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Chapter 4 Reflection

1. Please give a brief summary of the chapter?

The chapter begins with the reason behind CNN. To work with images such as xrays it is important to recognize that each individual pixel has other information gained from analyzing neighboring pixels in order to accurately represent the data. The chapter then starts talking about CNNs and how they work. In a single matrix scenario, there is an input matrix and a kernel that is convolved through the input matric performing dot products are recording that value. If we train that kernel to have optimized values for the subsequent dot product we can generate predictions.

We go over the motivation again. A CNN can capture special and temporal values of a given data point for scenarios where that could matter, such as an x-ray. CNNs have a benefit to them known as translational invariance which allows them to not have to worry about their sliding pattern to generate accurate predictions. Within localized sections of an image, the CNN can grab large amounts of detail and properly adjust the kernel to match that.

The chapter then goes into techniques we need to use to make convolution possible. We use padding to adjust the size of the input matrices for our desired step size and kernel size to make the convolution work. The padded values are almost always 0. Adjusting the stride of the kernel's convolution is another technique. This can adjust the computation as needed and we can still grab an accurate representation through the CNN. We can then average out values even more in a pooling layer, or we can take the maximum or minimum value from an input. This allows us to retain essential values for ease of computation.

The chapter then discusses the other types of modern CNNs that exist like LeNet and AlexNet and moves onto the example implementation which is using X-Ray images to classify a diagnosis.

2. What improvements do you want to see in this chapter? Please elaborate on them

It is incredibly difficult to do but I would like to see better visualizations of convolution. The graphs and images displayed here are very easily implementable and useful for those who have good enough ability to picture mathematics in their mind. However, with a topic that is more graphical than it is mathematical, an investment into the display of graphics is widely appreciated. A series of high quality well designed graphics depicting the act of convolution would make the lesson much easier to grasp. Especially because there are people who do not have ease when it comes to moving the filter, which is just a matrix of numbers, onto another matrix.

3. What are the typos in this chapter?

- Page 57: “Back to the old days” should be “Back in the old days”

Otherwise, no other changes were noticed.

4. Which part of the chapter do you like most?

I liked the motivation section of CNN a bunch. I think giving reason as to why we investigate, design, and develop the naïve approaches of deep learning is incredibly useful. Giving use cases to solve a problem helps people understand what they are doing and why. Furthermore, it gives them more of a reference to base off of when they need to use a CNN in the future. They can now think, “this is like analyzing an x-ray and I should use a CNN for this”. That kind of experience is extremely valuable.

5. What are the most useful things you learned from this chapter?

The most useful part of this chapter was the code blocks. PyTorch is an extremely powerful library, and it bears mentioning that seeing example code for a realistic example task helps students understand how to use this software for their own studies.

As we get deeper into the study of neural networks and deep learning techniques, knowing how to use the tools of study effectively is a great asset. The example at the end of the chapter which walks through an entire example is perfect for explaining how one uses PyTorch to make a CNN.

References

Xiao, C., Sun, J. (2021). Introduction. In: Introduction to Deep Learning for Healthcare. Springer, Cham. https://doi-org.proxy2.library.illinois.edu/10.1007/978-3-030-82184-5_1