Table 1: Linear Algorithm

Algorithm 1 Linear Algorithm for RWOC

Input:
$\mathbf{y} : n \times 1, X_1 : n \times p, X_2 : n \times q$,
learning rate lr, number of iterations k, number of IPOT iterations l, number of IPOT inner iterations m, a parameter in IPOT β
initialize: $w_1^{(1)}, w_2^{(1)}$
$\mathbf{b} \leftarrow \frac{1}{n}\mathbf{1}_n$
$S^{(1)} \leftarrow \mathbf{1}\mathbf{1}^T$
for $t = 1$ **to** k **do**
  $Y_1 \leftarrow \mathbf{y} - X_1 w_1^{(t)}$
  $Y_2 \leftarrow X_2 w_2^{(t)}$
  $C_{ij} \leftarrow (Y_1[i] - Y_2[j])^2$
  $G_{ij} \leftarrow e^{-\frac{C_{ij}}{\beta}}$
  for $h = 1$ **to** l **do**
    $Q \leftarrow G \odot S^{(h)}$
    for $f = 1$ **to** m **do**
      $\mathbf{a} \leftarrow \frac{\mathbf{1}_n}{Q\mathbf{b}}, \mathbf{b} \leftarrow \frac{\mathbf{1}_n}{Q^T\mathbf{a}}$
    end for
    $S^{(h+1)} \leftarrow diag(\mathbf{a})Qdiag(\mathbf{b})$
  end for
  $Loss \leftarrow \sum_{i,j} S_{ij}C_{ij}$
  $w_1^{(t+1)} \leftarrow w_1^{(t)} - lr \cdot \frac{\partial Loss}{\partial w_1}\Big|_{w_1 = w_1^{(t)}}$
  $w_2^{(t+1)} \leftarrow w_2^{(t)} - lr \cdot \frac{\partial Loss}{\partial w_2}\Big|_{w_2 = w_2^{(t)}}$
end for