Kaire Campomanes

Professor Patricia Mcmanus

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Lab 07 Reflective Journal

This lab involved the use of Convolutional Neural Networks for image classification; it focused primarily on how to make a difference between pictures of chihuahuas and muffins. These are my reflections on key aspects of CNN architecture, model performance, comparison to traditional neural networks, challenges, real-world applications, and ethical considerations.

Architecture of CNN

In this assignment, an Image Classification task was performed using a Convolutional Neural Network. CNNs represent a deep learning architecture that is particularly suited to image data. They are specialized neural networks because they have convolutional layers that extract general features through filtering—in the case of images, these are typically edges, textures, and shapes. This hierarchical nature inherently makes CNNs, by design, very effective for computer vision, as compared to traditional neural networks, which are fully connected and lack the capabilities mentioned above. The architecture of the CNN used here comprises multiple convolutional layers followed by pooling to downsample the dimensionality and retain important features. Finally, extracted features were fed into fully connected layers to perform the classification.

Comparison with Traditional Neural Networks

It outperformed the traditional approach of neural networks in comparison to the model that had been used in a previous workshop. Besides, the extra time to train the CNN was needed because of the complexity of the architecture and the necessity to process high-dimensional image data. However, despite longer training—which took a little more time—the superior performance of the CNN made them a far better choice for image classification tasks, especially when dealing with a special and complex dataset like "Chihuahua vs Muffin."

Problems and Solutions

Since I knew how to approach this data, it was easier to work on and adjust the inputs and parameters to get better performance. Iteratively experimenting with hyperparameters such as learning rates and batch sizes manages to yield better results in fine-tuning the model. One was related to learning how changing the number of epochs or adjusting the learning rate consumes the model's performance. I tried initially operating with fewer epochs, but soon came to realize that increasing the epochs can enable the model to learn better, hence improving the overall performance of the model. I got better with identifying optimal configuration settings for CNN through trial and error.

Real-World Applications

The variety of image classification models that can be used in this task has several real-life applications. For instance, CNNs find wide applications in face recognition, medical imaging to identify tumors from MRI scans, and more recently in autonomous drive systems, which apply it to identify pedestrians, vehicles, and traffic signs. It is their ability to learn those

hierarchical features that makes CNN useful in domains where exacting image classification is called for. Besides, such models could find good applications in e-commerce for product identification or visual searches. For example, one system can be built to help users find products through image uploads for intuitive search capabilities.

Ethical Issues

Despite the many advantages of CNNs and other machine learning models, there are also ethical concerns to be raised, mostly associated with bias and fairness. Individual cases can include biases of image classification models regarding the nature of the training data—if a dataset is small, then the model may underperform for some groups and make biased predictions. Facial recognition systems have been especially criticized because of having lower accuracy in identifying people from minority ethnic groups.

Furthermore, there are privacy concerns when deploying image classification models in areas such as facial recognition. These systems can be used for surveillance without people's consent, raising questions about the balance between security and individual privacy rights. Developers must consider these ethical implications when creating and deploying machine learning models.

Conclusion

This lab was both a valuable learning experience and showed off the power and complexity of deep learning models. While the CNN outperformed the traditional neural network, it also posed new challenges in terms of misclassifications and ethical concerns. As I continue to explore deep learning and computer vision, I am more mindful of the importance of

diverse data, model transparency, and the ethical considerations that accompany the deployment of AI models in real-world scenarios.

Works Cited

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