INNOVATIONS in Crop Science

UNIVERSITÉ CÔTE D'AZUR · MORPHEME MORPHologie Et IMAGES · BAYER

How to define a rejection class based on model learning?

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Introduction

- Supervised classification (Classifier = feature space splitter)
  - ➢optimize frontiers between classes (that appear in the learning set)
- Rejection option added to a classifier (SVM [Mukherjee et al.], Deep Neural Network [Chow et al.])
- System where **the prediction model** and the **selection mechanism** are **optimized simultaneously**

Our proposed method:

➢Take into account the possibility of rejecting a sample in the classifier design
➢Pay attention to the space in-between known classes or away from them

} **Better approach**

Method

Proposed strategy

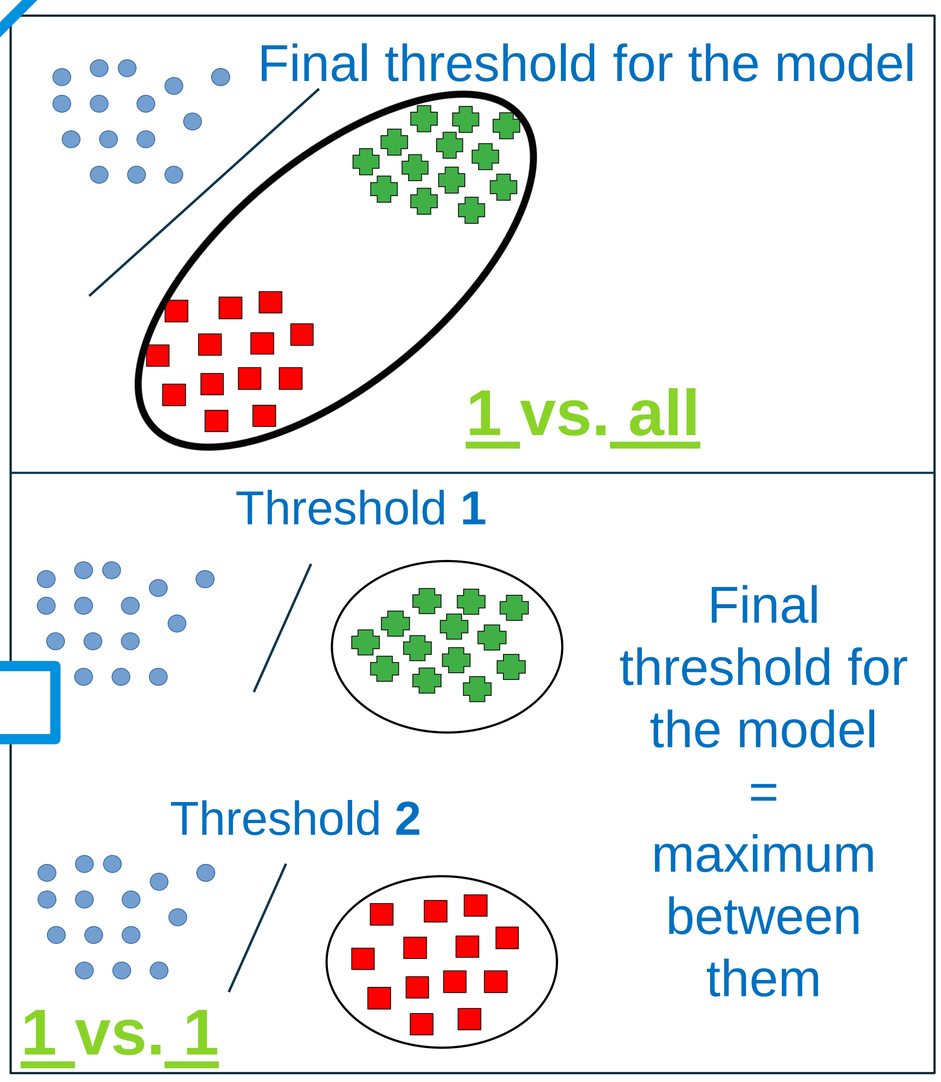
- Learning
  - One model per class, independently
  - One threshold per model, accounting for classes overlapping
- Prediction: Model accepts or rejects sample based on **threshold**

New Sample → Feature data → Model 1 → P1(s); Model 2 → P2(s); Model 3 → P3(s)

- All models reject => rejection class
- One or several models accept => associate class of **highest** model acceptance value

- Model type : **Gaussian mixture** (using EM)
- PDF threshold learning (1):

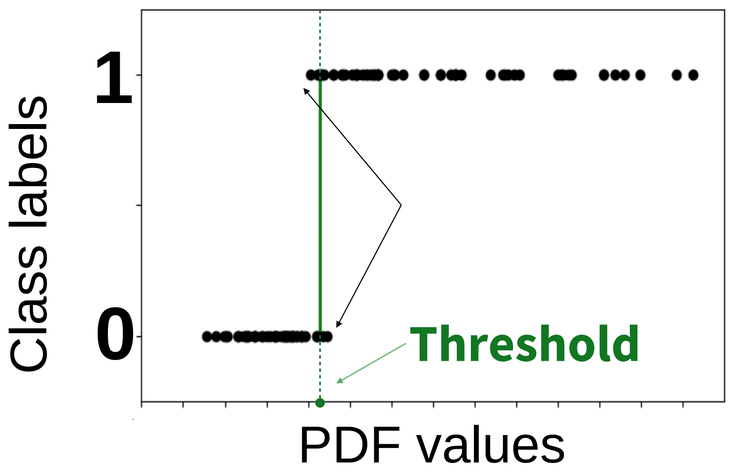
Two options



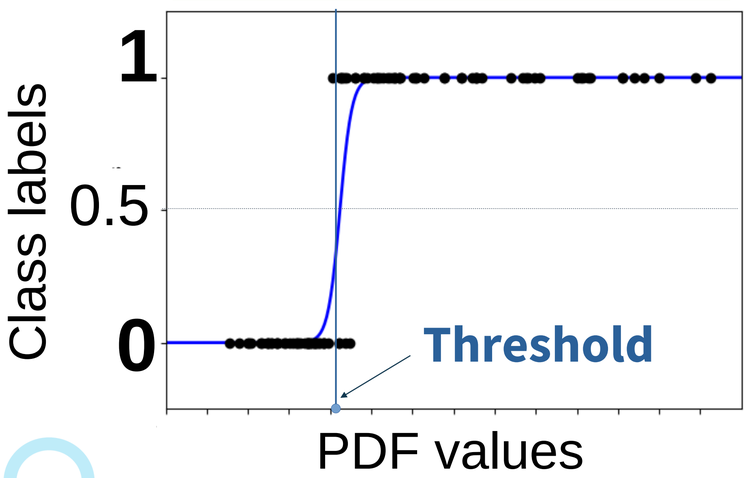
- PDF threshold learning (2):

Two methods

Misclassification



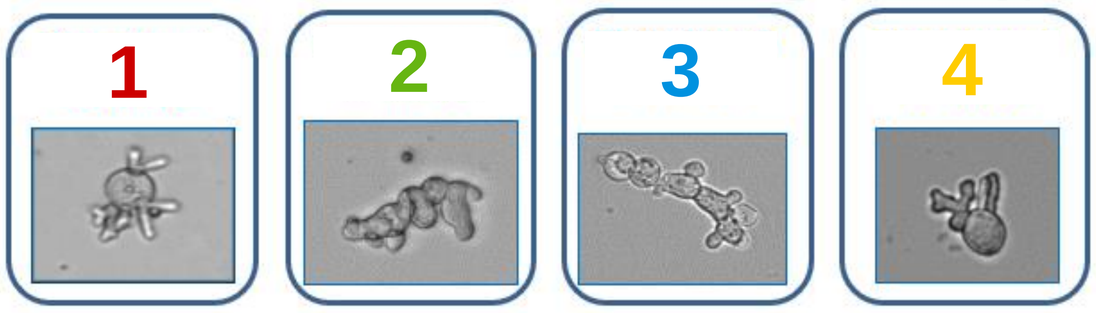
Logistic Regression



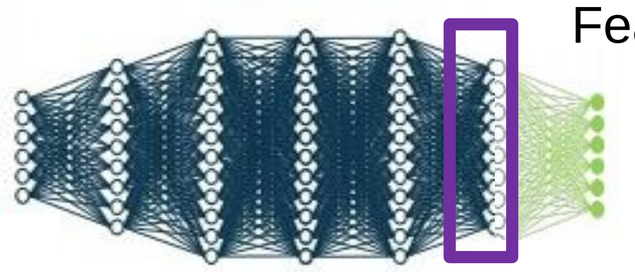
Threshold = inverse image of the fictitious tag value 0.5
Threshold = PDF value where nb* of false positives = nb* of false negatives

Results & Conclusions

- **4 classes** = 4 known MoA = 4 fungi phenotypes



Bayer Disease Control Research, Center focusing on Disease Control



MobileNet Network
*Trained on ImageNet database

Features= **Bottleneck**
- Dimension = 1001
⇒ Reduction: Variable importance or PCA

Parameter tuning:
➢**Features:** Type of dimension reduction
➢**GMM parameters:** nc* / Type of covariance matrix
➢**Threshold learning:** Option (1) / Method (2)

Best results with : (cross-validation on 20 folds)
Variable importance, 1 vs. All, Misclassification
⇒Classification accuracy =~ **94 %**
(**91 %** on known classes/**98 %** on rejection class)

*nb = number / *nc = number of components