Classification of Two Genera of Mushrooms from the Agaricaceae Family

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Machine Learning I
GWU

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Thus we want to...

- Classify mushrooms using Machine Learning
- Identify top relevant features so that
- Novices can quickly identify a poisonous mushroom, stop wasting time and move onto another potentially edible mushroom

Motivation

- People in the USA do not know the difference between an edible mushroom and a poisonous mushroom

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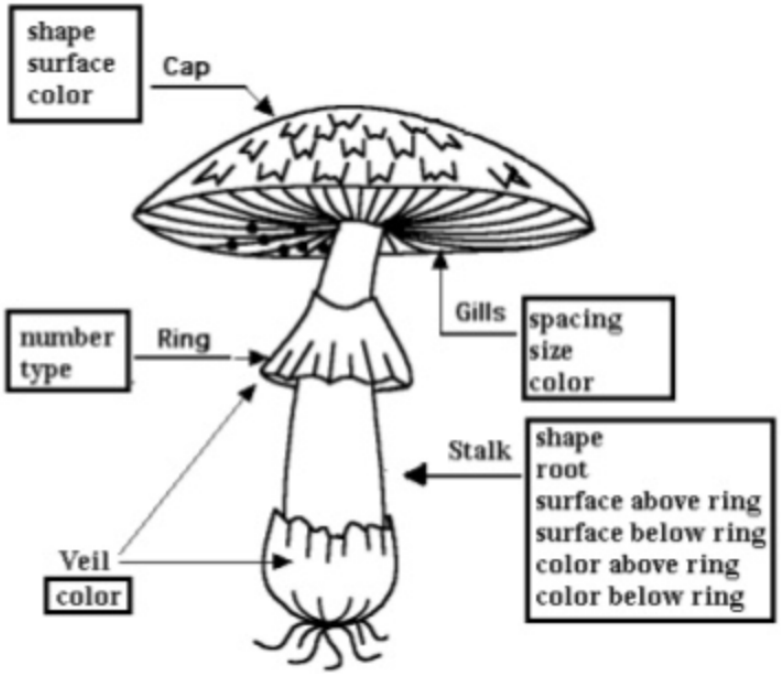
- Educate people on the top significant features that determine whether a mushroom is edible or not
- We hope this will help avoid tragedy, especially with children who are curious

Machine Learning Models

- Logistic Regression
- Decision Tree
- Random Forest
- K-Nearest Neighbors
- Gaussian Naive Bayes
- Support Vector Machine
- K-Means Clustering

Mushroom Features



Go to the jupyter notebook for an explanation of each of them.

Easy VS Hard Features

Easy:

- Cap Shape
- Cap Color
- Bruises
- Gill Color
- Stalk Shape
- Stalk Root
- Stalk Color
- Veil Color
- Ring Number
- Ring Type
- Spore Print Color
- Population
- Habitat

Hard:

- Cap Surface
- Gill attachement
- Stalk Surface
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Exploratory Data Analysis and Preprocessing

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  5. Mode imputation

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- 70-30 Train-Test Split

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- Also perfect scores for KNN and SVM without using `stalk-root`
- Naive Bayes gave a 0.999 accuracy
- "Supervised" Clustering gave 0.904 accuracy

Features Importances

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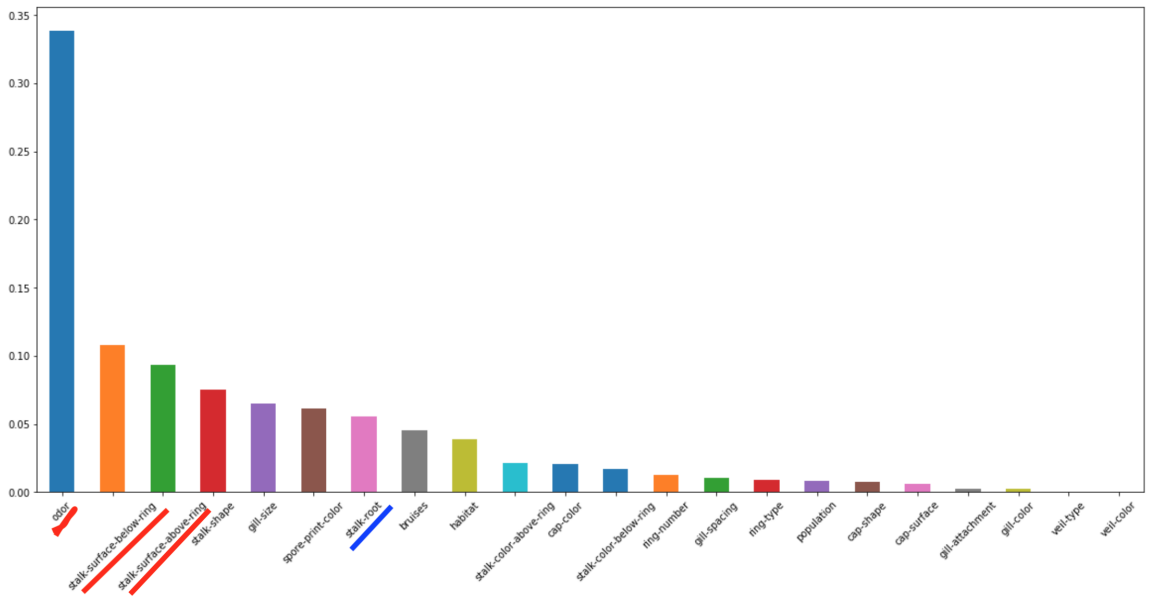
- Random Forest provided numerical feature importances by averaging the gini impurity at each node across all trees
- Similar results (Random Forest shown below)



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- Decided to drop the missing values to train the rest: Random Forest, KNN and SVM gave perfect scores
- Naive Bayes classified 16.6% of poisonous mushrooms as edible
- Clustering accuracy decreased to 0.855

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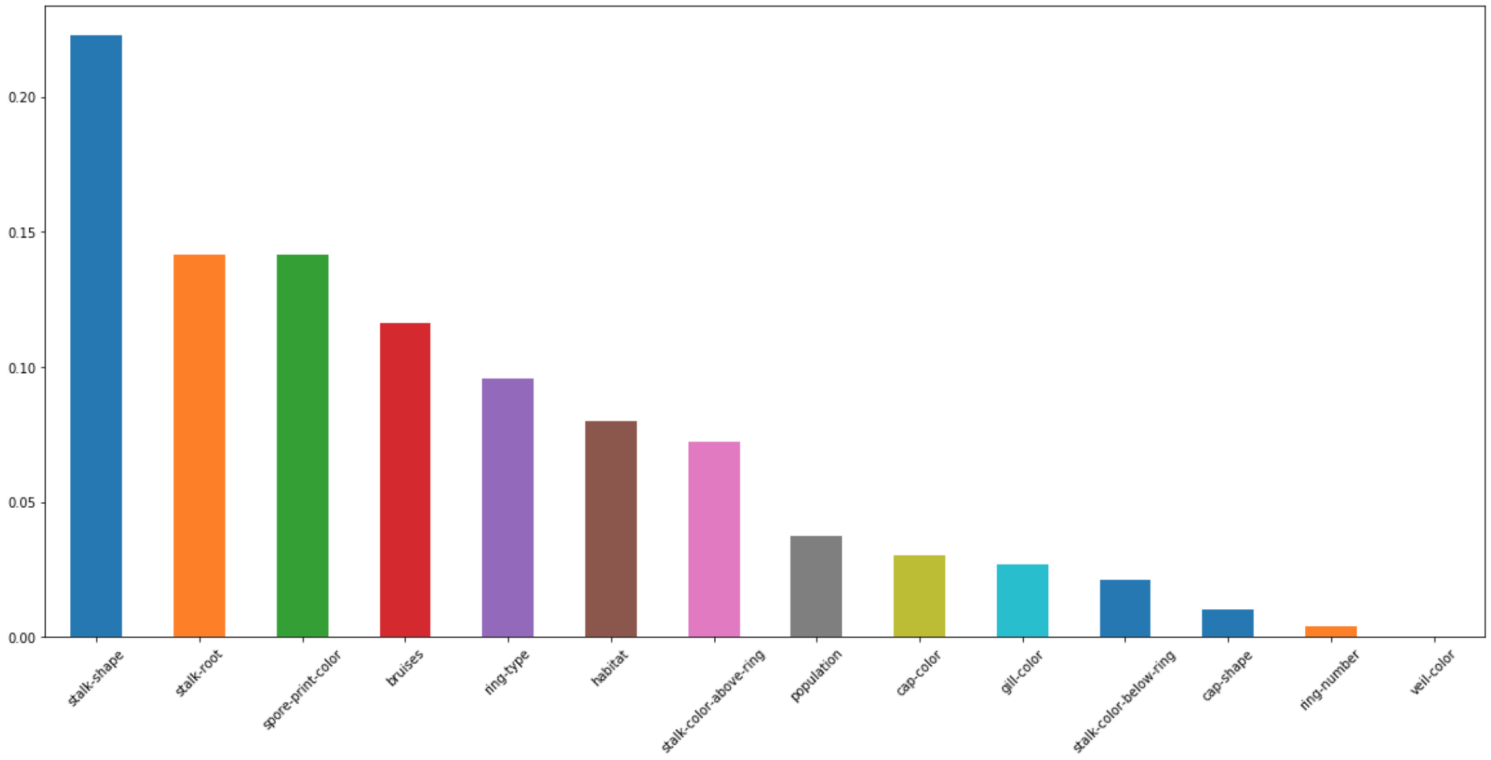
- `stalk-root` is the top 2



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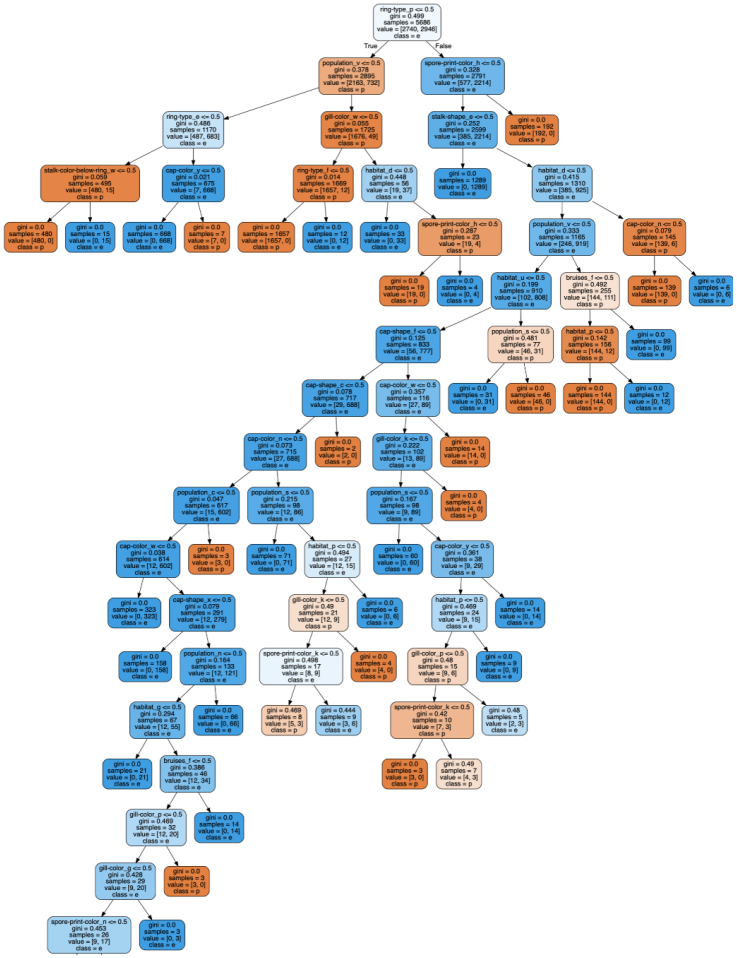

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  Some features that most likely make a mushroom poisonous:

- `spore-print-color` = chocolate, white or green
- Mushroom does not bruise
- Mushroom with large or no rings
- Mushrooms living on leaves, cities or paths
- `stalk-color-above-ring` = brown, buff, cinnamon or yellow

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- Although most models gave perfect cross-validated scores...
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- The data we used could also be compromised

Thus the authors...

- Take no responsibility on the usage of these models by other people
- Always advise to consult with an expert before ingesting wild mushrooms

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- Found some interesting features for mushroom hunters to look at first...
- So that they can quickly identify a likely poisonous mushroom...
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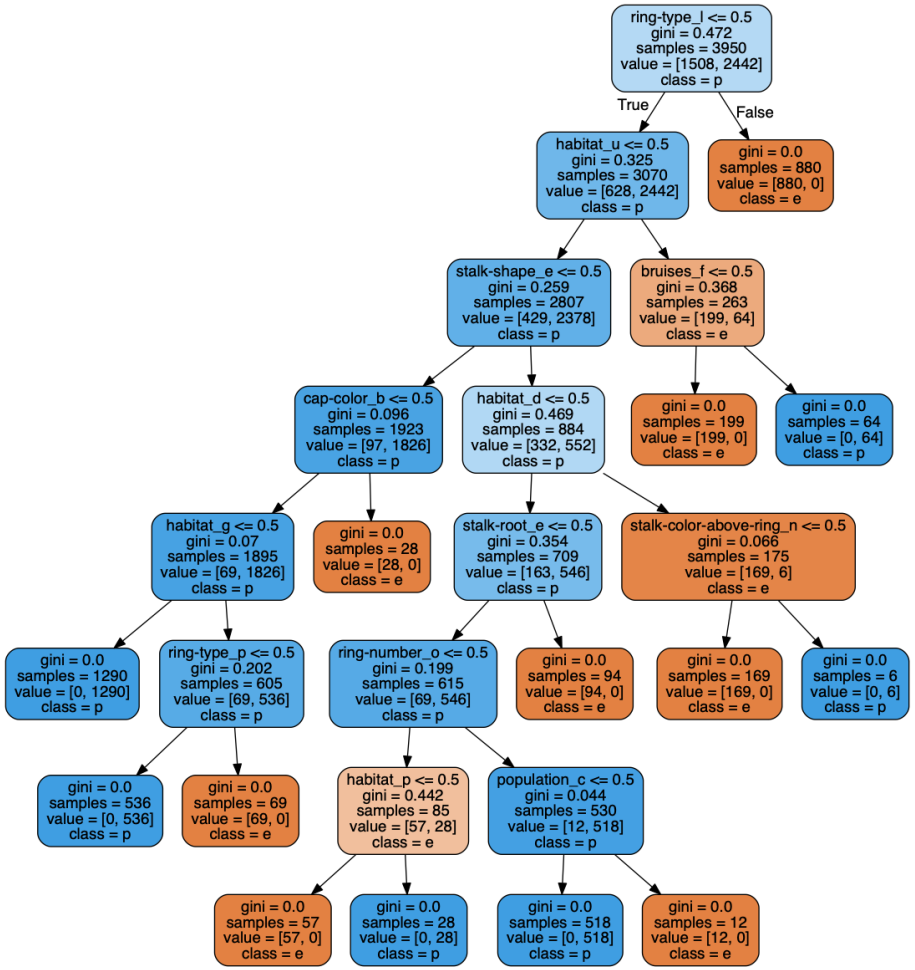
- Found some interesting features for mushroom hunters to look at first...
- So that they can quickly identify a likely poisonous mushroom...
- Thus saving them time to focus on other potential edible mushrooms
- Gave guidelines as to how to find more of these

Simplest Easiest Decision Tree



Happy Mushroom Hunting!

References

- Sebastian Raschka and Vahid Mirjalili. *Python Machine Learning*. Packt, Birmingham, 2017
- Machine Learning I's notes, slides, exercises and homework
- Wikipedia's entries for the various classifiers
- `https://arxiv.org/pdf/1410.5329v3.pdf`
- A bunch of other articles and coding questions, all referenced in the *jupyter notebook*

Github Repository: `https://github.com/QuirkyDataScientist1978/GWU-Machine-Learning-1-Fall-2018-Mushroom-Classification-Project`