TEK5010 MAS

Lecture 5: SR2

Exercise: Consensus modelling

Question 1

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

A robot i consider 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

b) Could you also describe and characterize the majority rule?

Robot i consider its neighbourhood group G_i (including i) and counts the occurance w_j of each opinion in O. The robot then switches its opinion to the most frequent option O_k with $k = \text{argmax}_j w_j$, 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

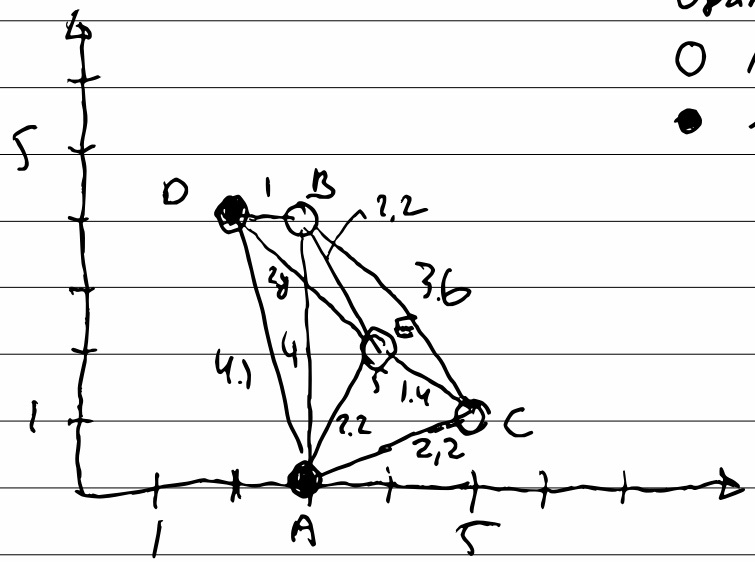
- Accuracy is the probability of system converging to the majority of initial states or reproducing the initial frequencies?

- Convergence is the number of iterations in the consensus process or the complexity of algorithms 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, host 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 $O(0,N)$?

Hand calculate for $k=3$

* Voter model
  1) Who gets picked for voting?
     a) Random? Update opinion state individually.
     b) All simultaneously?

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

3, Pick one neighbour of random
⇒ 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
⇒ A, B, C and E (G_i)
3, Calculate the frequencies of
opinions
$s_A = 0$, $s_B = 1$, $s_C = 1$ and $s_E = 1$
⇒ $f_{s=0} = \frac{1}{4}$ ∧ $f_{s=1} = \frac{3}{4}$

4, Change opinion of A to highest
frequency
⇒ $s_A = 1$

Notes

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