

# sensitivity and convergence

## I. CONVERGENCE

It is theoretically guaranteed that our algorithm converges to a local minimum. We also conduct experiments to verify that the algorithm is convergent or not. As shown in Fig. 1, the objective value curves are plotted in red on BBCSport, HW and ORL. The experimental results prove that our proposed algorithm can decrease monotonically and the iterations less than 150 usually. Thus it experimentally proves the convergence of our algorithm.

## II. VISUALIZATION

We visualize the clustering results of our algorithm in Fig. 2. In these figures, we represent the samples of the same class as a color. The points of the same color become closer and the points of different colors become further, the better the clustering performance is. It can be seen from Fig. 2 that the differences between intra-class structure and inter-class are becoming more and more obvious with the increase of the number of iteration on datasets BBCSports.

## III. PARAMETER SENSITIVITY

There are two sets of parameters in our proposed method, i.e., the balance coefficient  $\beta$  and the size of layer  $p$ . Next we will analyze the sensitivity of  $l_1$  and  $l_2$  in  $p_3$ . The Fig. 3 shows the sensitivity experimental results of  $l_1$  and  $l_2$  in  $p_3$  on ORL, 3Source and CiteSeer. Despite slight variation, we observe that it is relatively stable in most parameter combinations from these figures.

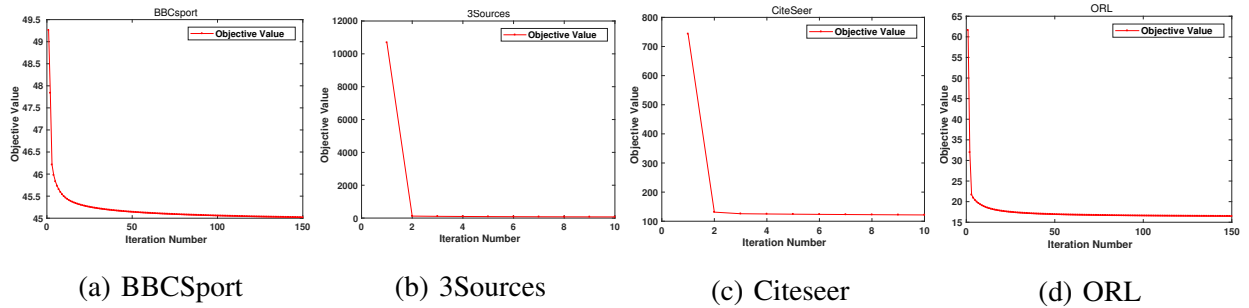


Fig. 1: The convergence of the proposed method on BBCSport, 3Sources, Citeseer and ORL.

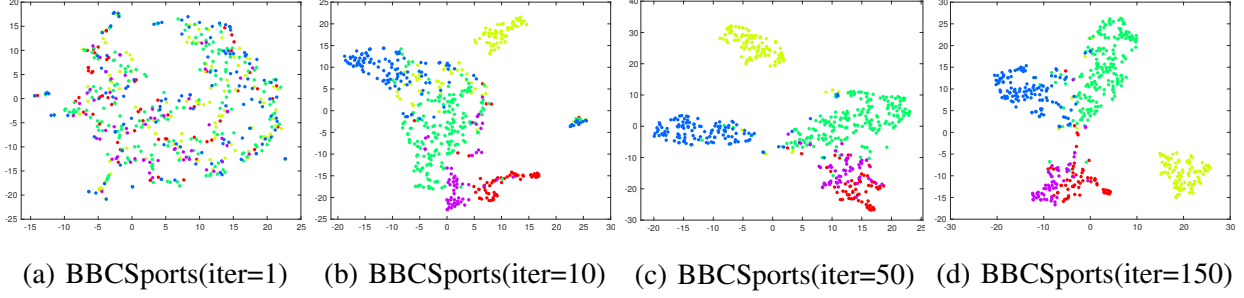


Fig. 2: The proposed algorithm use t-SNE on BBCSports when iterations are 1, 10, 50 and 150, The different colors indicate different classes for each dataset.

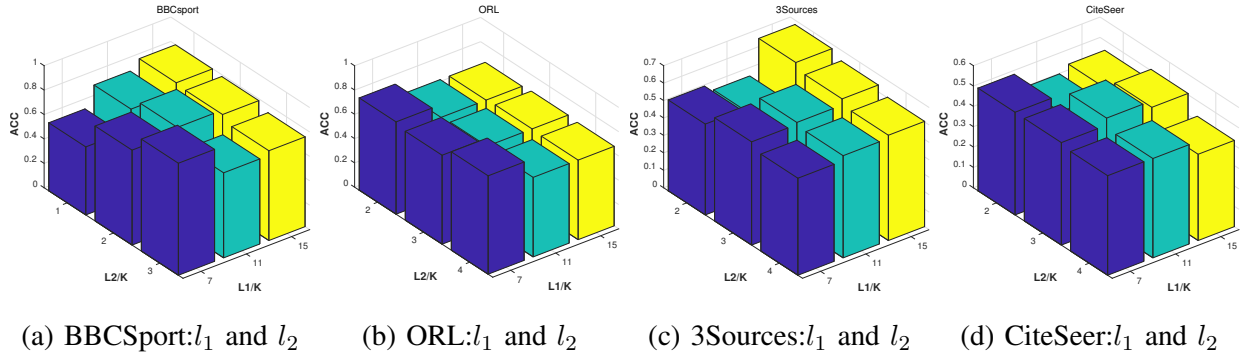


Fig. 3: The sensitivity of the proposed method with the variation of  $l_1$  and  $l_2$  in  $p_3$  on BBCsport, ORL, 3Sources and CiteSeers.