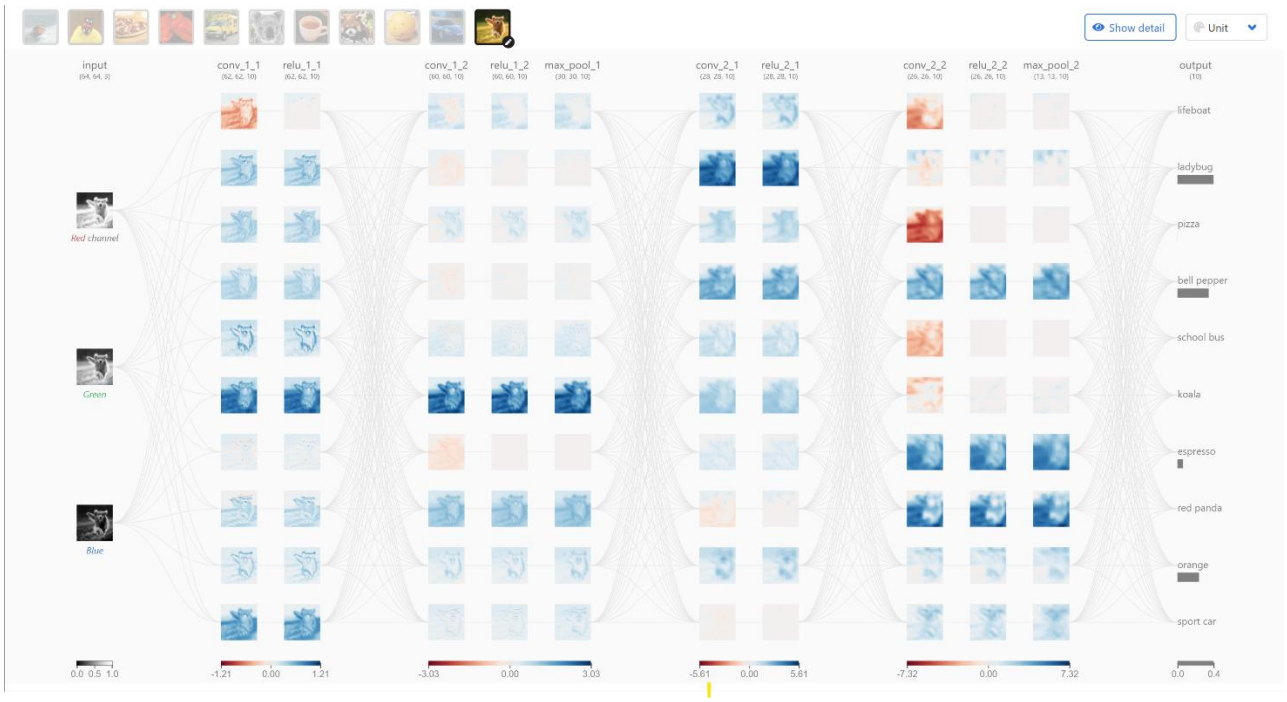
Exploring CNN Image Recognition: Observing Feature Processing and Classification Challenges

I have been experimenting with the CNN Explainer by uploading various images, starting with those similar to the model's training set, to observe its classification performance. Predictably, the model had no trouble correctly identifying pictures such as an espresso or a red panda. To challenge it further, I uploaded an image of a dog.

(Figure 1, The Conversation, 2024)

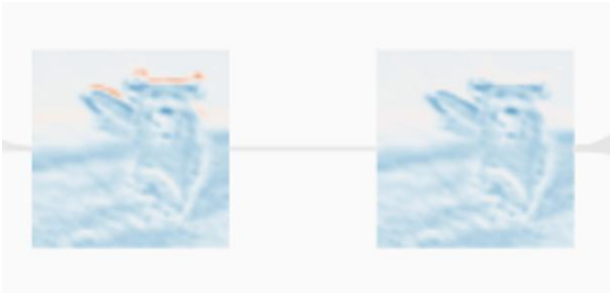
Knowing that "dog" was not included in the classifier's classes, I was curious to see whether it would classify the image as one of the animals present in the model.

Surprisingly, the model did not find the dog similar to a koala or red panda but instead classified it as most similar to a ladybug, followed by a bell pepper and an orange.



(Figure 2, CNN Explainer, n.d.)

This exercise allowed me to observe how features were processed through various layers of the CNN. The ReLU (Rectified Linear Unit) layers enhanced key patterns by retaining positive values while filtering out irrelevant details. For instance, in relu_1_1, features like the dog's edges and textures became more pronounced, highlighting crucial elements of the image.



(Figure 3, from left: conv_1_1, relu_1_1, CNN Explainer, n.d.)

The max-pooling layers further refined these features by reducing spatial dimensions while preserving essential details. In max_pool_1, the feature maps were simplified, focusing on the dog's overall shape and contours, making the model more efficient and robust.

(Figure 4, from left: conv_1_2, relu_1_2, max_pool_1, CNN Explainer, n.d.)

As the image progressed through the network, the extracted features evolved from simple edges to more complex, high-level representations, showcasing the CNN's hierarchical processing of visual information.

References:

CNN Explainer (n.d.) *Interactive explanation of convolutional neural networks*. Available at: https://poloclub.github.io/cnn-explainer/#article-relu (Accessed 26 Jan. 2025)

The Conversation (2024) *Image of a dog*. Available at: https://images.theconversation.com/files/625049/original/file-20241010-15-95v3ha.jpg?ixlib=rb-4.1.0&rect=4%2C12%2C2679%2C1521&q=20&auto=format&w=320&fit=clip&dpr=2&usm=12&cs=strip (Accessed 26 Jan. 2025).