Derek Sadler

Final Project Idea Proposal

Project Statement:

The objective of this project is to construct a dataset featuring various household items and then utilize a conventional neural network model (CNN) for accurate identification and categorization. The motivation for this project is to assess the model's performance when objects are trained and identified under different angles and environments as well as to see how much training data is required for consistent object identification.

In order to ensure a balanced dataset a set number of images will be taken for each object category. Each category of objects will have images taken from various angles and different backgrounds. For future data analysis each object will include different sections for different background settings. The effectiveness of the project will be assessed through a confusion matrix that provides the percentage of accurate and inaccurate predictions. Additionally another matrix will be created to see how different backgrounds individually affect the prediction accuracy. The matrix itself will serve as a guide to see if the model is accurate or needs adjusting.

Model:

The plan for creating a model of this data is to split it into an 80/20 ratio for training and testing. Prior to training, the images will be preprocessed to change its scale or resolution to best function for the model. For initial testing and training like mentioned each category of data will be split so that each category of data is represented.

A conventional neural network will then be used for modeling and classifying the data. The reason a CNN will be used is due to its specialized ability to process and recognize images. It is able to take an image and utilize convolutional layers to detect different edges or textures and then extract those features which are pooled together, flattened, fully connected together, and then output for training. This makes CNN an ideal training model consisting of image data.

Algorithms:

Some potential algorithms that could be useful for this project are Bag of Feature models like SIFT or other machine learning models such as regression and clustering algorithms. However, this would require more research before being utilized in my project.

Backup Plan:

I understand that collecting my own data for a project such as this comes with risks so if that is not feasible for the time left In the semester I found a large library of thousands of different image datasets on roboflow.com. These images can then be supplemented to my own dataset in order for better training of my model.

If the goals of this initial project are met or are not sufficient there are a few ways the scope of the project can be expanded. For instance the model can be expanded to identify multiple objects at once, identify objects in different backgrounds or distances. Additionally more data or object categories could be added to make the dataset more complex.

Conclusion:

Image recognition technology has majorly affected how data is processed and analyzed. The goal of this project is to get an understanding of how a basic dataset can be constructed and analyzed in order to identify different groups of objects. I am committed to executing this project and believe it's very feasible to be completed and expanded on.

Timeline:

- Oct. 25th - Research finished
- Oct. 31st - initial image collection
- Nov 3rd - Image preprocessing
- Nov 10th - Image feature extraction and training
- Nov 17th - Algorithm final implementation
- Nov 25th - Model testing and evaluation
- Dec. 4th - Project Final Presentation and demo