Jeffery. Dirden ITAI 1378

Module 1 Introduction to Computer Vision

Beginning in Module 1 was very fun and informative we created a timeline on a specific era and detailed some of the key advancements that happened during that time, while also gaining understanding of what Computer Vision actually is. Learning some of the most important tools, and technologies associated with it was very informative. Getting familiar with impactful innovations and applications that also occurred as well.

Computer vision is used in a variety of different industries including: Retail, E-commerce, Transportation, Manufacturing, Security and Safety, Healthcare, Construction, Gaming, Sports, and Education just too name a few. As time goes on it's persistently evolving and improving. It's helping these industries become more efficient, safer, and smarter. Being able to automate tasks that were previously done manually, it's improving accuracy, and reducing costs to most of these industries.

IMPACTFUL APPLICATIONS

Autonomous Vehicles (Self Driving Cars)

Autonomous Vehicles are able to detect objects, interpret road signs and markings. They can even make decisions on steering, accelerating and braking using computer vision.

Traffic Management

Applications are used to monitor and manage traffic, including detecting and analyzing congestion, monitoring and managing parking spaces, and identifying and enforcing traffic violations.

Safety Systems

Safety system applications are used to alert drivers of potential hazards they may encounter on the road. Being able to identify pedestrians, cyclists, other vehicles, and other potential hazards on its own.

Airport Security

Airports use computer vision to identify potential security threats and prohibited items, such as weapons, liquids, explosives, contraband and other threats that may compromise the security and integrity of the establishment.

Module 3 Tools of the Trade

This module was very important to me because this was the first time I was exposed to, and used Jupyter notebooks learning the platforms we would be using was very essential in my growth as an AI major. Also not being familiar with creating a Github repository, or just using the platform in general was informative on organizing and structuring projects. In this module I learned how to create my own repository on Github. Install Jupyter notebooks, and began to gain familiarity with Google colab, and AWS. I created my first notebook, learned how to add a markdown cell, code cell, and run the cells properly in Jupyter. Another important thing I learned was how to properly export the code files as HTML & ipynb.

Module 4 Fundamentals of Image Processing

Module 4 was hands down one the funniest assignments in this class for me as a group we had to pick one challenge and explore the different realms of image processing in a very fun interactive way. My group had the challenge of Dominion of OpenCV and Pillow. We created a fun video detailing the day in the life of a developer that uses OpenCV and Pillow in their daily work.

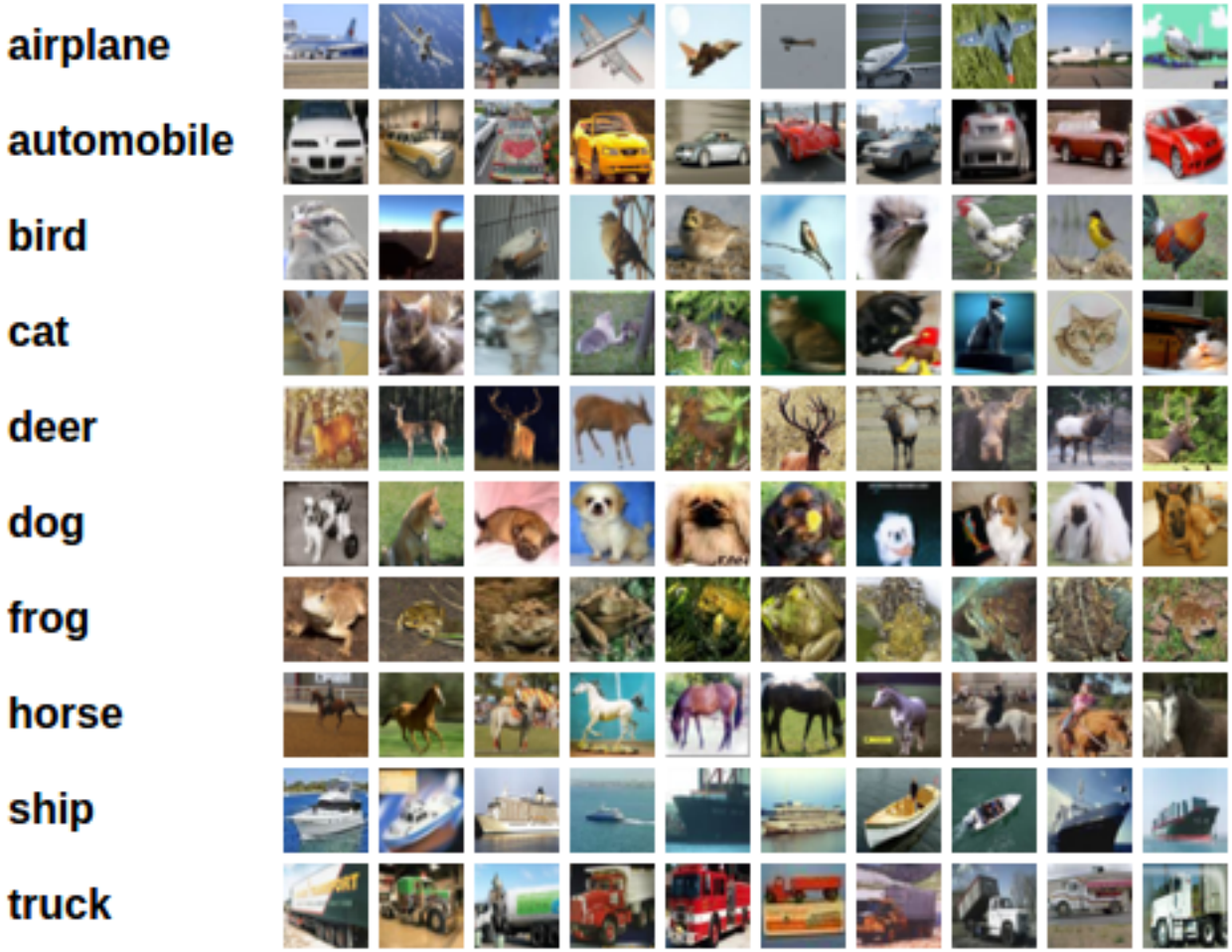
OpenCV is an advanced open source library used for computer vision and image processing. It has the capabilities to read and write images such as, JPEG, PNG, TIFF, PDF, & etc. It's responsible for tasks like resizing, cropping, rotating, and filtering video & photos.

Pillow is more so designed for simple basic manipulation while OpenCV is more advanced. Pillow is associated with an older Python library. Just because it's more simpler, and not as new doesn't mean its not efficient as well.

Some of the advantages of OpenCV are advanced image processing, optimization for performance, advanced filter and effects, and real time video support. Some of the disadvantages of OpenCV is a steeper learning curve. It's definitely more complex when it comes to learning vs. Pillow. Limited support for drawing text/shapes, and being more complicated in task like resizing or saving an image where Pillow may be the better choice. It was very informative diving into these different libraries to gain an understanding of their capabilities.

Module 5 Machine Learning for Computer Vision

Module 5 is definetly where things began to pick up extensively for me. Using Jupyter notebooks I began getting familiar with different libraries such as scikit-learn, matlpotlib, numpy, and tensor flow. This is also when the CIFAR-10 dataset was introduced which is a data set that contains images of 10 different classes.



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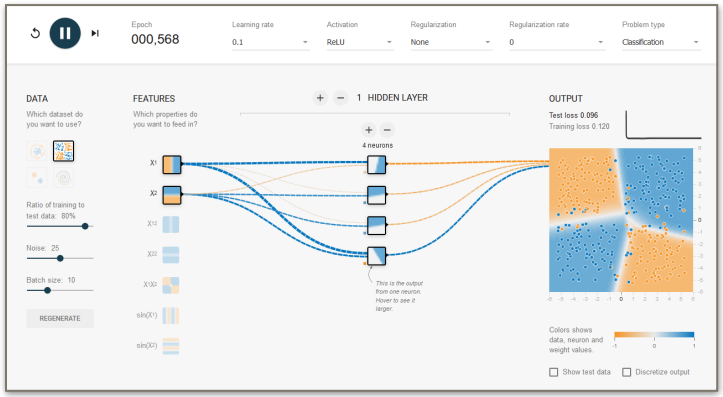
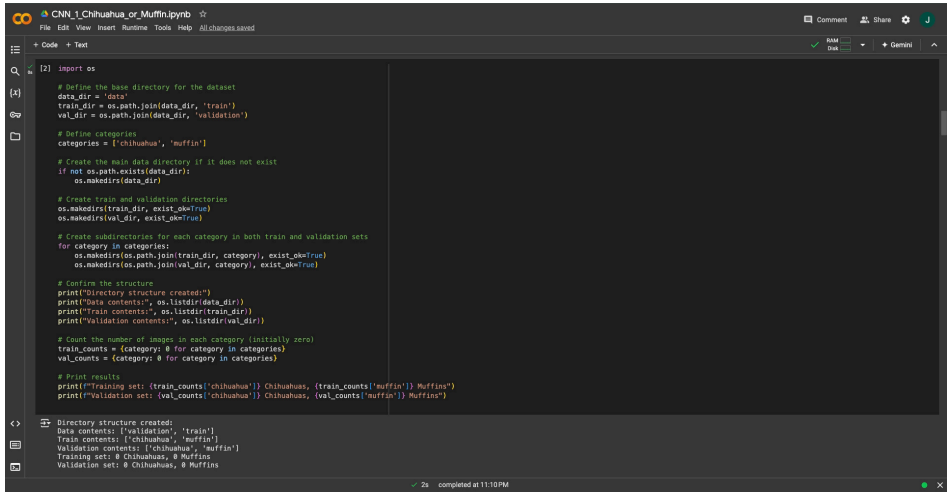
Module 6 Basic of Neural Networks

Neural networks are a type of artificial intelligence that attempt to simulate how the human brain works. They are composed of layers of neurons, which are interconnected units that process information. The key components of a neural network include input layers, hidden layers, and output layers. Information flows through these layers, where the neurons apply mathematical functions to make predictions or classifications. The significance of neural networks lies in their ability to recognize patterns in complex data, making them essential for tasks like image recognition and natural language processing. Activation functions, neurons, learning rates, and the structure of hidden layers all contribute to how effectively a neural network can learn from data. These components play a crucial role in how the network processes information and adapts to various types of data. Understanding how each parameter influences performance helps in designing more effective neural networks. This module was pretty fun and hands on because we actually got to experiment with a neural network simulator by changing parameters, neurons, and etc to see how it performed with multiple changes.



Module 7 Convolutional Neural Networks

This was a very fun lab to partake in learning, and adjusting more on how to incorporate different datasets, debugging and correcting syntax, doing extensive research to understand how to implement everything. CNN which is a convolutional neural networks is a neural network used for processing grid data, such as images. Unlike traditional fully connected networks CNNs use spatial structure from input data making them very effective for tasks like image classification. I personally used the CIFAR-10 dataset to train my CNN model for this case.



Module 9 Advanced CNN Architectures

This lab on object detection introduced essential concepts by using a pre-trained SSD MobileNet V2 model, making it accessible even with limited computational resources. Leveraging a pre-trained model means we could avoid the heavy computational demand of training from scratch. This approach allowed us to explore object detection without the need for a high-performance machine, focusing instead on understanding how the detection process works. The exercise covered key components like bounding boxes, class labels, and confidence scores, enabling us to see how models can classify multiple objects within a single image and accurately localize them with bounding boxes. A particularly interactive aspect of this lab was trying out detection on custom images, which was a hands-on way to deepen our understanding of object detection fundamentals.

Github Repository Link:

https://github.com/JefferyDirden/1371-Portfolio