Main message:

Adaptive boundary for **out-of-domain detection** can add substantial **performance boost** when combined with **metric learning.**

Paper name: **Metric Learning and Adaptive Boundary for Out-of-Domain Detection**

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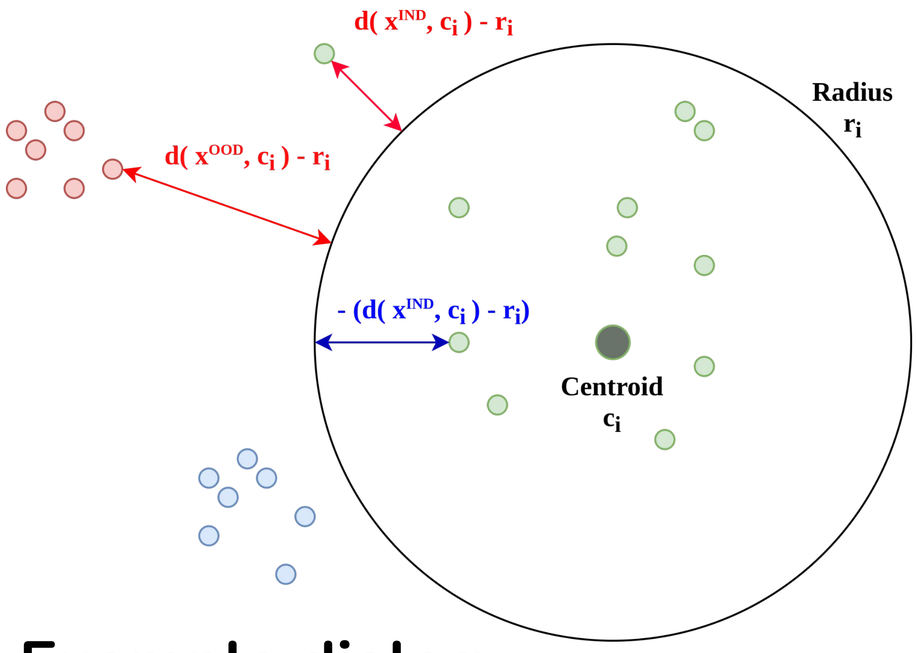
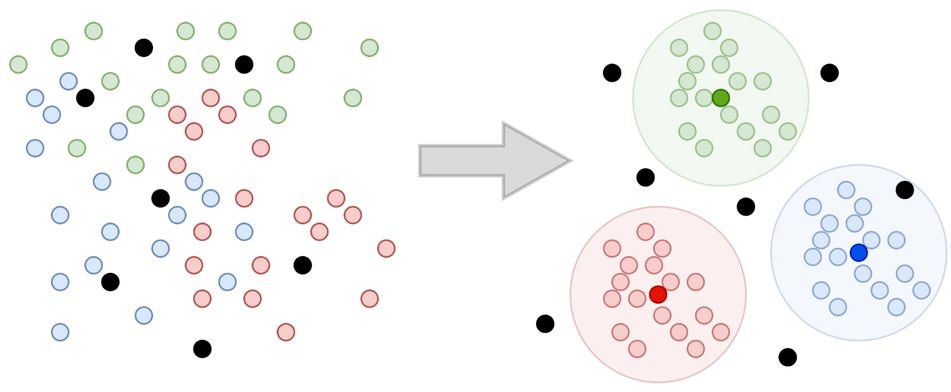
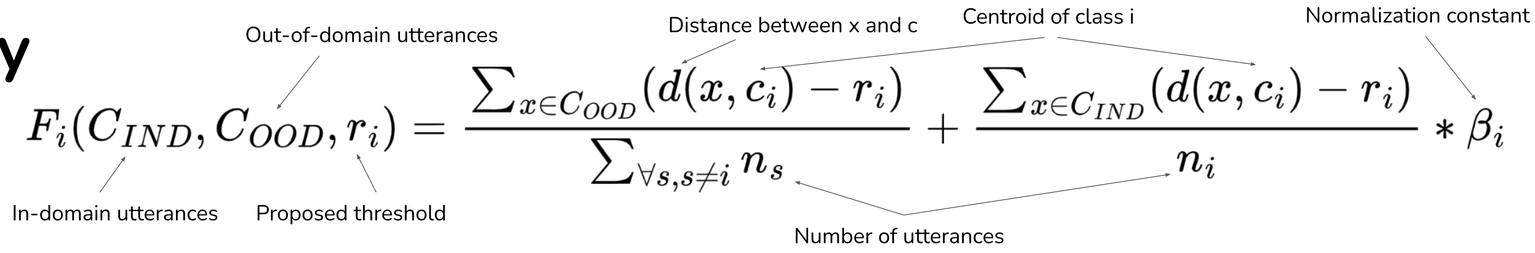
Main parts of our algorithm

- **Metric learning**
  - maximizes interclass variance and minimizes intraclass variance of our examples in the vector space
  - Large margin cosine loss
  - Triplet loss
- **Adaptive decision boundary**
  - Iterative process of searching for boundary based on stopping criterion







$$F_i(C_{IND}, C_{OOD}, r_i) = \frac{\sum_{x \in C_{OOD}} (d(x, c_i) - r_i)}{\sum_{\forall s, s \neq i} n_s} + \frac{\sum_{x \in C_{IND}} (d(x, c_i) - r_i)}{n_i} * \beta_i$$

Table 1: Results on CLINC150 dataset. Mean of own measurements based on USE-TRAN where ± is standard deviation

	25% known ratio		50% known ratio		75% known ratio	
Method	**Accuracy**	**F1**	**Accuracy**	**F1**	**Accuracy**	**F1**
MSP	47.02	47.62	62.96	70.41	74.07	82.38
DOC	74.97	66.37	77.16	78.26	78.73	83.59
OpenMax	68.50	61.99	80.11	80.56	76.80	73.16
DeepUnk	81.43	71.16	83.35	82.16	83.71	86.23
ADB	87.59	77.19	86.54	85.05	86.32	88.53
ODIST	89.79	UNK	88.61	UNK	87.70	UNK
Our$_{LMCL}$	**91.81** ± 0.11	**85.90** ± 0.08	88.81 ± 0.15	89.19 ± 0.09	**88.54** ± 0.05	**92.21** ± 0.10
Our$_{Triplet}$	90.28 ± 0.07	84.82 ± 0.14	**88.89** ± 0.03	**89.44** ± 0.04	87.81 ± 0.11	91.72 ± 0.17

Table 2: Results on BANKING77 dataset. Mean of own measurements based on USE-TRAN where ± is standard deviation

	25% known ratio		50% known ratio		75% known ratio	
Method	**Accuracy**	**F1**	**Accuracy**	**F1**	**Accuracy**	**F1**
MSP	43.67	50.09	59.73	71.18	75.89	83.60
DOC	56.99	58.03	64.81	73.12	76.77	83.34
OpenMax	49.94	54.14	65.31	74.24	77.45	84.07
DeepUnk	64.21	61.36	72.73	77.53	78.52	84.31
ADB	78.85	71.62	78.86	80.90	81.08	85.96
ODIST	81.69	UNK	80.90	UNK	82.79	UNK
Our$_{LMCL}$	**85.71** ± 0.13	**78.86** ± 0.10	**83.78** ± 0.14	**84.93** ± 0.08	**84.40** ± 0.21	**88.39** ± 0.11
Our$_{Triplet}$	82.71 ± 0.34	70.02 ± 0.18	81.83 ± 0.15	83.07 ± 0.15	81.82 ± 0.08	86.94 ± 0.09

Example dialog

Agent: Do you travel a lot?
User: Yes, I do. (IND)
Agent: Great! Do you travel alone?
User: I like Valencia much more than Barcelona. (OOD)

More information and **source code**:

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https://github.com/tgargiani/Adaptive-Boundary