Introduction to Mushroom Learning

Machine Learing in Mushroom Context

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Structure

1.) Goals

2.) Data Set

3.) Method Decisions

4.) Implementation with *mlr3*

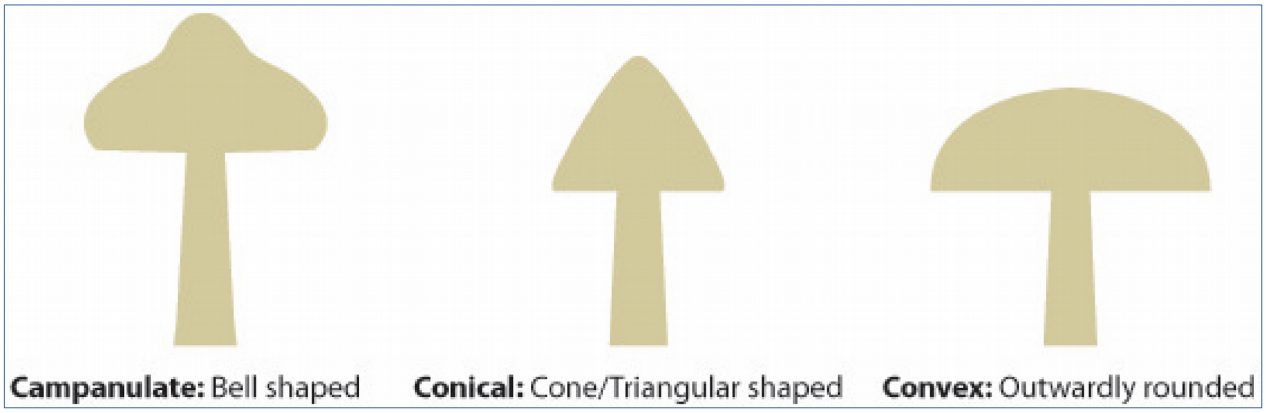
5.) Results

Goals

- Classification of mushrooms: edible or poisnous
- Using Machine Learing methods
- Using *mlr3*-Package

Data set

- 8124 observations
- Binary target variable (edible or poisonous)
- 22 nominal features (characteristics of each mushroom)



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Method decisions

- 6 classification methods:
  - Featureless
  - Naive Bayes
  - Decision Tree
  - Random Forest
  - KNN
  - Logistic Regression

Method decisions

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  - Featureless
  - Naive Bayes
  - Decision Tree
  - Random Forest → + Tuning *mtry*
  - KNN → + Tuning *k*
  - Logistic Regression

Method decisions

- Generalisation Error & Hyperparameter tuning
  - Nested Resampling
    - Inner loop: 5-fold CV (Hyperparameter tuning)
    - Outer loop: 10-fold CV (final GE)
  - Optimization criterion: AUC
  - Further measure: False Positive Rate

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Implementation with *mlr3*

- Task

```
# Construct Classification Task
task_mushrooms = TaskClassif$new(id = "mushrooms_data",
                                 backend = mushrooms_data,
                                 target = "class",
                                 positive = "e") # "e" = edible
```

- Learner

```
# Define learner:
learner_knn = lrn("classif.kknn", predict_type = "prob")
```

Implementation with *mlr3*

- Tuner

```
# Set up autotuner instance with the predefined setups
tuner_knn = AutoTuner$new(
  learner = learner_knn,
  resampling = resampling_inner_5CV,
  measures = measures_tuning,
  tune_ps = param_k,
  terminator = terminator_knn,
  tuner = tuner_grid_search_knn
)
```

- Benchmark

```
design = benchmark_grid(
  tasks = task_mushrooms,
  learners = learners,
  resamplings = resampling_outer_10CV
)



bmr = benchmark(design, store_models = TRUE)
```

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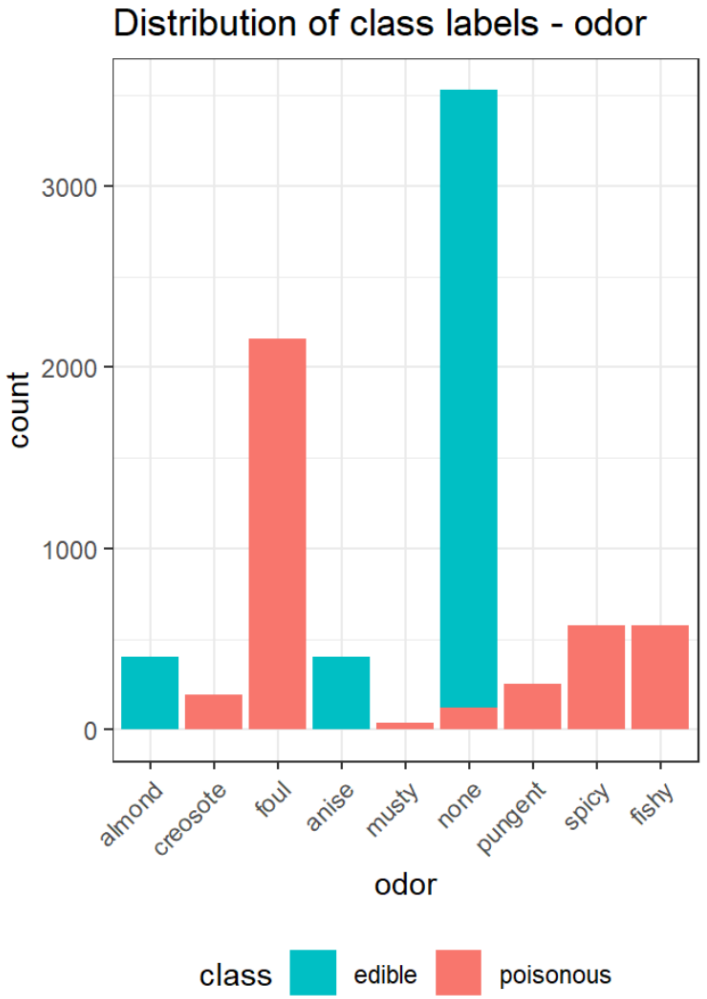
Results

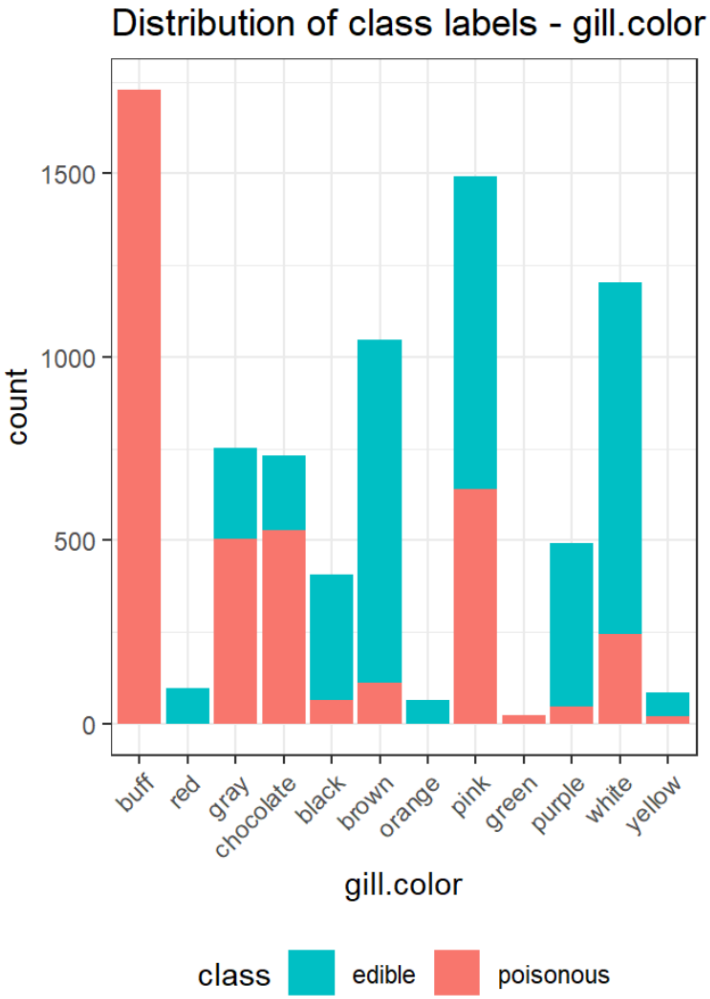
- Performance measures:

Method	AUC	FPR
Featureless	0.5000	1.000
Naive Bayes	0.9960	0.1156
Decision Tree	0.9939	0.0122
Random Forest	1.0000	0.0000
KNN	1.0000	0.0003
Logistic Regression	1.0000	0.0000

- Warning messages with logistic regression

Results


Distribution of class labels - odor
count
3000
2000
1000
0
almond
creosote
foul
anise
musty
none
pungent
spicy
fishy
odor
class
edible
poisonous


Distribution of class labels - gill.color
count
1500
1000
500
0
buff
red
gray
chocolate
black
brown
orange
pink
green
purple
white
yellow
gill.color
class
edible
poisonous

Results

- Performance measures:

Method	AUC	FPR
Featureless	0.5000	1.000
Naive Bayes	0.9960	0.1156
Decision Tree	0.9939	0.0122
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Logistic Regression	1.0000	0.0000

- Warning messages with logistic regression

Thank you!!!