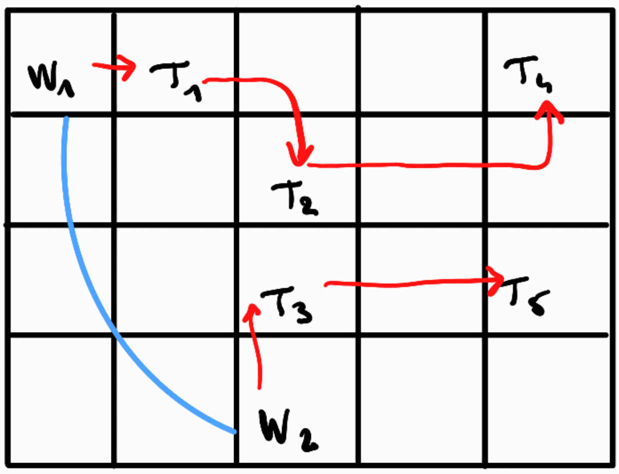
CBBA multi-task assignment.



— : communication.

environment:

Let W be the set of agents

$W = \{W_1, W_2\}$

Let T be the set of tasks

$T = \{T_1, T_2, T_3, T_4, T_5\}$

y_i : the winning bid matrix

y_{ij}	T_1	T_2	T_3	T_4	T_5
W_1	-inf	-inf	-inf	-inf	-inf
W_2	-inf	-inf	-inf	-inf	-inf

z_i : the winning agent list $\in I^{|W|}$

z_i	T_1	T_2	T_3	T_4	T_5
W_1	1	1	1	1	1
W_2	2	2	2	2	2

← winning agent list for W_1, initialized with his id.

same for W_2

b_i : the bundle for agent i of size L^T

b_i	empty list appended with tasks.
W_1	
W_2	

⚠ order in stack of who got here first in time

P_i : the path of agent i of size L^T

P_i	empty list appended with tasks
W_1	
W_2	

⚠ order based on the location of the task in the assignment.

Let **G_{ik}**, the adjacency matrix of the communication network.

G_{ik}	W_1	W_2
W_1	1	1
W_2	1	1

(we suppose G_{ik} to be constant in time)

$G_{ik} = 1$ if w_i and w_k are connected

Algorithm Trace We assume the agents have a velocity of 1 step a time and that L_T, the maximum number of tasks assigned, is 5.

For a single iteration, the trace includes:

- Agents build their bundles using local information
- Agents exchange information based on their communication network G_i.
- Agents update their task assignement based on the information they received.

1st iteration for each agent.

W_1

$b_1 = < T_1, T_2, T_3, T_4, T_5 >$

$p_1 = < T_1, T_2, T_3, T_4, T_5 >$

$y_1 = < 1, 3, 4, 4, 6 >$

$z_1 = < 1, 1, 1, 1, 1 >$

W_2

$b_2 = < T_3, T_2, T_5, T_1, T_4 >$

$p_2 = < T_3, T_2, T_5, T_1, T_4 >$

$y_2 = < 4, 2, 1, 5, 3 >$

$z_2 = < 2, 2, 2, 2, 2 >$

The Algorithm 3 provides a condition: while $|b_i| < L_T$ i.e. the bundle is not full.

17: calculate marginal score improvement c_{ij} : we assume the score is the manhattan dist

$$c_{ij} = \max_{n < |p_i|} S_i^{p_i \oplus_n \{j\}} - S_i^{p_i}, \forall j \in T \setminus b_i$$

line 8: $c_{ij} > y_{ij}$ initially

$$h_{ij} = \begin{cases} 1 \text{ if } c_{ij} > y_{ij} \\ 0 \text{ else.} \end{cases}$$

Valid tasks.

- based on the score of each task W_1 selects the following tasks:
  T_1, T_2, T_3, T_4, T_5 in order of their score.

- based on the score of each task W_2 selects the following tasks:
  T_3, T_2, T_5, T_1, T_4, in order of their score.

- At the end of this process, for each agent $|b_i| = L_T$ so we stop phase 1.

Communication

W_1	W_2
$y_1 = \langle 1, 3, 4, 4, 6 \rangle$	$y_2 = \langle 4, 2, 1, 5, 3 \rangle$
$s_1 = \{0:0, 1:0\}$	$s_2 = \{0:0, 1:0\}$
$z_1 = \langle 1, 1, 1, 1, 1 \rangle$	$z_2 = \langle 2, 2, 2, 2, 2 \rangle$
$y_2 = \langle 4, 2, 1, 5, 3 \rangle$	$y_1 = \langle 1, 3, 4, 4, 6 \rangle$
$s_2 = \langle 0:0, 1:0 \rangle$	$s_1 = \langle 0:0, 1:0 \rangle$
$z_2 = \langle 2, 2, 2, 2, 2 \rangle$	$z_1 = \langle 1, 1, 1, 1, 1 \rangle$

⚠ According to the rules in the article.

Consensus Phase:

For each task: we apply the ruleset defined in the article involving the sender and the receiver:

T_1:

Action rules for agent i based on comm with agent k on task j

Rule 1: for k in neighbors:

$z_{kj} = z_{2,1} = 2$ # sender W_2

$z_{ij} = z_{1,1} = 1$ # current agent W_1

$y_{kj} = y_{2,1} = 4$

$y_{ij} = y_{1,1} = 1$

$z_{kj} = 2$ and $z_{ij} = i$

$\Leftrightarrow z_{2,1} = 2$ & $z_{1,1} = 1$

→ no update needed, $W_1 \rightarrow T_1$

because $y_{1,1} > y_{2,1}$

T_2:

Rule 1:

W_2: $z_{2,2} = 2$, $y_{2,2} = 2$

W_1: $z_{1,2} = 1$, $y_{1,2} = 3$

from the rule set, $y_{2,2} > y_{1,2}$:

$W_2 \rightarrow T_2$

⋮

The final bundle for each agent should be:

$W_1 = [T_1, T_2, T_4]$

$W_2 = [T_3, T_5]$

That way, all tasks are allocated.