultaneously or sequentially update of individuals?
- k-nearest neighbours or within distance of?

c) Given a network of 5 agents, could you track one iteration of the consensus process for this population using both models?



What are main parameters

1, opinions o , start frequency

2, Nearest neighbour k
(or distance d ?)

3, N is number of agents

Performance is dependent on

1) Accuracy

How often will system converge to

a) Majority of initial state?

b) Initial frequency?

2) Speed

How fast will system converge,

a) Number of iterations in convergence?

b) Complexity of algorithm in terms of $O(n, N)$?

Hand calculate for $k=3$

* Voter model

1) Who gets picked for voting?

a) Random? Update opinion on state individually.

b) All simultaneously?

2) Lets pick A and find neighbours
 $\Rightarrow B, C \text{ and } E (N_i)$

3, Pick one neighbour of random
 \Rightarrow E of $s_E = 1$ and change A
to $s_A = 1$

* Majority rule

1, Who gets picked?

a) Random?

b) All simultaneously?

2, Lets pick A again and find
neighbours including itself

\Rightarrow A, B, C and E (G_i)

3, Calculate the frequencies of
opinions

$s_A = 0, s_B = 1, s_C = 1$ and $s_E = 1$

$\Rightarrow f_{s=0} = \frac{1}{4}$ and $f_{s=1} = \frac{3}{4}$

4, Change opinion of A to highest
frequency

$\Rightarrow s_A = 1$

Notes

- 1) How to determine start criteria for opinion consensus?
- 2) How to determine stop criteria for opinion consensus?