

Pareto Optimal Streaming Unsupervised Ensemble Learning

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Streaming Unsupervised Ensemble Learning

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Agents: Neural Networks and Humans

- Deterministic Labeling
- Unknown Confusion matrices

Tasks: Stream of unlabeled images for labeling

Resource Allocation and Label Aggregation:

1. Each image is sequentially routed to subset of agents
2. Collected labels are continually aggregated

Routing: Online routing based on **ALL** the collected labels

Exit: Image exits with a final label only if
'accuracy is high' or 'all labels are collected'

Online Learning: Explore-exploit learning of confusion matrices

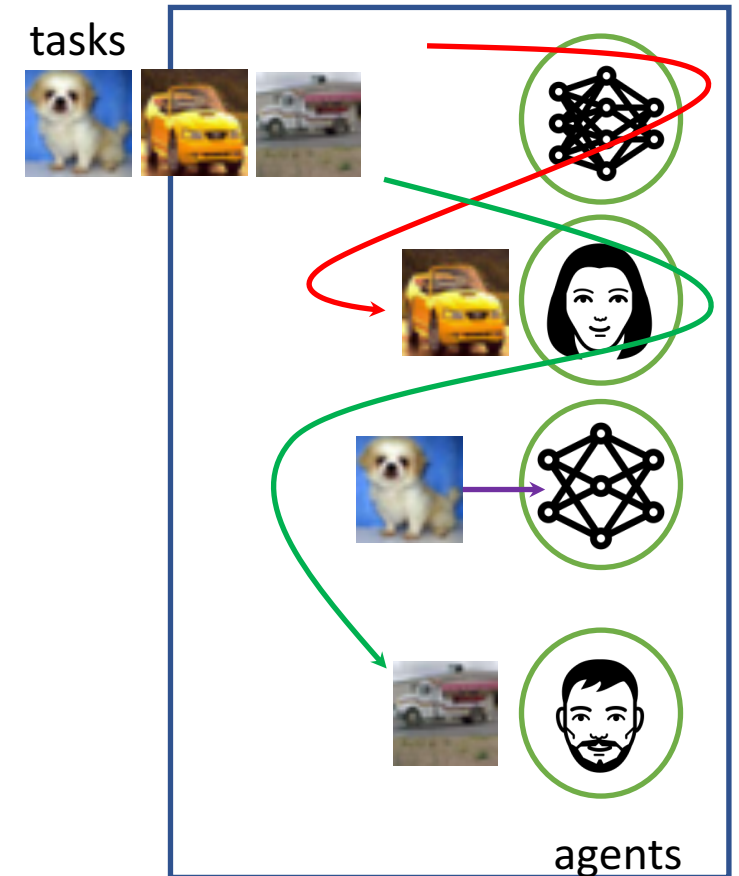


Image credits: CIFAR-10, A. Krizhevsky, 2009; thenounproject.com, (NNs - K. M. Synstad; Faces - A. Selimov)

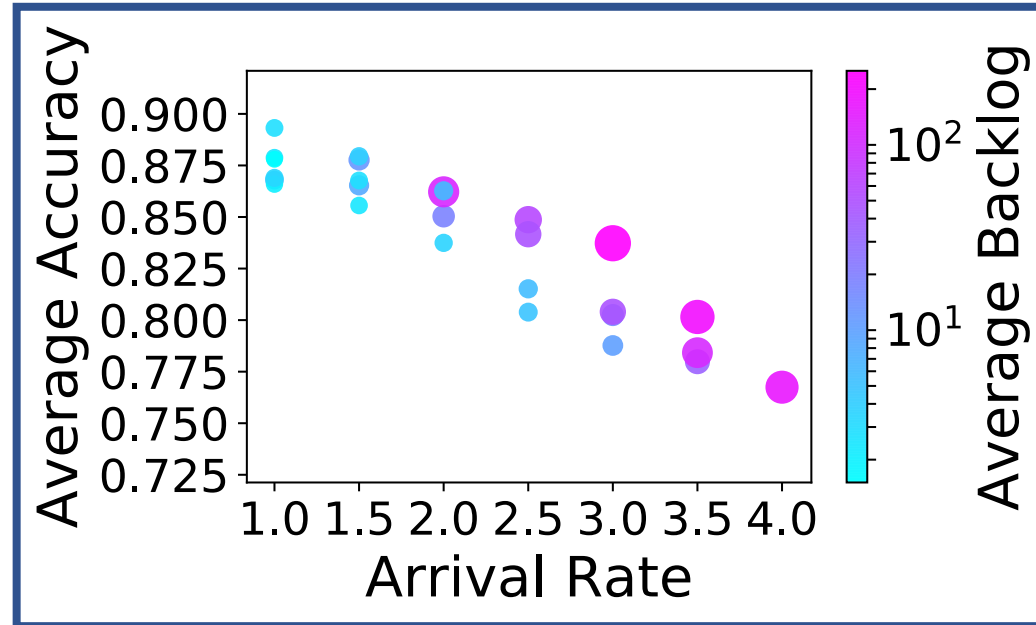
Pareto Optimality

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Accuracy vs Rate Tradeoff

Low arrival rate
= Large number of agents per image
= High Accuracy

High arrival rate
= Small number of agents per image
= Low accuracy



Dataset:
Grouped Cifar-10
Ensemble:
Three AlexNet
One VGG-19
Two ResNet18

Contributions

- Queue-based architecture for dynamic routing
- Online tensor decomposition for learning confusion matrices
- Provably supports any point in the Pareto region