Algorithm 1: component matrices computing

Input: $\mathcal{X} \in \mathbb{R}^{l_1 \times l_2 \times \cdots \times l_N}, \varepsilon, \lambda, \delta, R$

Output: $A^{(j)}s$ for $j = 1$ to N

Initialize all $A^{(j)}s$ //which can be seen as the 0^{th} round iterations;

$l'' = L$ //if we need to judge whether (11) is true then l'' denotes $L|_{t-1}$;

for *each* $A_{i_j r}^{<!----->j} (1 \leq j \leq N, 1 \leq i_j \leq I_j, 1 \leq r \leq R)$ **do**

  //1^{st} round iterations;

  $g_{i_j r}^{(j)'} = g_{i_j r}^{(j)}$;

  $A_{i_j r}^{(j)'} = A_{i_j r}^{(j)}$//if the rollback shown as (12) is needed,$A_{i_j r}^{(j)'}$ denotes $A_{i_j r}^{(j)}|_{t-1}$;

  $A_{i_j r}^{(j)} = A_{i_j r}^{(j)} - <!----> \mathbf{sign}\left(g_{i_j r}^{(j)}\right) \cdot \delta_{i_j r}^{(j)}$;

repeat//other rounds of iterations for computing component matrices

  $l' = L$ //if we need to judge whether (11) is true then l' denotes $L|_t$;

  for *each* $A_{i_j r}^{<!----->j} (1 \leq j \leq N, 1 \leq i_j \leq I_j, 1 \leq r \leq R)$ **do**

    if $g_{i_j r}^{(j)} \cdot g_{i_j r}^{(j)'} > 0$ **then**

      $A_{i_j r}^{(j)'} = A_{i_j r}^{(j)}$;

      $g_{i_j r}^{(j)'} = g_{i_j r}^{(j)}$;

      $\delta_{i_j r}^{(j)} = \mathbf{min}\left(\delta_{i_j r}^{(j)} \cdot \eta^{+}, Max\_Step\_Size\right)$;

      $A_{i_j r}^{(j)} = A_{i_j r}^{(j)} - <!----> \mathbf{sign}\left(g_{i_j r}^{(j)}\right) \cdot \delta_{i_j r}^{(j)}$;

    else if $g_{i_j r}^{(j)} \cdot g_{i_j r}^{(j)'} < 0$ **then**

      if $l' > l''$ **then**

        $g_{i_j r}^{(j)'} = g_{i_j r}^{(j)}$;

        $A_{i_j r}^{(j)} = A_{i_j r}^{(j)'}$// if (11) is true then rollback as (12);

        $\delta_{i_j r}^{(j)} = \mathbf{max}\left(\delta_{i_j r}^{(j)} \times \eta^{-}, Min\_Step\_Size\right)$;

      else

        $A_{i_j r}^{(j)'} = A_{i_j r}^{(j)}$;

        $g_{i_j r}^{(j)'} = g_{i_j r}^{(j)}$;

        $\delta_{i_j r}^{(j)} = \mathbf{max}\left(\delta_{i_j r}^{(j)} \cdot \eta^{-}, Min\_Step\_Size\right)$;

        $A_{i_j r}^{(j)} = A_{i_j r}^{(j)} - <!----> \mathbf{sign}\left(g_{i_j r}^{(j)}\right) \cdot \delta_{i_j r}^{(j)}$;

    else

      $A_{i_j r}^{(j)'} = A_{i_j r}^{(j)}$;

      $g_{i_j r}^{(j)'} = g_{i_j r}^{(j)}$;

      $A_{i_j r}^{(j)} = A_{i_j r}^{(j)} - <!----> \mathbf{sign}\left(g_{i_j r}^{(j)}\right) \cdot \delta_{i_j r}^{(j)}$;

  $l'' = l'$;

until $\boldsymbol{L \leq \varepsilon}$ *or maximum iterations exhausted*;