Similarity-based Multi-Dimensional Multi-Label Classification

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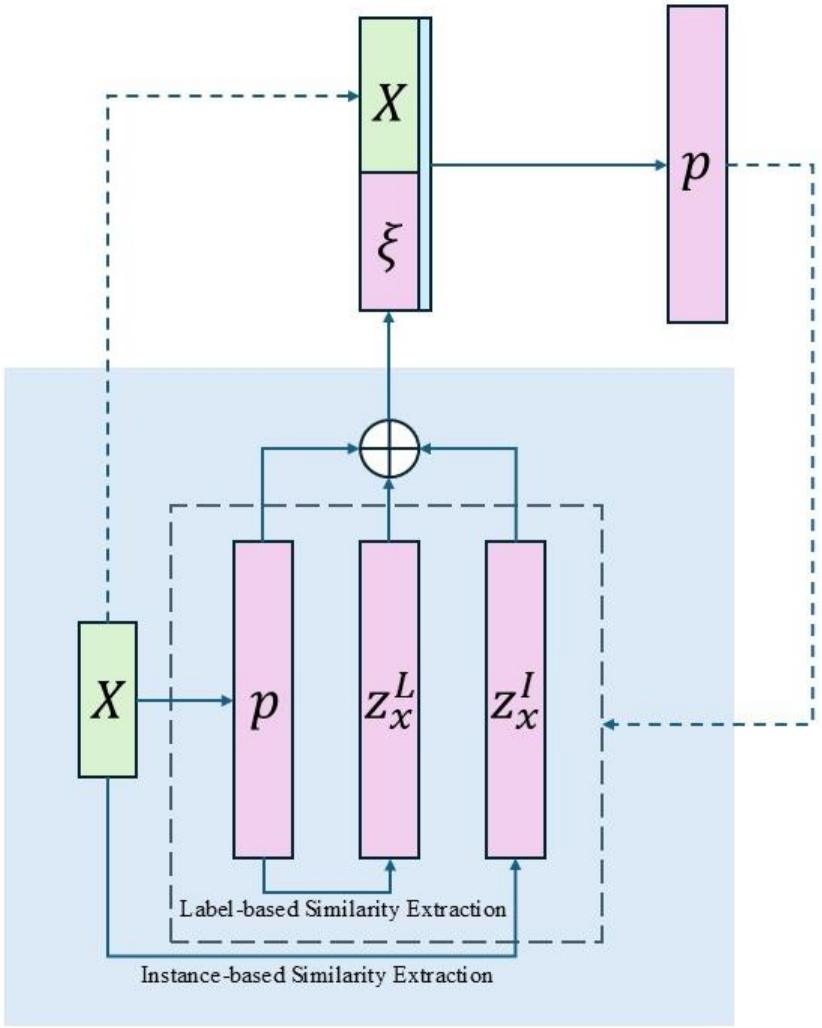
Problems & Ideas



Main structure of SIDLE. Similarity extraction parts mentioned in the structure applied *k* nearest neighbor strategy.

- Problems of Multi-dimensional Multi-label Classification
  - A new framework with both multi-dimensional and multi-label nature.
  - How to assemble the correlations between labels within label spaces and among different dimensions.
- Ideas: Applying the similarity information from label-based and instance-based aspects as feature augmentation.

Main Contributions

- SIDLE outperforms five baseline approaches in five metrics on five benchmark datasets.
- Contributions:
  - A novel application utilizes both instance-based and label-based similarity information.
  - It can help induce better similarity-based predictive models by simultaneously leveraging instance-based and label-based similarity information.
  - Another effective strategy to leverage label-based similarity information is introduced.

Dataset	SIDLE	CLIM	MLKNN	BR	CC	WRAP
			(↓) Hamming loss			
Song-v1	**0.174±0.007**$_1$	0.176±0.007$_2$	0.179±0.007$_3$	0.190±0.014$_6$	0.187±0.013$_4$	0.189±0.006$_5$
Song-v2	**0.126±0.006**$_1$	**0.126±0.006**$_1$	0.129±0.007$_3$	0.204±0.007$_5$	0.204±0.008$_5$	0.158±0.008$_4$
Yeast-v1	**0.403±0.005**$_1$	0.406±0.007$_2$	0.407±0.006$_3$	0.408±0.008$_4$	0.411±0.005$_5$	0.422±0.005$_6$
Yeast-v2	0.271±0.005$_2$	0.271±0.004$_2$	**0.270±0.004**$_1$	0.482±0.011$_5$	0.486±0.010$_6$	0.288±0.004$_4$
Flickr	**0.133±0.003**$_1$	0.137±0.003$_2$	0.138±0.005$_3$	0.236±0.006$_5$	0.235±0.008$_6$	0.177±0.004$_4$
			(↓) Ranking loss			
Song-v1	**0.133±0.009**$_1$	0.138±0.008$_2$	0.138±0.008$_2$	0.207±0.025$_6$	0.200±0.019$_5$	0.157±0.011$_4$
Song-v2	**0.111±0.009**$_1$	0.117±0.010$_2$	0.117±0.011$_2$	0.500±0.065$_5$	0.502±0.060$_6$	0.126±0.011$_4$
Yeast-v1	**0.368±0.009**$_1$	0.372±0.009$_2$	0.373±0.007$_3$	0.378±0.011$_4$	0.382±0.009$_5$	0.389±0.008$_6$
Yeast-v2	**0.336±0.006**$_1$	0.345±0.006$_3$	0.342±0.008$_2$	0.560±0.009$_5$	0.560±0.009$_5$	0.351±0.006$_4$
Flickr	**0.100±0.003**$_1$	0.109±0.002$_2$	0.110±0.012$_3$	0.479±0.042$_5$	0.481±0.055$_6$	0.117±0.009$_4$
			(↓) Coverage			
Song-v1	**0.457±0.011**$_1$	0.468±0.011$_3$	0.464±0.013$_2$	0.523±0.021$_6$	0.515±0.015$_5$	0.497±0.014$_4$
Song-v2	**0.230±0.017**$_1$	0.237±0.019$_2$	0.239±0.018$_3$	0.532±0.054$_5$	0.534±0.048$_6$	0.244±0.017$_4$
Yeast-v1	**0.715±0.005**$_1$	0.717±0.005$_2$	0.718±0.003$_3$	0.718±0.006$_3$	0.721±0.005$_5$	0.732±0.004$_6$
Yeast-v2	**0.480±0.007**$_1$	0.490±0.006$_3$	0.487±0.008$_2$	0.644±0.008$_5$	0.644±0.007$_5$	0.490±0.006$_3$
Flickr	**0.244±0.003**$_1$	0.254±0.002$_2$	0.259±0.014$_3$	0.567±0.055$_5$	0.567±0.044$_5$	0.266±0.003$_4$
			(↓) One error			
Song-v1	**0.084±0.019**$_1$	0.087±0.016$_2$	0.093±0.018$_3$	0.284±0.101$_6$	0.282±0.085$_5$	0.101±0.018$_4$
Song-v2	**0.256±0.018**$_1$	**0.256±0.015**$_1$	0.261±0.021$_3$	0.986±0.008$_5$	0.986±0.006$_5$	0.288±0.020$_4$
Yeast-v1	**0.318±0.017**$_1$	0.321±0.013$_2$	0.327±0.015$_4$	0.335±0.018$_5$	0.344±0.017$_6$	0.323±0.014$_3$
Yeast-v2	**0.552±0.012**$_1$	0.562±0.016$_3$	0.555±0.016$_2$	0.826±0.010$_6$	0.825±0.011$_5$	0.564±0.017$_4$
Flickr	**0.120±0.006**$_1$	0.134±0.002$_2$	0.135±0.008$_3$	0.244±0.017$_5$	0.247±0.011$_6$	0.141±0.006$_4$
			(↑) Average precision			
Song-v1	**0.841±0.009**$_1$	0.834±0.011$_2$	0.832±0.008$_3$	0.721±0.037$_6$	0.730±0.026$_5$	0.813±0.012$_4$
Song-v2	**0.782±0.012**$_1$	0.778±0.009$_2$	0.775±0.012$_3$	0.251±0.026$_5$	0.249±0.026$_6$	0.751±0.015$_4$
Yeast-v1	**0.711±0.005**$_1$	0.709±0.006$_2$	0.707±0.005$_3$	0.703±0.007$_4$	0.700±0.006$_5$	0.698±0.006$_6$
Yeast-v2	**0.577±0.008**$_1$	0.561±0.010$_4$	0.574±0.010$_2$	0.383±0.007$_5$	0.383±0.007$_5$	0.565±0.010$_3$
Flickr	**0.891±0.003**$_1$	0.882±0.002$_2$	0.879±0.004$_3$	0.875±0.007$_4$	0.875±0.012$_4$	0.870±0.012$_6$

Results for SIDLE and other comparable approaches. Subscripts shows the ranking, and boldface means the best performance.