
Algorithm 1 UCB-DE

Input: $\theta_1(\lambda), \theta_2(\lambda), \theta_3(\lambda)$

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1: for  $t = 1, 2, 3$  do
2:    $I(t) \leftarrow t$ 
3:    $n_{I(t)} \leftarrow 1$ 
4:    $\hat{\theta}_{I(t)} \leftarrow r_{I(t)}$ 
5: end for
6: for  $t = 4 \rightarrow N$  do
7:    $I^{opt} = \arg \max_{i \in \{1, 2, 3\}} n_i$ 
8:    $\Lambda = \left\{ \lambda : |\theta_{I^{opt}}(\lambda) - \hat{\theta}(I^{opt})| \leq \sqrt{\frac{2 \ln(t)}{n_{I^{opt}}}} \right\}$ 
9:    $\mathcal{C} = \left\{ j : \theta_j(\lambda) = \max_{i \in \{1, 2, 3\}} \theta_i(\lambda) \text{ for some } \lambda \in (0, 1) \right\}$ 
10:   $I(t) \leftarrow \arg \max_{i \in \mathcal{C}} \left( \hat{\theta}_i + c \sqrt{\frac{2 \ln(t)}{n_i}} \right)$ 
11:   $n_{I(t)} \leftarrow n_{I(t)} + 1$ 
12:   $\hat{\theta}_{I(t)} \leftarrow \hat{\theta}_{I(t)} + \frac{r_{I(t)} - \hat{\theta}_{I(t)}}{n_{I(t)}}$ 
13: end for
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Algorithm 2 UCB-LB

Initialize: Sort arms in ascending order of cost.

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1:  $W_1 = W$ 
2: for  $t = 1, 2, 3$  do
3:    $I(t) \leftarrow t$ 
4:    $n_{I(t)} \leftarrow 1$ 
5:    $\hat{\theta}_{I(t)} \leftarrow r_{I(t)}$ 
6:    $W_{t+1} = W_t - c_{I(t)}$ 
7: end for
8: for  $t = 4 \rightarrow N$  do
9:    $\mathcal{S} = \left\{ i : c_i \leq W_t, i \in \{1, 2, 3\} \right\}$ 
10:  if  $\mathcal{S} = \emptyset$  then
11:    Terminate the algorithm
12:  end if
13:   $I(t) \leftarrow \arg \max_{i \in \mathcal{S}} \left( \frac{\hat{\theta}_i + C \sqrt{\frac{2 \ln(t)}{n_i}}}{c_i} \right)$ 
14:   $n_{I(t)} \leftarrow n_{I(t)} + 1$ 
15:   $\hat{\theta}_{I(t)} \leftarrow \hat{\theta}_{I(t)} + \frac{r_{I(t)} - \hat{\theta}_{I(t)}}{n_{I(t)}}$ 
16:   $W_{t+1} = W_t - c_{I(t)}$ 
17: end for
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