

# MINING MAGNIFICENT MUSHROOMS

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A Fun Project Exploring Wild Edibles and Deep Learning

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**Flammulina velutipes:** Flew on Space Shuttle Columbia to determine how mushrooms would handle low gravity.

## 2 THE CASE FOR FORAGING

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**Entoloma rhodopolium:** Finding this mushroom is not quite as lucky as it appears.

- Mushrooms are one of the superfoods, known for health benefits
- Unfortunately they can also be highly toxic resulting in illness and even death
- Millions of mushroom species, 14,000 described species, ~600 are common and edible
- Mushrooms are beautiful wild edibles, even in urban settings

**But how do you know, delectable or dangerous?**



### 3 ANSWERING THE QUESTION

- Classification using University of Copenhagen's, Natural History Museum of Denmark, Fungi Classification Challenge dataset of 1,394 wild mushrooms species
- Selected 41 edible and 44 poisonous common mushrooms, with 7700 images

Is delectable or dangerous the right question?

What are the characteristics of an edible or poisonous mushroom?



Edible (Amanita)



Poisonous (Amanita)



# 4 CLASSIFICATION PROCESS

Layer	Layer
Input (32 and 256 batch generator)	(None, 256, 256, 3)
2D Convolution (3,3)	(None, 254, 254, 32)
Activation (ReLU)	(None, 254, 254, 32)
2D MaxPooling	(None, 127, 127, 32)
2D Convolution (3,3)	(None, 125, 125, 32)
Activation (ReLU)	(None, 125, 125, 32)
2D MaxPooling	(None, 62, 62, 32)
2D Convolution (3,3)	(None, 60, 60, 64)
Activation (ReLU)	(None, 60, 60, 64)
2D MaxPooling	(None, 30, 30, 64)
Flatten	(None, 57600)
Dense	(None, 64)
Activation (ReLU)	(None, 64)
Dropout (0.5)	(None, 64)
Dense	(None, 1)
Activation (Sigmoid)	(None, 1)

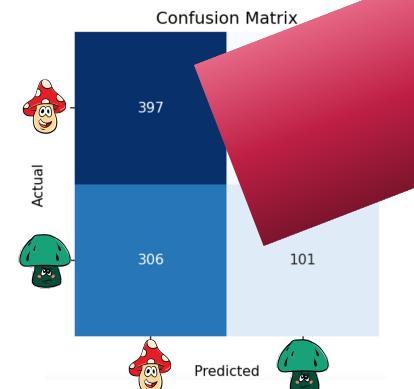
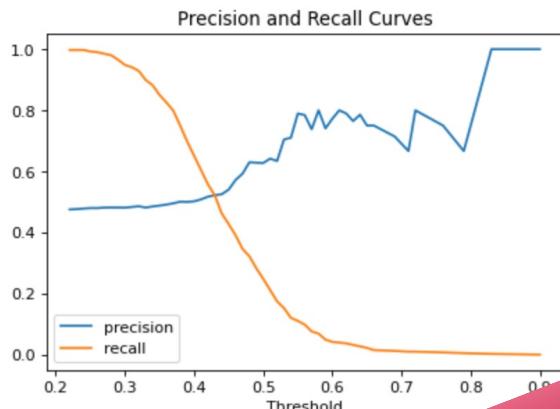
Transfer Learning

- **Loss**
  - Binary Cross Entropy
- **Optimizer**
  - RMSprop
  - Adam
- **Metrics**
  - Accuracy
- **Epochs**
  - 10 with 100 steps per epoch
  - 50 full epochs
- **Transfer Learning**
  - VGG16 with ImageNet weights
  - ResNet50 with ImageNet weights



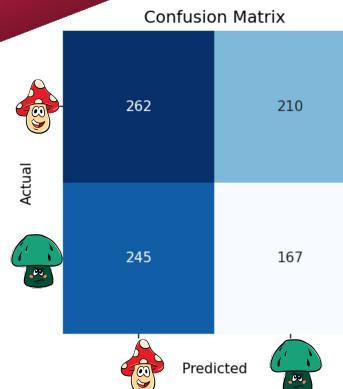
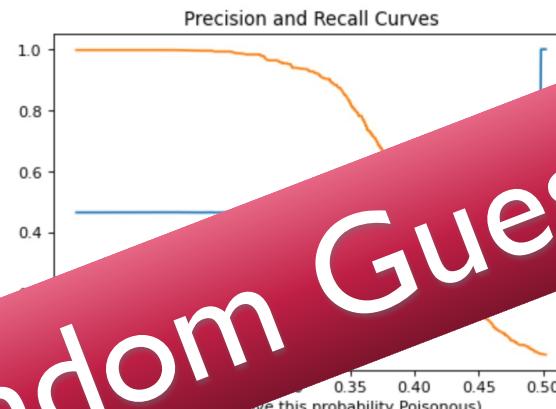
# 5 DELECTABLE OR DANGEROUS

**Baseline Random Forest**



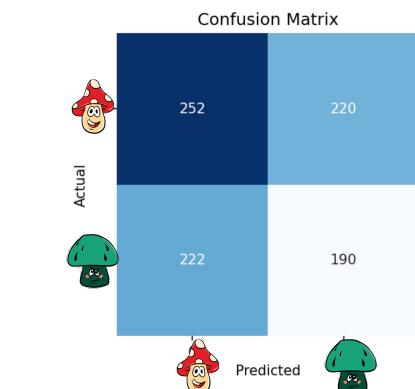
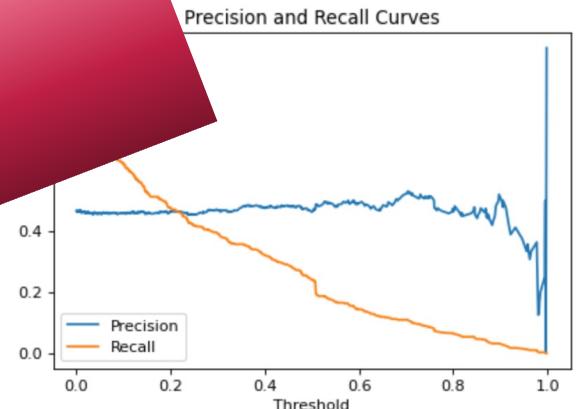
Threshold: 0.4 ROC AUC: 0.558

**Custom CNN**



Threshold: 0.4 ROC AUC: 0.480

**Transfer Learning**



Threshold: 0.22 ROC AUC: 0.507

Random Guess!

## 6 CONCLUSIONS AND NEXT STEPS

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- None of the models learned the images sufficiently to classify edible or poisonous
- As anticipated, the project design may be flawed
  - Very difficult to classify edible or poisonous without understanding the mushroom categorization
- Using the upcoming module on cloud computing to handle the processing
  - Develop a by **Genus** and **Species** classification model
  - Map the Genus and Species to **Delectable** or **Dangerous**

**Until then, don't go mushroom foraging with Alison**



## 7 REFERENCES

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- Slide Master Photo by [Lukasz Szmigiel](#) on [Unsplash](#)
- [MushroomExpert.com](#) and [Mushroom Council](#) Fun Facts
- Wikipedia [Edible Mushrooms](#) and [Poisonous Mushrooms](#)
- [University of Copenhagen, Natural History Museum of Denmark Fungi Classification Challenge](#) [Images](#)

