

1UP or 6' Under?

Classifying Mushrooms by Matt Edrich

The Question

Is a machine learning model capable of identifying poisonous mushrooms?

- The *Lepiota* genus of mushrooms, taxonomically mixed with *Agaricus* for a long time, consists of 400+ species, many of which are poisonous
- The *Agaricus* genus of mushrooms consists of 300+ species, some being edible and some being deadly
 - Includes the Common button mushroom, Portobellos, and the Field Mushroom



Which would you eat?



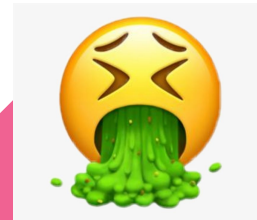
Agaricus augustus



Lepiota brunneoincarnata

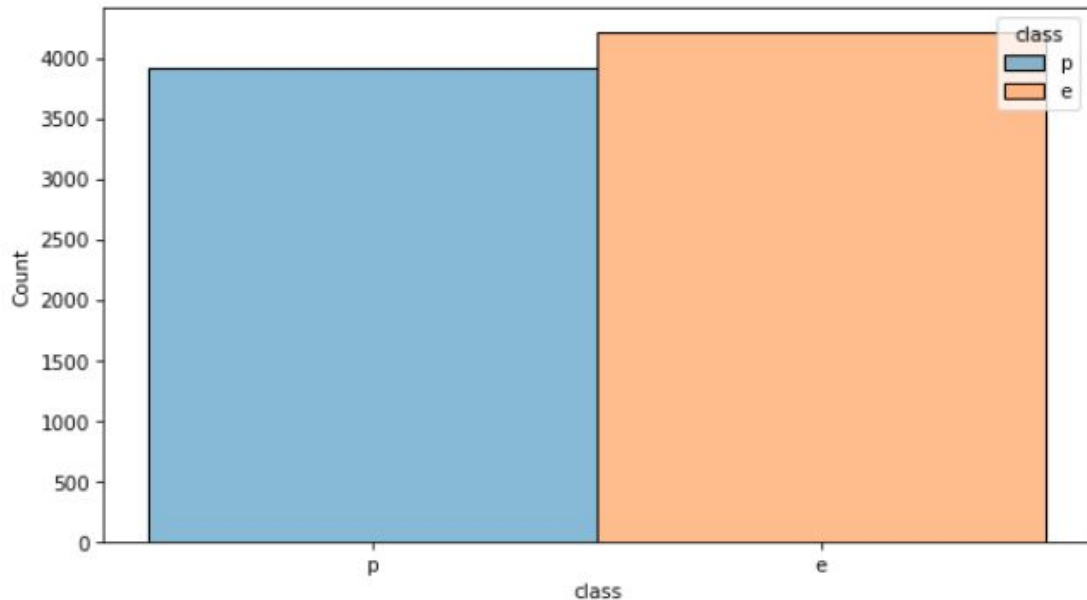


Agaricus hondensis



The Data

- The excellent [Mushroom Classification dataset](#) from UCI's ML Repository
- 8,125 observations with 22 features and one target
- Extremely clean upon arrival
- The target, "class" (aka edibility) was very balanced



Models & Metrics

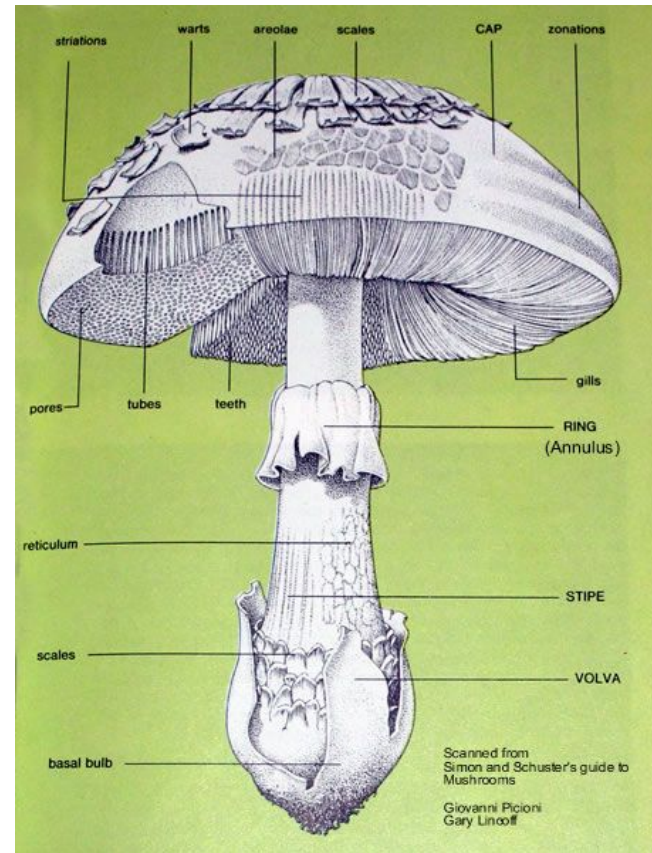
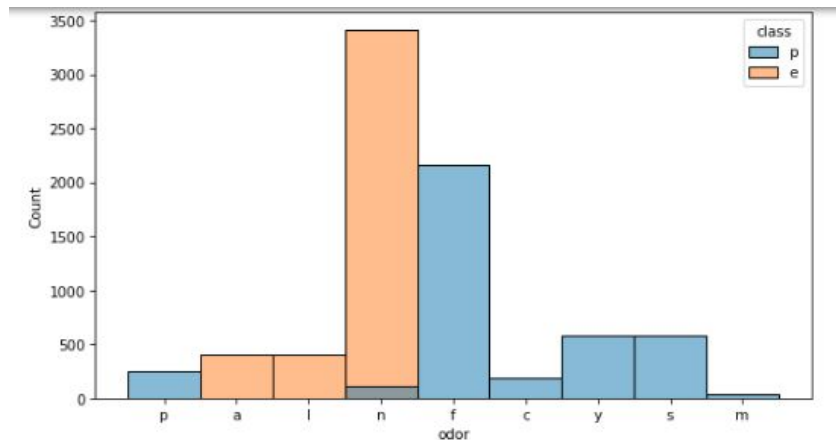
- Given the balanced nature of the data, **accuracy** is an appropriate metric
- *Potentially lethal consequences* of false negatives mean that **a low Type II error rate** is extremely important
- Model **simplicity and mobility** are important to *function in the field*

Model	Test Accuracy	Test Precision	Test Recall	Test F1
LR	99.8154	1	1	1
kNN	100	1	1	1
DT	100	1	1	1
RF	100	1	1	1



Why The High Metrics?

- Baseline models are taking in 73 features
- Certain mushroom characteristics are hallmarks of toxicity:
 - Odor
 - Gill color
 - Ring type



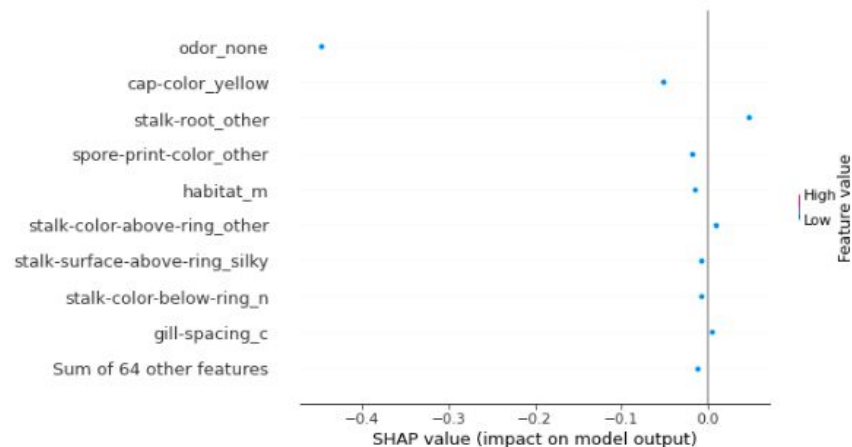
Guidance From SHAP Values

- A SHAP explanation of feature importance suggests:
 - Odor
 - Cap Color
 - Stalk Root Type
 - Spore Print Color
 - Habitat

Training AUC: 99.2122 %

Training accuracy: 95.9378 %

	precision	recall	f1-score	support
0	0.93	1.00	0.96	3357
1	1.00	0.92	0.96	3142
accuracy			0.96	6499
macro avg	0.96	0.96	0.96	6499
weighted avg	0.96	0.96	0.96	6499



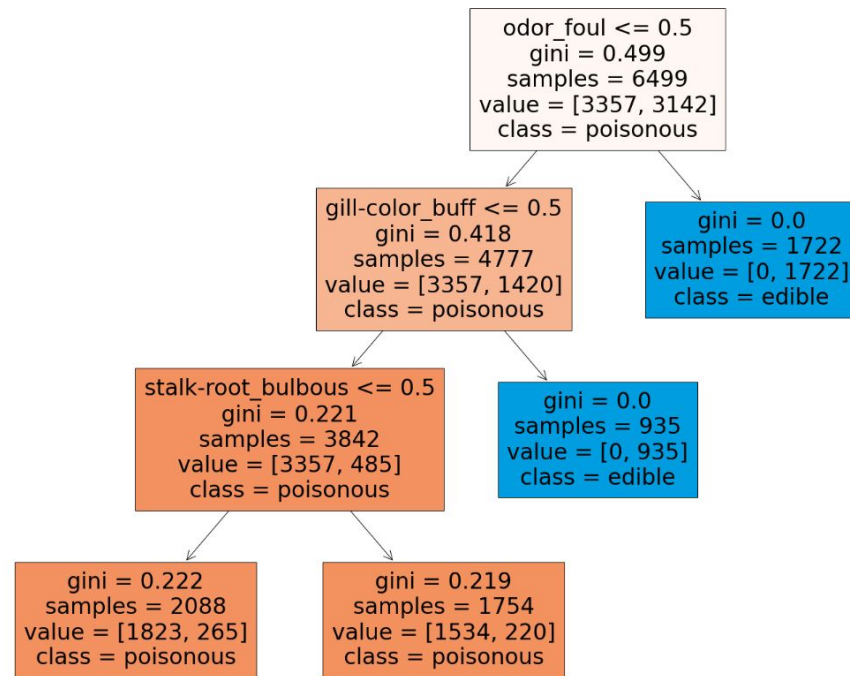
Guidance From Professionals

Mycologists agree that in the field, there are four main considerations:

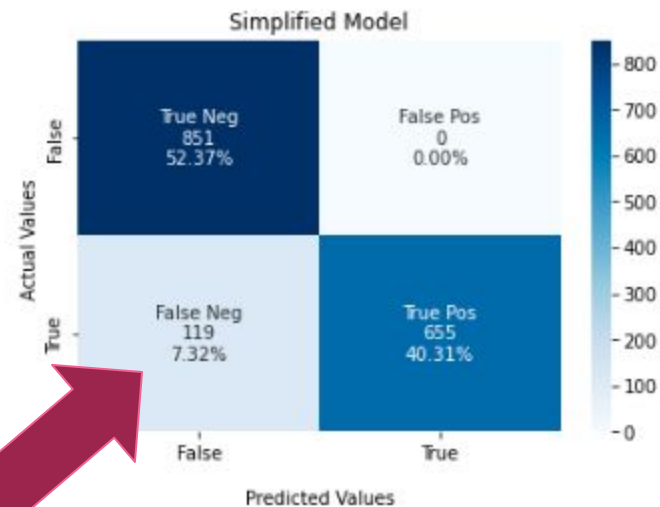
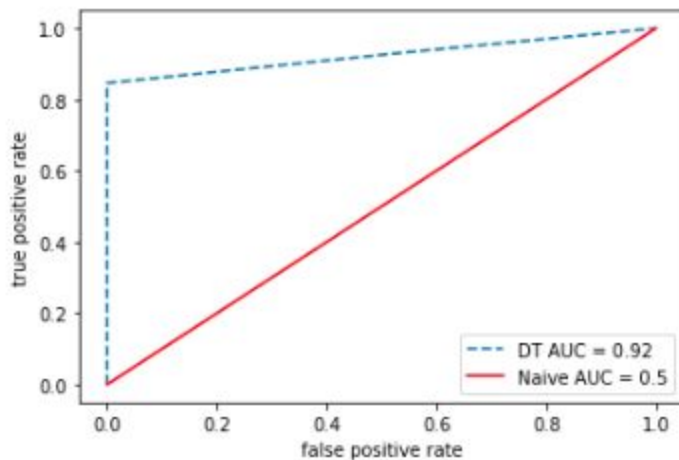
- Is the odor foul?
- Are the gills buff colored?
- Is the root bulbous?
- Does the stalk have a large ring?

Training AUC: 92.3078 %
Training accuracy: 92.5373 %

	precision	recall	f1-score	support
0	0.87	1.00	0.93	3357
1	1.00	0.85	0.92	3142
accuracy			0.93	6499
macro avg	0.94	0.92	0.92	6499
weighted avg	0.93	0.93	0.92	6499



Are Four Features Enough?



Don't Rely On This Model!

- 7.32% chance of a false negative - that could mean death!
- Four features are good enough for a confident guess *in the field* (wear gloves)
- Much more testing should be done before consumption
- Future work:
 - Refine guidance from SHAP values
 - Apply other classifiers
 - Incorporate image classification

Questions?

