Classification-Oriented Dawid Skene Model for Transferring Intelligence from Crowds to Machines

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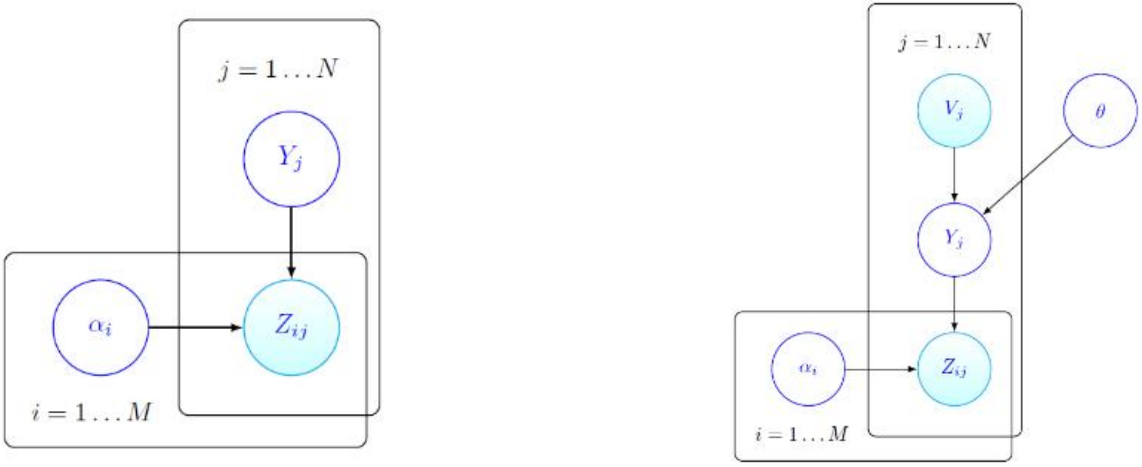
Problems & Ideas

- Problems of learning classifier from crowds:
  - The traditional way is to infer the ground-truth label from crowd annotations, since the subsequent classifier learning heavily depends on the inferred ground-truth label.
  - Existing pipe-line based human-in-the-loop classification model will be affected by the error propagation problem.
- Ideas: A unified probabilistic model for aggregating the worker-provided labels, modelling the workers' skill levels and finally learning a classifier for labelling future items.



Probabilistic model for DS and CODS. Left:The Dawid-Skene model; Right: A simplified model for learning classifier from crowds.

Main Contributions

- Contributions:
  - An extension of Dawid-Skene EM Algorithm which estimates worker skill levels and label predictions on items by considering both worker labels and item features. The model also learns a classifier on the item set and the predicted labels to make predictions on future tasks.
  - An active learning algorithm which integrates three tasks, namely, crowd label aggregation, crowd-assisted classifier construction and crowd worker selection.

	Weather		Movie		Spam σ^2_{good}		SLS σ^2_{good}		Iono σ^2_{good}	
	AA	AA	AA	AA	AA	AA	AA	AA	AA	AA
	60%	40%	60%	40%	60%	40%	60%	40%	60%	40%
MV	0.680	0.654	0.890	0.890	0.893	0.898	0.817	0.808	0.905	0.894
DS	0.756	0.726	0.820	0.820	0.906	0.914	0.817	0.811	0.914	0.908
KOS	-	-	0.820	0.824	0.905	0.911	0.816	0.811	0.895	0.890
CPC	-	-	0.846	0.860	0.923	0.924	0.804	0.800	0.886	0.872
LAA	0.761	0.730	0.906	0.904	0.908	0.915	0.813	0.809	0.920	0.908
CLA	0.759	0.728	0.912	0.911	0.919	0.918	0.815	0.811	0.928	0.915
	AA	CA	AA	CA	AA	CA	AA	CA	AA	CA
CODS	0.765	0.706	0.920	0.690	0.924	0.920	0.818	0.766	0.932	0.881

Performance of CODS in Crowd-Assisted Classifier Construction Against the Baselines. For CODS, 60% columns are the aggregation accuracies (AA), and the 40% columns are the classification accuracies (CA).