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Professor: Patricia McManus

ITAI 1378 Comp Vision

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Reflective Journal

This workshop focused on creating a model that classifies images as either a chihuahua or a muffin. The main goal was to learn how machine learning, particularly convolutional neural networks (CNNs), can be applied to image classification. We used CNNs because they are designed to handle the complex nature of image data, and we also explored transfer learning to make our model more efficient.

Key Concepts Learned

The core concept of the workshop was image classification, which refers to the process of training a model to categorize images into different groups or classes based on their visual content. This process involves analyzing the features of the images, such as color, texture, and shapes, to make accurate predictions. CNNs were central to this task, as they are particularly effective for image-related tasks due to their ability to automatically extract important features like edges, patterns, and more complex structures from images without requiring extensive manual feature engineering. We used several layers in our CNN model, which detect low-level features, to deep layers that capture high-level abstractions, ultimately leading to the final predictions made by the network.

We also worked with transfer learning, a powerful technique that leverages existing pre-trained models instead of training a model from scratch. By using a pre-trained model like RedNet, we can take advantage of the knowledge that the model has already gained from training on a large dataset, such as ImageNet. This approach not only saves significant time and computational resources but also enhances model performance. As the model has already learned useful features that can be applied to our specific task of classifying chihuahuas and muffins.

Challenges Encountered

One challenge I faced was handling the data size. The images needed resizing and normalization before feeding them into the model. It was tricky to get the image dimensions right at first. I overcame this by using PyTorch’s transform.Resize function, which ensures that all images are resized consistently.

Another challenge was optimizing the model’s learning parameters. I initially struggled with choosing the right leaning rate. After multiple experiments, I found that reducing the learning rate improved the accuracy of the model’s predictions. This trial-and-error approach helped me understand the importance of fine-tuning hyperparameters.

Insights Gained

Through this workshop, I gained a better understanding of how CNNs work for image classification. CNNs use layers to detect features at various levels, mimicking how humans

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visually process information. Transfer learning also became clear to me as an efficient way to reuse knowledge from one task to solve another, speeding up model training.

Real-World Applications

The techniques learned in this workshop have numerous practical applications across various industries. In healthcare, image classification using CNNs can be utilized to analyze medical images such as X-rays, MRIs, and CT scans. This capability can assist doctors in diagnosing diseases like cancer by identifying abnormal patterns in medical images that may be overlooked by the human eye. Another significant application is in the field of autonomous vehicles, where images classification is crucial for object detection. Self-driving cars use advanced CNNs to identify pedestrians, traffic signals, and other vehicles on the road, enhancing safety and navigation.

In retail, companies are increasingly employing image classification to automate inventory management and improve customer experience. For example, retailers can analyze images of store shelves to monitor stock levels and ensure that products are displayed correctly. Additionally, social media platforms utilize these techniques for image tagging and content moderation, automatically categorizing and filtering user-uploaded content based on its visual characteristics. These examples illustrate the versatility and impact of image classification techniques in solving real-world problems, making them invaluable in today's data-driven landscape.

Personal Reflections

Overall, this workshop was a great learning experience. It showed me the practical side of machine learning and how models handle real-world data. I learned the importance of optimizing models to improve performance. Going forward, I'm excited to dive deeper into machine learning, especially areas like object detection and more advanced CNN architectures.

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