

Sample Efficient Learning of Predictors that Complement Human

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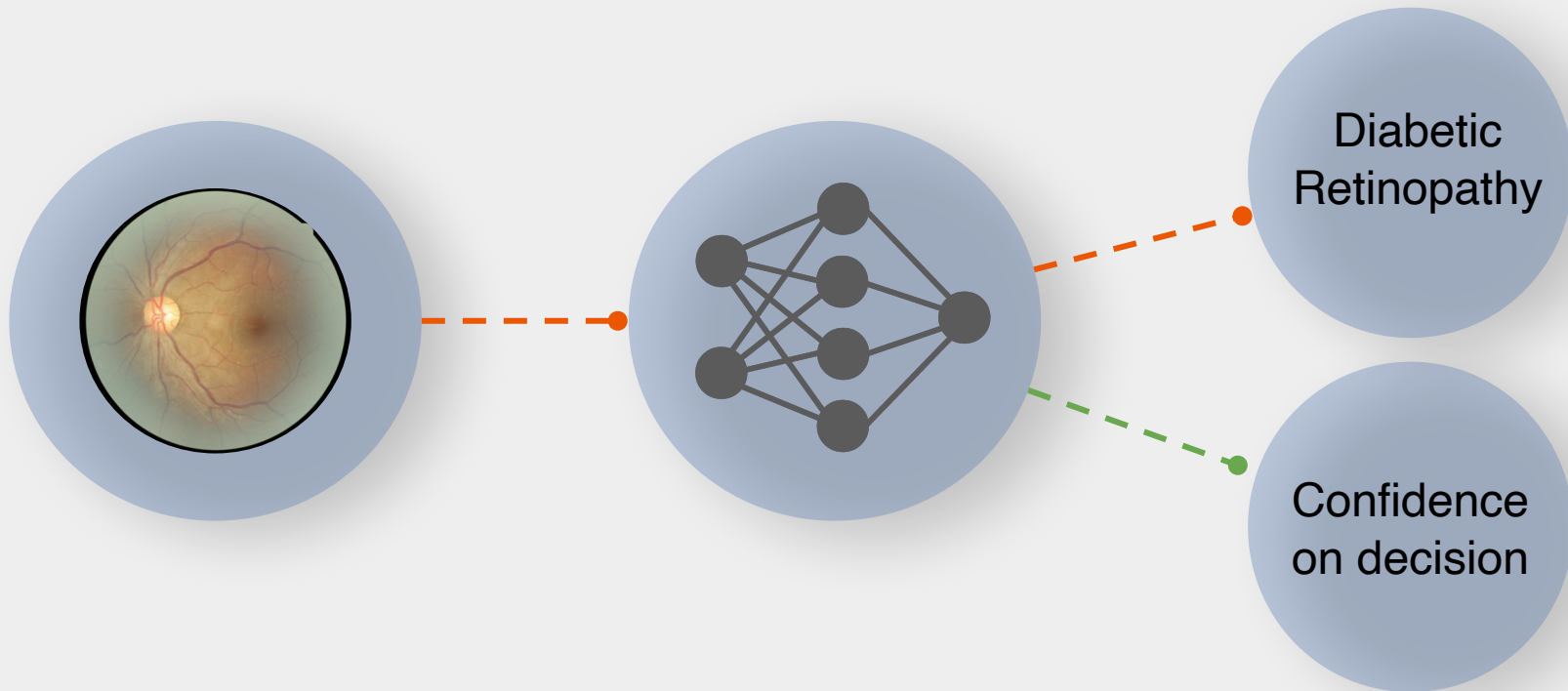


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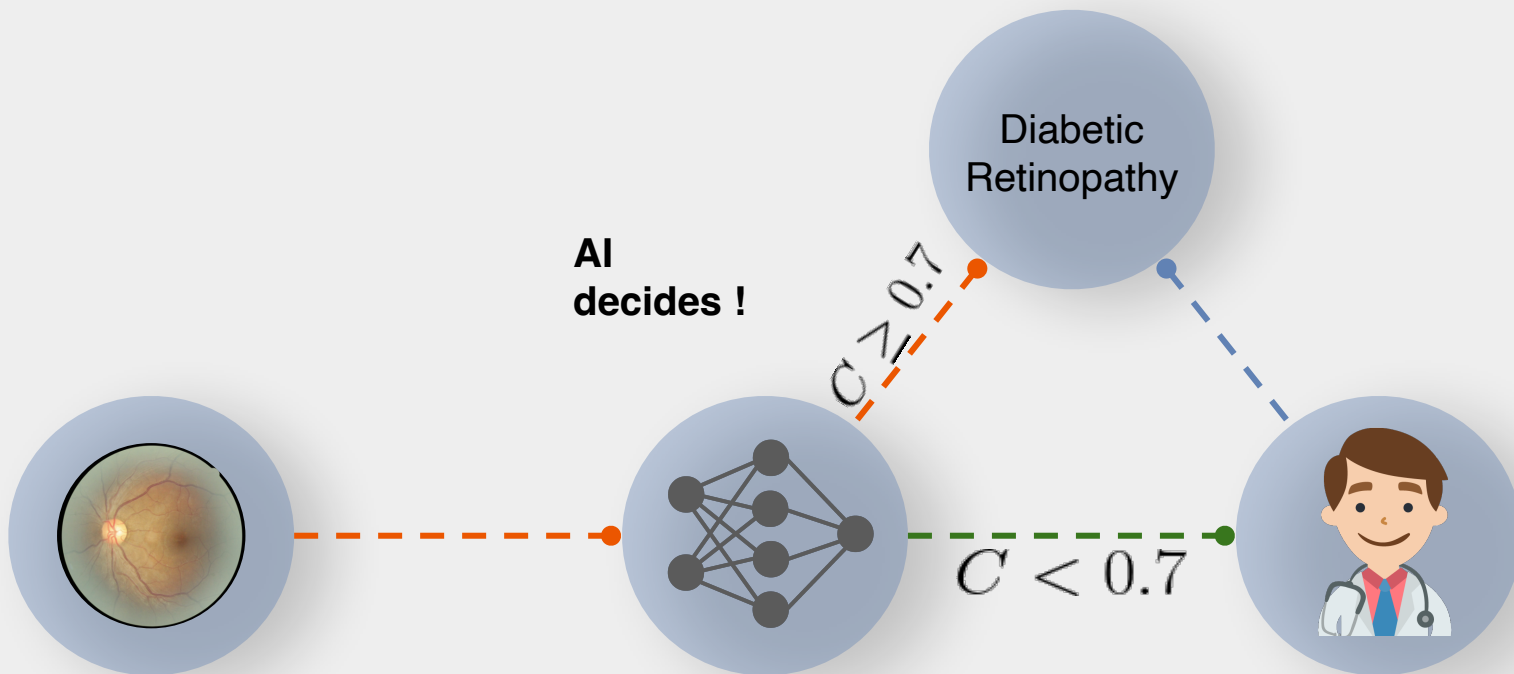
Deferral Setting: a staged learning approach



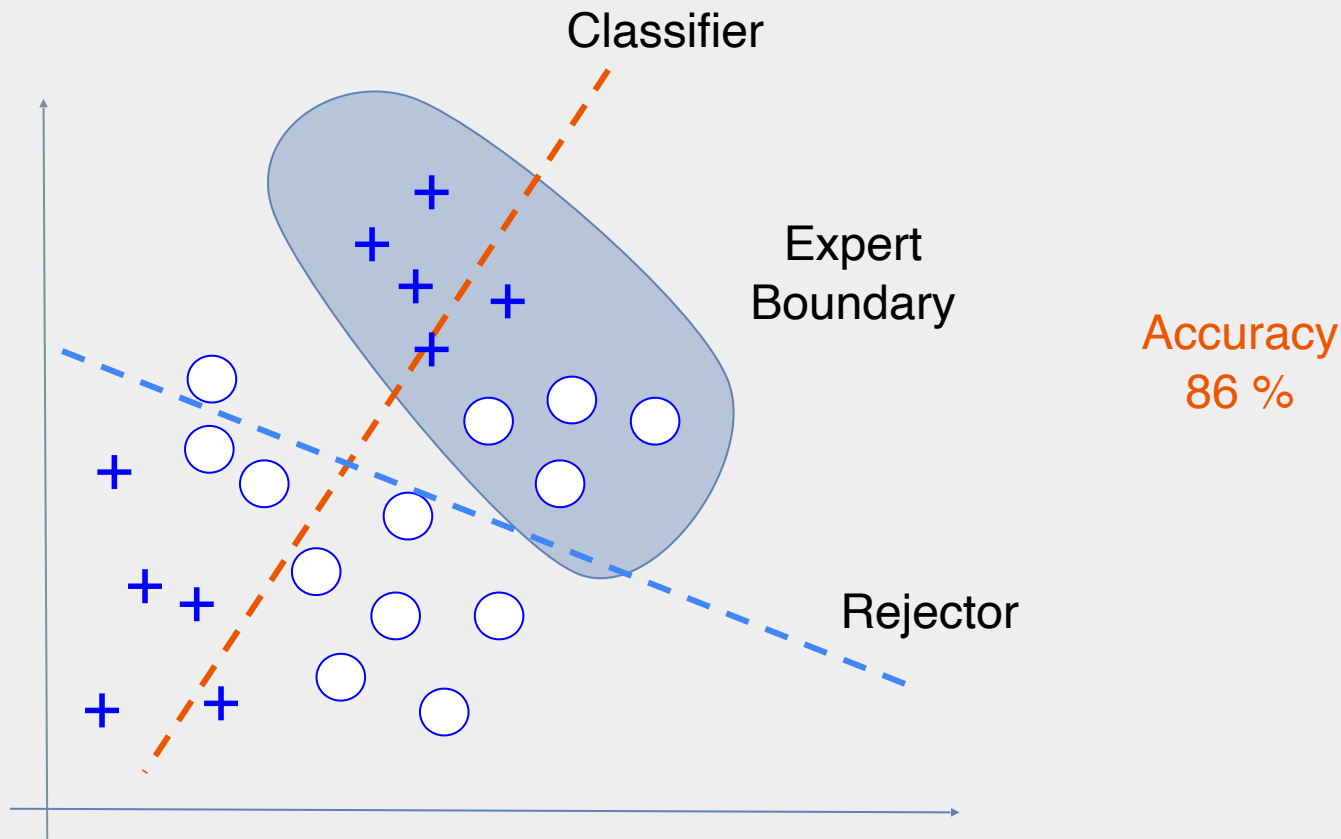
Deferral Setting: a staged learning approach



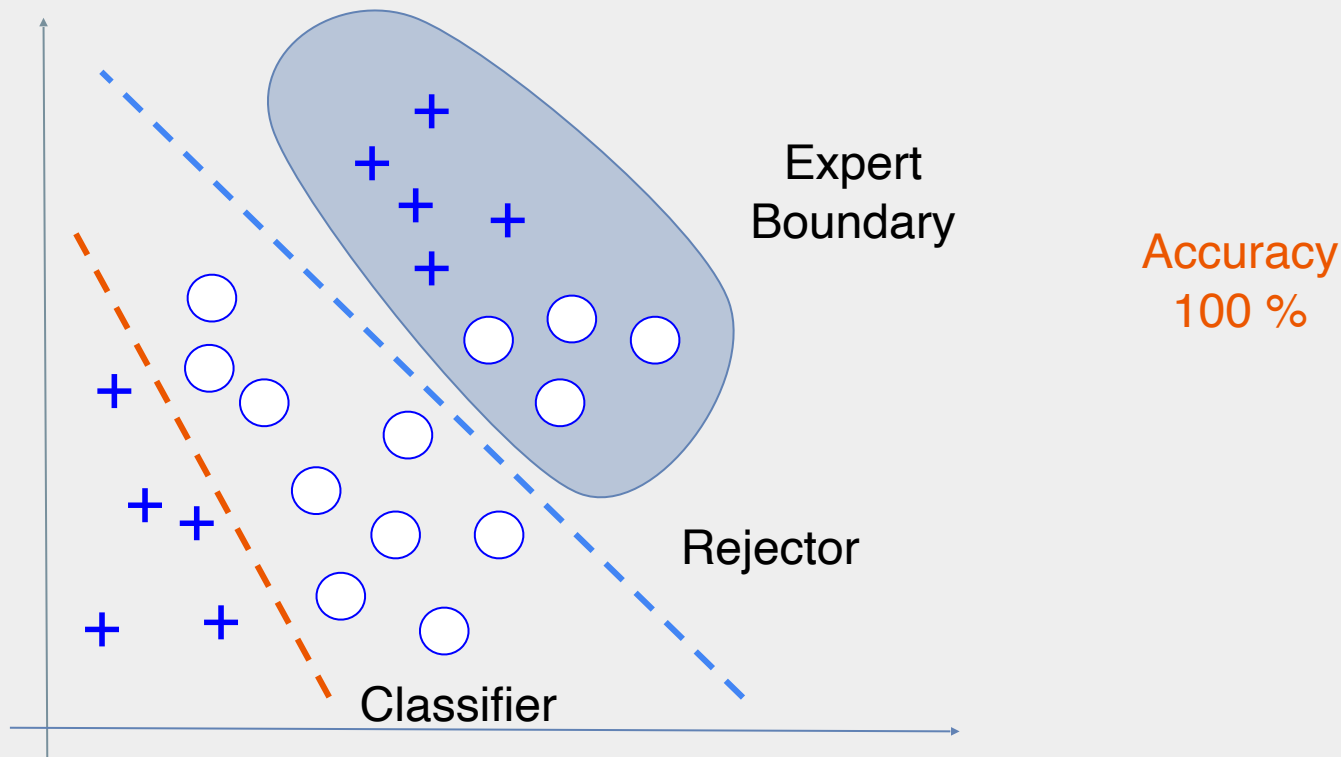
Deferral Setting: a staged learning approach



Staged Learning



Joint Learning



How suboptimal is staged learning ?

$$\frac{1}{d(\mathcal{H}) + 1} \leq \Delta \leq \frac{d(\mathcal{R})}{d(\mathcal{H})}$$

 Δ

Minimax measure of gap between staged and joint learning

 \mathcal{R}

Hypothesis class of rejectors

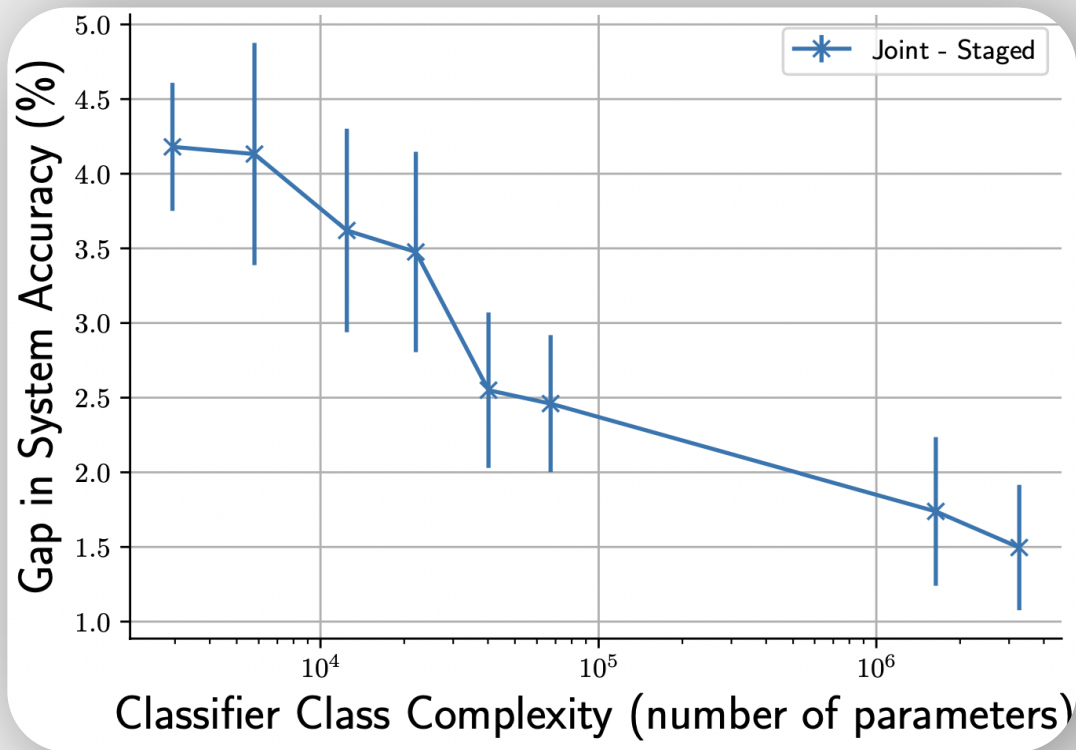
 \mathcal{H}

Hypothesis class of classifiers

 $d(\cdot)$

Complexity of a hypothesis class

How suboptimal is staged learning ?



Human label complexity as a playing factor

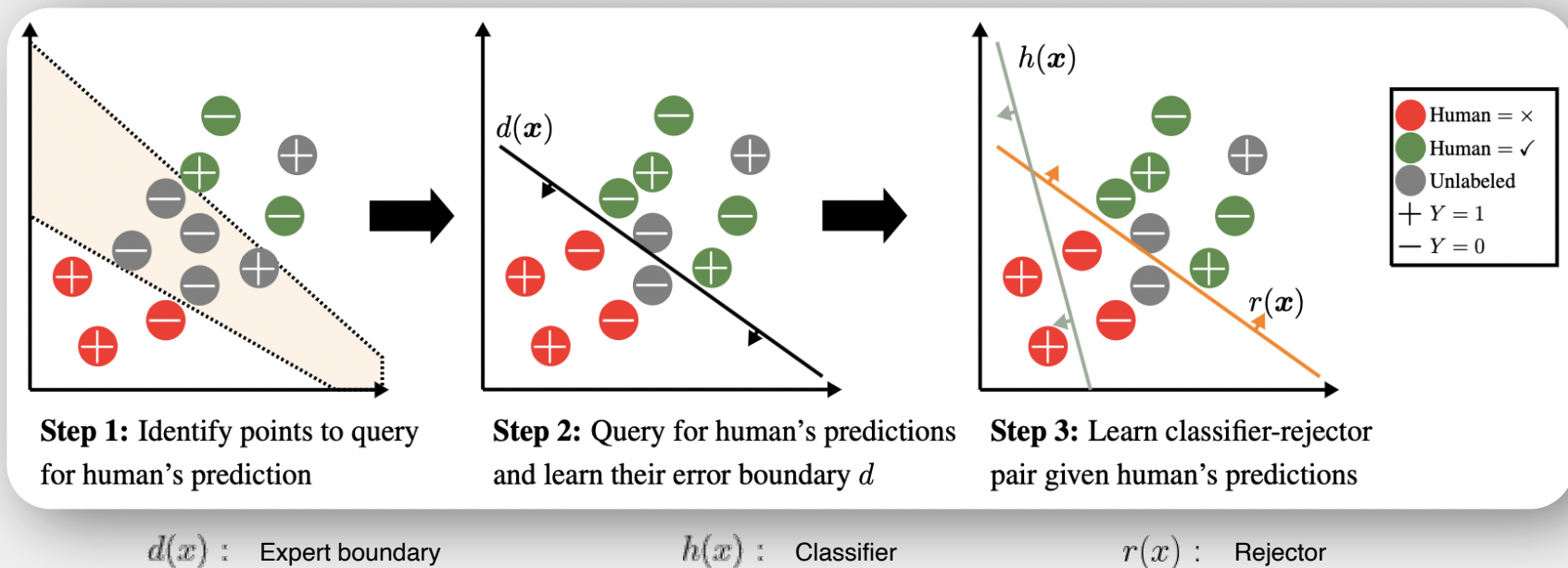


Staged learning \rightarrow no need to know about human's decision in the stage of training classifier \rightarrow better generalization, since we have $O(\frac{1}{\sqrt{n_u}})$ in generalization bound instead of $O(\frac{1}{\sqrt{n_l}})$

n_u : size of unlabeled data by human

n_l : size of labeled data by human

Actively learning classifier / rejector pair



Actively learning classifier / rejector pair

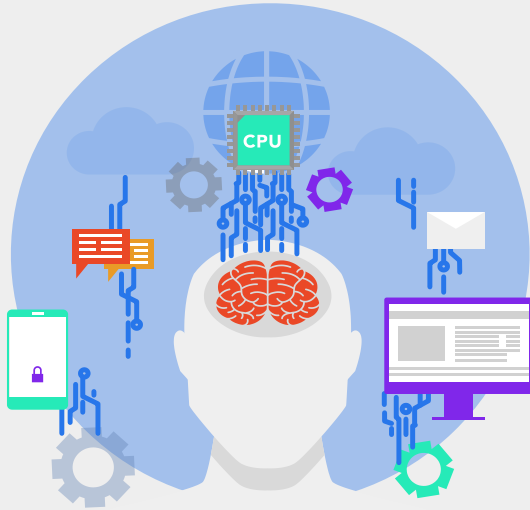
Sample complexity of the active learning method for having ϵ error:

$$n_u \sim O(1/\epsilon^2), \quad n_l \sim O(\log 1/\epsilon \cdot \log \log 1/\epsilon)$$

Sample complexity of staged and joint learning:

$$n_u, n_l \sim O(1/\epsilon^2)$$

Conclusion



- Fundamental gap between joint and staged learning in terms of complexity
- Human label complexity and better generalization of staged learning
- Actively learning a pair of classifier and rejector
- A new set of surrogates with useful properties

Thank you!