CSCI 481/597J Project Proposal

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1. This project's goal is to take a colored image of a bird and determine what species it is within a list of 190 categorized species. This should be done faster and with as much or more accuracy than could be done with a person using a field guide.

2. The current method of identifying birds is through knowledge held by someone who has learned about them or through a field guide. Different field guides may have different organization, but often you can search by region and then by bird family, divided by raptors, owls, water birds, etc. If the bird family is unknown the user has to look through all the pages of the birds in the region to find the bird they saw. The bird is identified by pictures, description, and behavior in the book and the user has to match the bird they saw with these descriptions. The existing limits are that the process is time consuming and may be difficult for a user to identify the bird correctly.

   The current deep learning solutions as stated on Kaggle to classify bird species rely on Features Learning using a Convolutional Neural Network (CNN). The model gradually learns to recognize distinct features for each bird species (e.g. beak sizes, wingspan, color spots). This requires a substantial data set, and given our current restrictions of approximately 25,000 images this is an impractical approach. The need for a larger data set reveals a limitation of Feature Learning. Many problems, the bird identification task included, have data sets that are too small and will result in deep learning overfitting for the specific cases rather than getting the correct generalizations.

3. Our approach is going to be using the process of Few-Shot learning using the Prototypical Networks approach as recommended by Dr. Brian Hutchinson. Since this style of Few-Shot can work well on smaller data sets and is achievable to learn, we believe that we as a group can complete the task by the end of the quarter. We will be using this approach because we need our model to be able to take in very few images of a bird and identify which species it is with very high accuracy. We have reason to believe it will be successful because the few-shot method has been used with image classification previously.

4. The people that will be impacted by the modeling are outdoor enthusiasts. It is common for people to be on a hike, walk, or their backyard and be curious about a bird that they see. Simplifying the process of identifying the bird will make it more accessible to a larger group of people. By using Prototypical Networks, it is a newer approach to Few-Shot Learning, so having one more proof of concept will be beneficial to the deep learning community.

5. There are few significant risks to misidentifying a bird. The main risks are to the user; they would be misinformed about which birds they saw or the behavior of the bird they saw because the bird was misidentified. One way we could go wrong is that the model may learn only how to classify male birds (distinctive, bright colors) and not female birds (similar in looks, dull colors). There also is potential for misinformation if there was a bird identified and considered as safe when it is actually potentially dangerous (carrying a respiratory disease that is transmitted through touch or maybe fecal matter). This would certainly be worst case scenario and even if this were to happen, we don't intend people to use this model for identifying harmful birds, so we might need to include some disclaimers in order to cover our bases if the model is made public.

6. We will know we are on track based on the accuracy of our model in identifying birds based on images. If our accuracy in bird identification is increasing and we are achieving or surpassing our baseline then we are on track for success. We will know we are on track to complete the project by meeting the following deadlines:
   5/01 Data fully processed
   5/04 Baseline implemented and evaluated
   5/10 Skeleton of model finished
   5/17 All methods implemented
   5/20 Begun conducting experimental results and identify potential flaws
   5/27 All experimental results obtained

7. We plan to compare our model against a majority class baseline. By selecting the bird species that has the most data points and using that as the result for all predictions, we can get a lower bound for our accuracy. If our model is able to learn from our data set, then it should be able to predict bird species with a higher accuracy than this baseline.

8. We will be using the data set from the Kaggle website. https://www.kaggle.com/gpiosenka/100-bird-species It contains over 25,000 training images of 190 different bird species allowing our model to learn effectively. The images are 224x224x3 and while the data set is not balanced, each species of bird has at least 100 training images.

9. This is not a continuation or extension of an existing project.