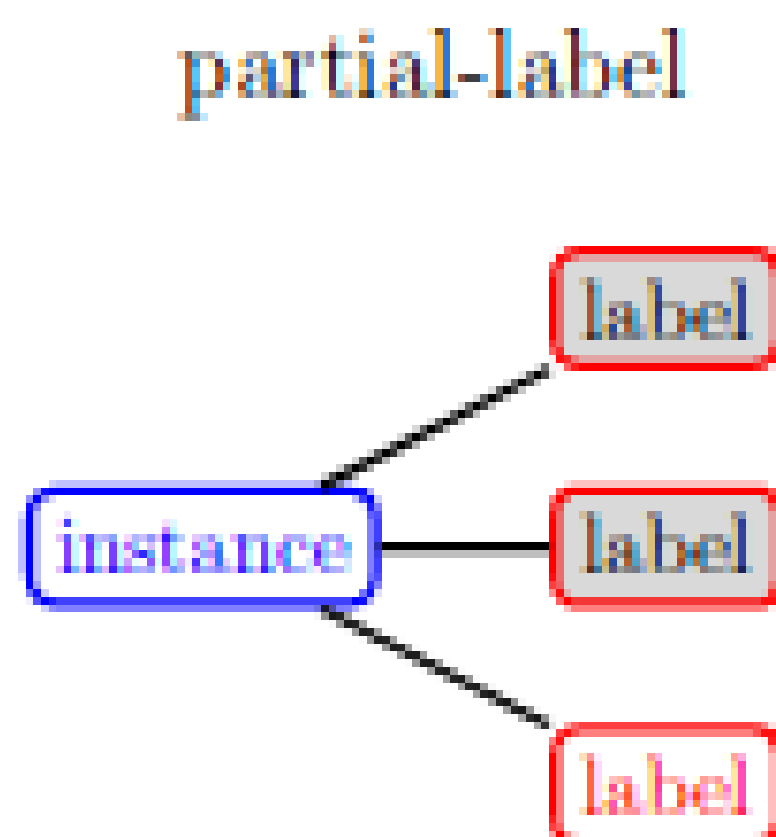




Exact Passive-Aggressive Algorithms for Multiclass Classification using Partial Labels

Problem Statement

- Let's say we want to classify an instance from K classes.
- Generally, we assume that we know the true label for every instance.
- But in many applications, we don't have access to the true class label. Instead we get a set of labels (candidate set) which contains true/actual label.
- We propose an online algorithm called PAPL which using SCA solves the problem of online multiclass classification using candidate set as feedback.
- We also give PAPL-I and PAPL-II which are the 2 variants of the PAPL algorithm, for multiclass classification using partially labelled data.



Application

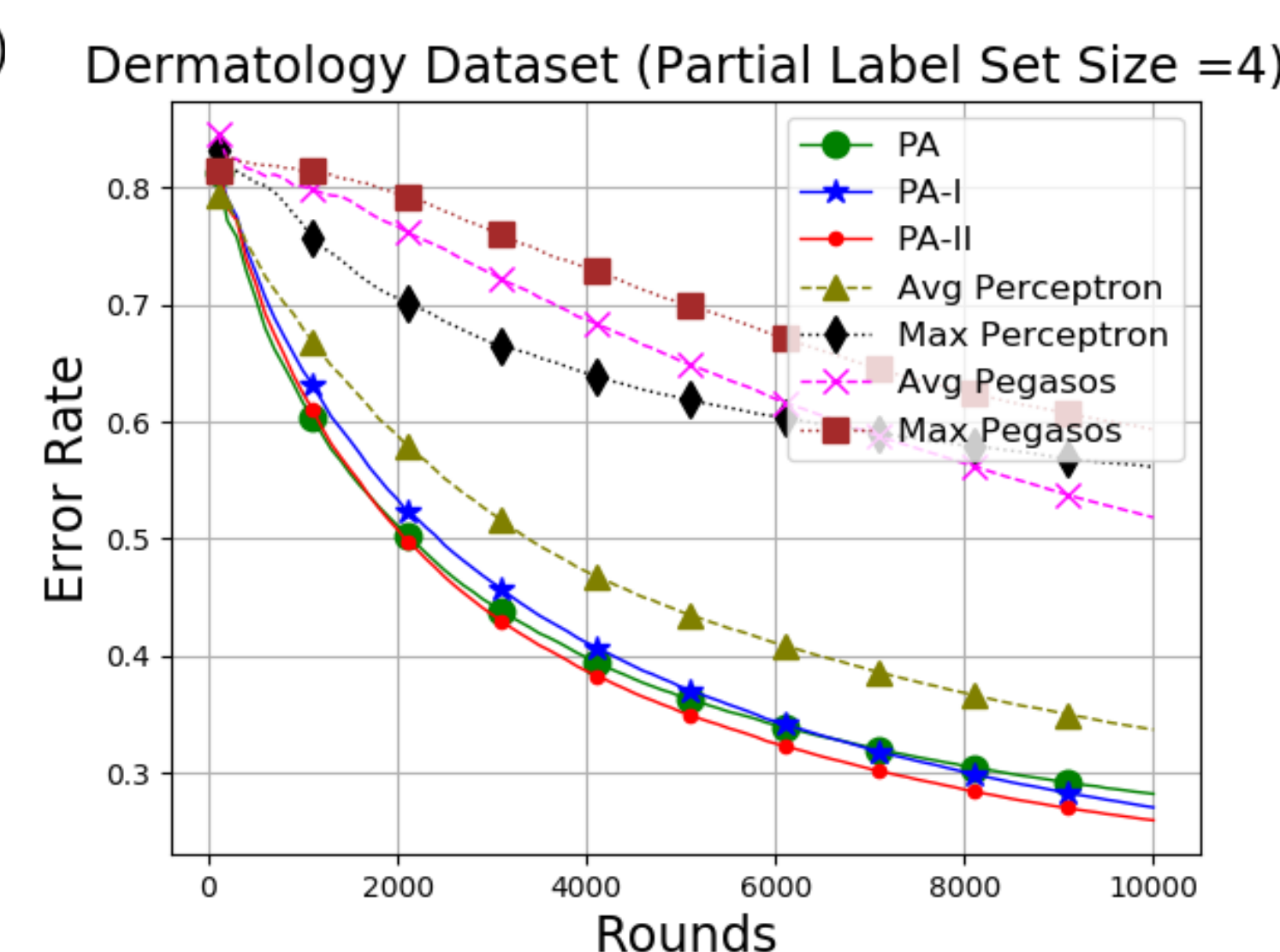
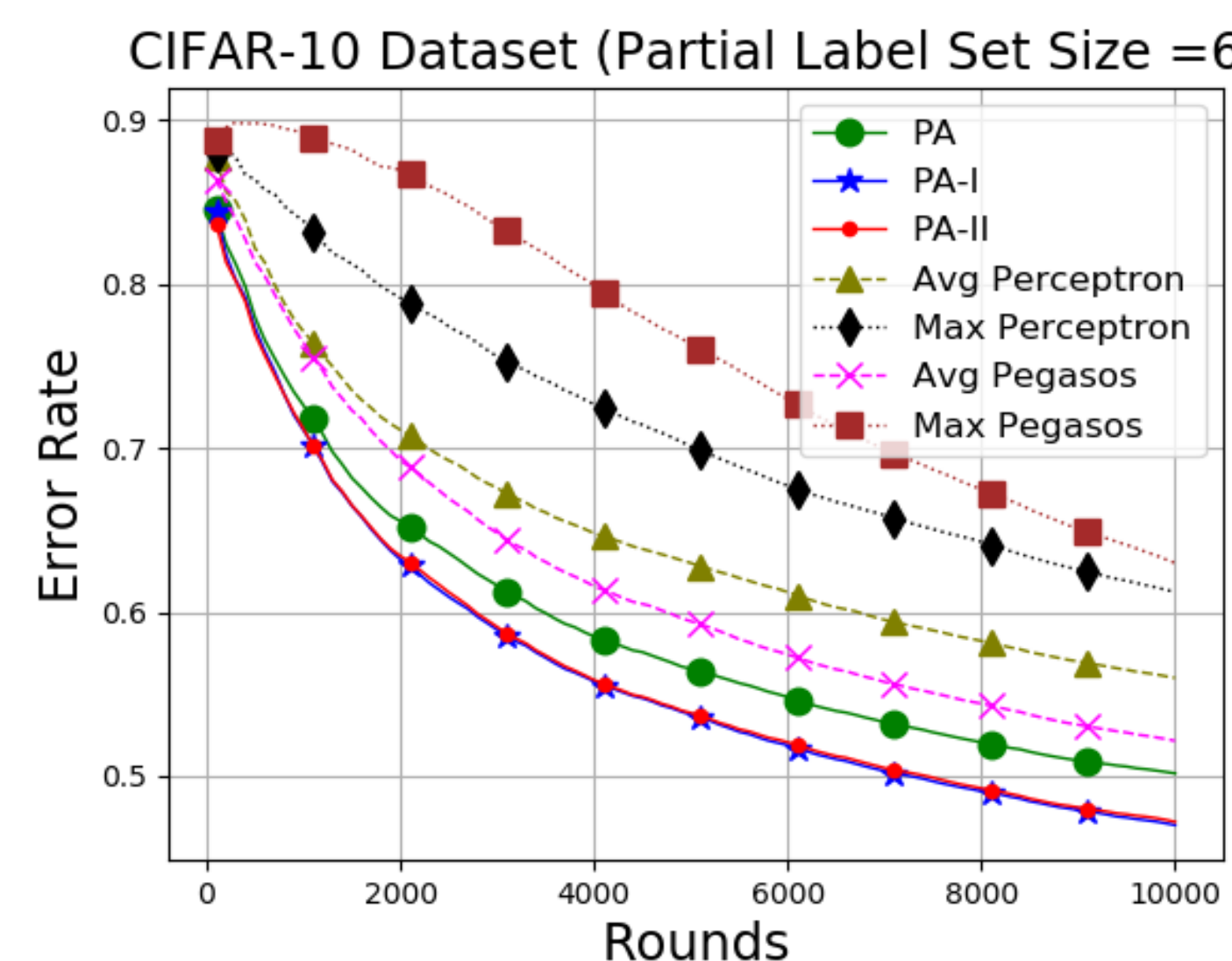
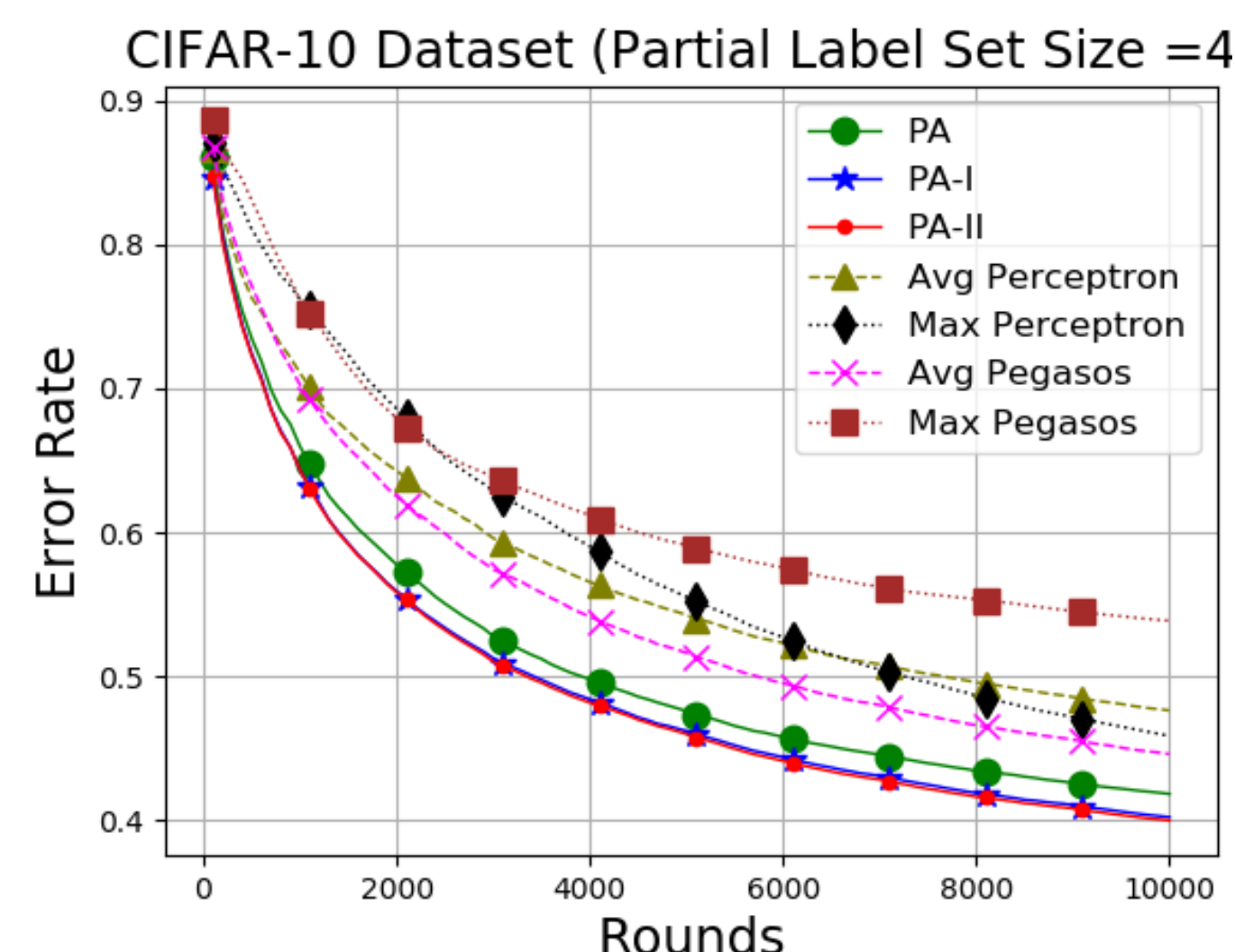


Results

Support Class Algorithm

Algorithm 2 Support Class Algorithm (SCA)

Initialize: $S^t := \phi$
 Sort $I_r^t, r \in \bar{Y}^t$, in descending order. Let $\sigma(1), \dots, \sigma(|\bar{Y}^t|)$ be the sorted order.
 for $k = 1$ to $|\bar{Y}^t|$ do
 if PA then
 if $\sum_{j=1}^{k-1} I_{\sigma(j)}^t < (|Y^t| + (|S^t|)) I_{\sigma(k)}^t$ then
 $S^t = S^t \cup \sigma(j)$
 end if
 else if PA-I then
 if $\frac{\sum_{j \leq k-1} I_{\sigma(j)}^t - (k-1)I_{\sigma(k)}^t}{\|x^t\|^2} < \min\left(C, \frac{\sum_{j=1}^{k-1} I_{\sigma(j)}^t}{\|x^t\|^2 \left(1 + \frac{k-1}{|Y^t|}\right)}\right)$ then
 $S^t = S^t \cup \sigma(j)$
 end if
 else if PA-II then
 if $\sum_{j \leq k-1} I_{\sigma(j)}^t < \frac{\frac{(k-1)}{2C} + \|x^t\|^2 \left(\frac{1}{|Y^t|} (k-1) + 1\right)}{\frac{1}{2C} + \frac{1}{|Y^t|} \|x^t\|^2} I_{\sigma(k)}^t$ then
 $S^t = S^t \cup \sigma(j)$
 end if
 end if
 end for



Our algorithms achieve sublinear regret of $O(\sqrt{T})$

References

Maanik Arora, Naresh Manwani, Exact Passive-Aggressive Algorithms for Multiclass Classification using Partial Labels. CODS-COMAD 2021

Rajarshi Bhattacharjee, Naresh Manwani, Online Algorithms for Multiclass classification using Partial Labels. PAKDD 2020

