**fileS2 Optimization Procedure of TCLS and LRTC**

**Tensor Completion with Laplacian Smoothing (TCLS) model**

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Using the parameter separating trick, the original problem can be transformed into



and it equals to solve the following subproblem



The augmented Lagrangian function is defined as

 where 

Thus,



**Update**: The optimal in current iteration can be obtained by solving the following minimization problem

Setting its derivate to be 0, then we got the optimal.



**Update *Y*(*v*)**: The optimal ***Y*(*v*)** in current iteration can be obtained by solving the following minimization problem



Setting the minimization objection to be 0, then we got the optimal ***Y***(***v***).



**Update *S*(*v*)** : The optimal solution of Lagrange multiplier ***S*(*v*)** can be obtained by the following equation.



**Low-Rank Tensor Completion (LRTC) model**

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Using the parameter separating trick, the original problem can be transformed into



The augmented Lagrangian function is defined as

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where 

that is,



**Update** : The optimalin current iteration can be obtained by solving the following minimization problem



since 



which can be solved by HOOI algorithm



**Update :** The optimal **:** in current iteration can be obtained by solving the following minimization problem



According to the inner product of tensor in the preliminary, it can be separated into four independent minimization problems, and the *v*-th minimization subproblem is



Setting the derivate to be 0, then we got the optimal ***W***(v): 