Multi-AL: Robust Active learning for Multi-label Classifier

On wrong label noise

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Research Question | How could one benefit from active learning to identify informative examples to relabel by the expert?

1. Background

Data acquisition for multi-label purposes is **expensive** and data is often corrupted[1]

Active Learning identifies possibly **mislabelled** instances and identifies the most **informative** instances to train a high-accuracy classifier, with as little queries as possible.

ASL[3] is a **current state-of-the-art multi-label classifier** build using a Deep Neural Network (DNN) Architecture.

2. Method

Multi-AL consists of two measures; **mislabelling measure** and an **informativeness measure** and uses ASL[3] as base classifier

1. **Mislabelling measure:** Calculate mislabelling likelihood using conflicting label pairings and output probability of the neural network.
2. **Safe mode:** A portion of instances with a sufficiently low mislabelling value are used **without querying the expert**
3. **Informative measure:** Identify informative instances to relabel on either:
   a. The **amount of conflicting information** present in features (CBIM) from [2] but now **multi-label** and using a **DNN** as classifier, (used as baseline)
   b. The classifier's uncertainty (Entropy).

Both identified **safe instances** and already **relabelled instances** are used during the training phase.

Figure 1: Multi-Label Data with Wrong Labels

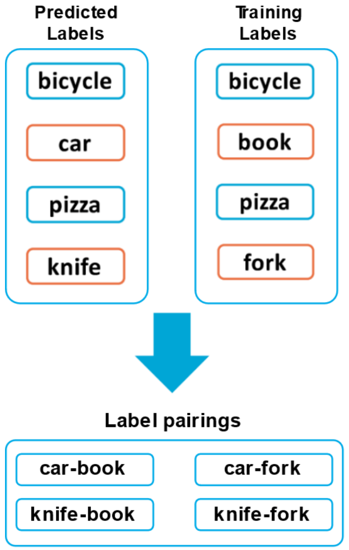

Figure 2: Construction of conflicting label pairings

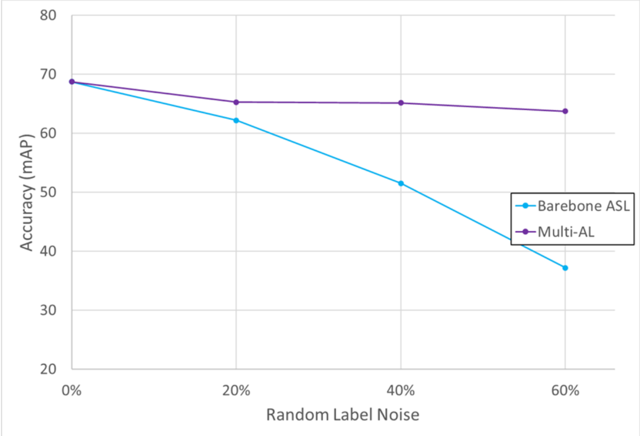

Figure 3: Accuracy barebone ASL compared to Multi-AL for different noise levels

3. Evaluation

How well does **Multi-AL** compare to current state-of-the-art classifier **ASL** and other sampling approaches?

Instances are sampled from subset of **MS COCO**[1] consisting of 23k instances total.

100 instances used to train initial classifier

Query 50 instances each iteration

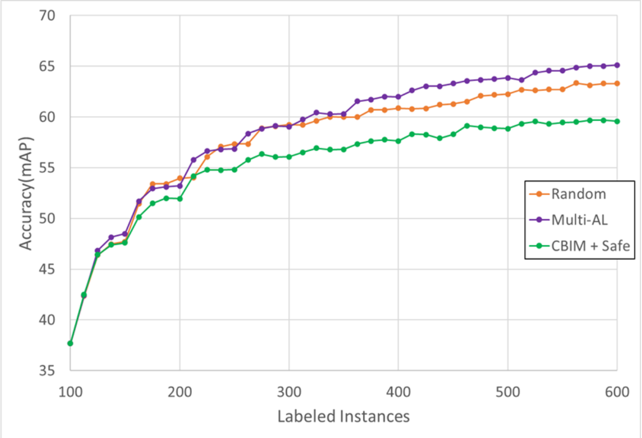

Figure 4: Validation Accuracy according to number of queried instances for 40 % random label noise

4. Conclusion

Safe mode increases the accuracy significantly when applied to 20 and 40% noise for any sampling method

Multi-AL outperforms default **ASL** for all levels of noise on average by 28% even though **only a fraction of the instances** are used during training

References

[1] T.-Y. Lin et al. Microsoft coco: Common objects in context, 2015.
[2] M.-R. Bouguelia et al. Stream-based active learning in the presence of label noise, ICPRAM, pp. 25-34, 2015
[3] E. Ben-Baruch, Asymmetric loss for multi-label classification, 2020