

# COM S 5730: Project Proposal

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## 1 Project Title

Image Classification using the ImageNet Dataset

## 2 Team Members

- Gabriel Ferreira

## 3 Project Details

### 3.1 Project Objective

Please describe your project objective in this part.

- What is the project Objective?

The project aims to build a machine learning model for image classification using the ImageNet dataset. The objective is to accurately classify images into predefined categories, such as animals, vehicles, or everyday objects.

- What problem to solve?

Image classification is a fundamental problem in computer vision, with applications in various fields such as satellite image, autonomous vehicles, healthcare, and content recommendation systems.

- Why the problem is important?

Accurate image classification is very important for improving automation and machine intelligence in areas mentioned above and beyond.

- Why machine learning can help to solve the problem?

Machine learning, especially deep learning through Convolutional Neural Networks (CNNs), has proven effective in automatically learning the features necessary for image classification. Even leveraging pre-trained models and transfer learning for complex use cases is a possibility to achieve high accuracy with less computational resources.

### 3.2 Datasets

Please describe your dataset in this section.

- What is the data and where you obtain it?

The dataset used for this project is the ImageNet dataset, which contains millions of labeled images with thousands of categories. It is publicly available through platforms like Kaggle, TensorFlow datasets, and ImageNet website.

- How the data is collected?

ImageNet is very used benchmark dataset collected from various online image sources and annotated by human. The dataset includes diverse images representing real world scenarios.

- What will be the features and labels you will use?

The features are pixel values of images, which will be resized and normalized. The labels correspond to the class each image belongs to (dog, cat, bananas).

- How many examples for training, validation, and testing?

I will split the dataset into training, validation, and testing sets. I am anticipating separating 70% of the data to be used for training, 15% for validation, and 15% for testing. For the first experiments, a subset of ImageNet will be used due to its large size.

### **3.3 Machine Learning Algorithm**

Please describe the machine learning algorithm you want to use for your project. Please justify your selection.

I intend to develop a CNN for image classification. The CNN will consist of multiple convolutional layers, pooling layers, and fully connected layers, optimized for feature extraction and classification tasks. CNNs are effective for image classification due to their ability to automatically learn spatial hierarchies of features.

### **3.4 Expected Outcomes**

What is your expected outcome for this project?

The expected outcome is to achieve a high classification accuracy on a subset of the ImageNet dataset. I also intend to visualize the model's performance using confusion matrices and tools like Grad-CAM to highlight which parts of the images contributed most to the classification decision.

Personally, I expect to gain experience with designing and training CNN architectures from scratch and explore various design choices in CNNs, such as kernel size, number of layers, activation functions, and regularization techniques like dropout and batch normalization. Additionally, training the model from scratch will help me to gain deeper insights into how image classification models learn from raw data.