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Chihuahua vs Muffin Journal

The Chihuahua vs Muffin workshop is a playful and creative experience for beginners who want to expand their skills and knowledge of machine learning and image classification. It is used in design and perception studies to discover visual recognition and classification techniques. It is a challenge to discern between images of Chihuahuas and muffins, giving us more sharpen visual acuity and classification skills. In the workshop it shows how one can get confused by how similar edges and textures are, emphasizing the importance of context and perspective. It helps participants to think outside the box and find unconventional ways of categorizing objects based on visual cues. The workshop provides many codes already displayed with images to help guide the participant and fill in what is needed to complete the correct code. The techniques used were presenting images in a randomized order,  and AI algorithms like transfer learning and convolution neural networks to analyze visual features. Overall it is an experience to learn and gain skills to work visual perceptions and classification systems.

    Some key concepts that I learned more in-depth include image classification, convolution neural networks, and transfer learning. Image classification is a task in computer vision where the main goal is to categorize images into one of the many predefined classes. It trains models, and the most common are convolution neural networks on a labeled dataset of images. In the process of training, it finds patterns and learns features from the images that tell apart classes. After the model is trained, it can predict the class of new unknown images, because of the learning features it achieved. Convolution neural networks are a deep learning model meant to essentially process and analyze visual data. They are designed to automatically and adaptively learn spatial hierarchies of features with many layers. To start off it works with convolutional layers that apply filters over tiny areas of inputted data, extracting local features such as edges and textures. Pooling layers then take in the sample and reduce complexity to only have the important features. Lastly, fully connected layers take the features persevered and make predictions or classifications out of them. Transfer learning is a machine learning technique where the model trained on one task is manipulated for a different but similar task, typically requiring less data and computation than training a model from scratch. Often involving the use of pre-trained neural networks as a starting point and fine-tuning it on a new dataset to manipulate the learned features and parameters for improvement. These three techniques offer efficiency, versatility, flexibility, and opportunities to be used many applications.

   Some challenges I encounter where at the start of the notebook, because I couldn’t get the file code to upload correctly, leading to all the codes not working. I solved it by meeting up with the professor and she helped me through it by solving the indentation problem with the code, and giving me more knowledge about how image classification works. Some other problems that occurred were that when running the code it took a while to load the results, which was frustrating, but I reopened the website several times and it stopped happening. Overall the main challenge was to understand what was going on during the project, but one just has to focus and try to comprehend the situation. The challenges were difficult, but with patience and determination it can be solved.

   Some insights I gained from machine learning and image classification are how computers interpret and categorize visual data. Using algorithms like conventional neural networks helps automate tasks of identifying objects in images with higher accuracy and easier control. The importance of extraction, meaning where patterns and unique features are found in images and taken to be able to classify them. This differs from traditional methods, but emphasis the evolution of large-scale datasets in achieving breakthroughs in accuracy and generalization. Understanding these new insights enhances the ability to build more efficient, robust models, and opens path to many applications in fields from finance business to medical diagnostics.

   The techniques learned have many uses and have been inputted in potential real- life applications like object detection, facial recognition, medical imaging, and many more. For example in object detection, image classification identifies and assigns a label to all objects in an image, and uses CNN to be able to classify objects into categories based on their features, while transfer learning makes it faster when fine tuned. This has brought the evolution of object detection, because it enables cars to detect driving lanes, and works well in video surveillance or image retrieval systems. In facial recognition the goal is to be able to identify individuals based on their unique facial features, often requiring deep learning models such as CNN to extract special features, with the help of transfer learning to fine tune it and adapt it. Image classification trains a dataset containing labeled pictures of faces, that during training the network learns to identify someone by their individual features. In medical imaging both image classification and CNN help analyzes and classify medical images to identify different diseases, tissue types, anomalies, etc. They aid in diagnosing conditions, planning treatments for patients, and improving overall patients care. Image classification often employs CNNs trained on annotated datasets and corresponding labels. CNN uses its layers to extract hierarchical features relevant to medical conditions, while transfer learning leverages the pre-trained CNNs and adapts them to medical imaging tasks.

    My personal reflection on the learning experience was good overall, because I feel that with the guides that were provided, one can learn easier or better understand it, because you have comprehensive examples and suggested improvements to foster the nuances involved in image classification. In hindsight, this experience taught me more than just technical skills. It prominences patience, persistence, and systematic problem solving. The structured approach provided of the notebook facilitated learning and encouraged exploring beyond the basics, pushing past to more advanced techniques. The notebook experience served as a valuable foundation, giving me essential knowledge and confidence to tackle future challenges in the field of machine learning.

References:

*What Is Transfer Learning? - Transfer Learning in Machine Learning Explained - AWS*, aws.amazon.com/what-is/transfer-learning/. Accessed 4 July 2024.

“ArcMap.” *What Is Image Classification?-ArcMap | Documentation*, desktop.arcgis.com/en/arcmap/latest/extensions/spatial-analyst/image-classification/what-is-image-classification-.htm. Accessed 5 July 2024.

Larry Hardesty  |  MIT News Office. “Explained: Neural Networks.” *MIT News | Massachusetts Institute of Technology*, news.mit.edu/2017/explained-neural-networks-deep-learning-0414. Accessed 5 July 2024.

Kampakis, Dr. Stylianos (Stelios). “Real World Machine Learning Examples: Image Classification.” *The Data Scientist*, 3 Dec. 2023, thedatascientist.com/real-world-machine-learning-examples-image-classification/.