L06 Chihuahua or Muffin

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ITAI-1378: Computer Vision Artificial Intelligence

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**Introduction / Summary of the workshop**

This laboratory workshop will walk you through the creation of the simple neural network classifier that was able to determine between the images of the muffin and chihuahuas. Furthermore, I will be talking about how I have applied various machine learning techniques for the image classification. This includes data preprocessing, building simple neural network architecture, optimalization and learning rate scheduling. At the very end of the workshop, we have also reviewed the accuracy scores and visual results which was key element for me to really understand how the system understanded the provided data.

Overall, I very much enjoyed the objectives of this laboratory workshop, and I have learned several key concepts including image classification, basics of the neural networks, forward and backward propagation and accuracy evaluation. Some of the terms were new to me and I had to learn first the meaning in order to proceed with the workshop.

**Understanding Image classification, Neural networks, Forward and backward propagation, Learning rate scheduler.**

From the previous assignment I have learned what the image classification means and how it is applied in computer vision. This was very beneficial to know as this was the hand on application with the image processing. I can now imagine how the image processing works for the Healthcare system. At least I believe I know the basics.

Neural network is not a new term to me as we have covered this term in artificial intelligence history, but Forward and backward propagation [1] was something new I have learned today. These concepts were critical on how the network learns from the data. How it calculates the predictions during the forward pass and how it is adjusting weights during the backward pass based on the error that it has encountered.

Important part of the assignment that was an Aha moment for me was the optimization technique such as learning rate scheduler [2] which reduced the learning rate periodically to ensure that the network is more effective.

*I have to say that I am starting to realize that I really enjoy working with the data and the way the data are analyzed. I believe this is very beneficial to my daily work as I am working in quality management area.*

**Workshop challenges and insights gained during the workshop**

During the workshop I have faced multiple challenges. I believe the significant one was the image preprocessing. At first, I was unsure how to address different sizes of the images that were provided as part of the dataset. To overcome this, I have used ChatGPT to review the options that can be applied (OpenAI, personal communication, October 1st, 2024). I have figured out that we can perform resizing and padding to ensure that all the images were standardized to a specific size 200x200. Later during the actual data training, I have tried different size (128x128) to see how it impacts the final accuracy. Furthermore, I wanted to ensure that the aspect ratio will remain intact as I was unsure whether it can have impact or not. By common sense I believe it will have impact. So, I have applied the code that covered the previously mentioned concerns. This was another Aha moment for me as I have learned how to ensure that the preprocessing is done correctly.

A collage of different types of muffins

Description automatically generated Secondly, I had a challenge with the optimizer. I have tried several techniques that I have observed on the official PyTorch website [4]. At first, I have tried to use the SGD model, but I was not successful. After that I have used the Adam optimizer with the 0.001 learning rate set. I found this the optimal to receive high accuracy rate.

One of the biggest insights I have learned with this workshop was how important is to play and experiment with the learning rate, number of epochs and the batch size. Changing just a single value by a slight increase or decrease had significant impact on the final accuracy. This can be seen in Figure 1 on the right side.

Figure 1 – example of validation set.

**Real World applications**

As I have mentioned earlier, medical imaging is a very close topic to me, and I am happy that I have learned the basics today on how the images are processed. I believe that in the near future we will see significant improvement in healthcare industry when it comes to X-ray and MRI image reading turnaround times thanks to medical image processing.

Secondly, we can see that some of the Security companies are improving the detection of the objects. Me personally, I have security camera from Netatmo. Their accuracy in people or animal detection is somewhere around 60-70% and I believe this is something that can be still improved.

**Conclusion / personal Reflection**

The workshop was very engaging and have significantly improved my knowledge of the image processing. I have appreciated the walk-through the processes, but I have also enjoyed tweaking some of the code to improve the desired outcome. This workshop has also impacted me on my profession side, where I can see real world application in my role as a quality manager. I will further review and learn deeper on how the image processing works.

**Resources:**

[1] GeeksforGeeks. (2024b, July 9). *Backpropagation in neural network*. GeeksforGeeks. <https://www.geeksforgeeks.org/backpropagation-in-neural-network/>

[2] GeeksforGeeks. (2024a, January 6). *Understanding PyTorch Learning Rate scheduling*. GeeksforGeeks. <https://www.geeksforgeeks.org/understanding-pytorch-learning-rate-scheduling/>

[3] OpenAI. ChatGPT. Accessed October 1st, 2024. <https://chat.openai.com>

[4] *torch.optim — PyTorch 2.4 documentation*. (n.d.). <https://pytorch.org/docs/stable/optim.html>