An Algorithm for Searching Optimal Coalition Structure in Cooperative Spectrum Sensing

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Algorithm 1 Scheduling transmission pairs iteratively

Input: a set of user equipments, i.e. $\mathbf{V}$
Initial: $CS \leftarrow \varnothing$ \\schedule set
Sort UEs by its pathloss increasingly.
$\mathbf{V}' = \{[v_1\ v_2 ... v_n] | PL(v_i) \leq PL(v_j) \forall i < j\}$
While $\mathbf{V}'$ is not empty
  $u = \mathbf{V}'.first()$ \\select the first element
  For $r \in \mathbf{V}'$, $r \neq u$
    If $pair(u,\ r)$ is feasible for given constraint
      $\mathbf{M} = pair(u,\ r).getMCS()$ \\feasible MCSs
      For $W_m, m \in \mathbf{M}$
        If $W_m > best$
          $best \leftarrow W_m$
          $r' \leftarrow r$
        End If
      End For
    End For
    If v' exists \\u can form a pair.
      $\mathbf{V}' \leftarrow \mathbf{V}' \backslash \{r', u\}$, $CS \leftarrow CS \bigcup \{r', u\}$
    Else
      $\mathbf{V}' \leftarrow \mathbf{V}' \backslash \{u\}$, $CS \leftarrow CS \bigcup \{u\}$
    End If
  End While
Return $best$, CS

I. ALGORITHM

Algorithm 2 Searching the optimal coalition structure

Input: a set of secondary users, i.e. $\mathbf{V}$
Partition coalition structures to subspaces:
$\mathcal{P}_k = \{\mathcal{S} \in \mathcal{B}_{|\mathbf{V}|} | \text{pivot user set of } \mathcal{S} \text{ is } A^{\mathcal{P}_k}\}$
calculate upper bounds for each subspaces:
$U^{(\mathcal{P}_k)} = \sum_{i \in \mathbf{V}} \max_{\mathcal{G}_k \in \mathcal{L}} U_i(\mathbb{P}^{(i)}_{\text{SHD}}\Big|_{\mathcal{G}_k})$
sort $\mathcal{P}_k$ by the value $U^{(\mathcal{P}_k)}$ and rename subspaces by the corresponding order so that $U^{(\mathcal{P}_1)} \geq U^{(\mathcal{P}_2)} \geq ...$
Set best utility value $U^{(S^\dagger)} = 0$
For subspace $\mathcal{P}_k$, $k = 1, 2, 3, ...,$
  If $U^{(\mathcal{P}_k)} > U^{(S^\dagger)}$
    For each coalition structure $S \in \mathcal{P}_k$
      If $U^{(S)} > U^{(S^\dagger)}$
        Replace the best:$\mathcal{S}^\dagger \leftarrow \mathcal{S}$ and $U^{(\mathcal{S}^\dagger)} \leftarrow U^{(\mathcal{S})}$
      End If
    End For
  End If
End For
Return $\mathcal{S}^* \leftarrow \mathcal{S}^\dagger$