Course : CS 598 Deep Learning for Healthcare

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**General Questions**

1. **Please give a brief summary of the chapter?**

Convolutional Neural Networks (CNNs) have become prominent for their effectiveness in processing image and time series data, with origins traced back to Neocognitron by Fukushima & Miyake in 1980 and further developed by LeCun et al. in 1989 for digit classification. CNNs offer specialized architectures capable of discerning patterns in grid-like data structures, such as EEG signals, chest X-ray images, and CT scans, overcoming limitations of traditional models that treat each pixel as an individual feature. Through convolution operations inspired by human visual processing, CNNs enable the extraction of spatial relations in images, paving the way for powerful new architectures.

Motivations for CNN: Two fundamental motivations underpin the design and success of CNNs are:

1. **Translation Invariance** in CNN ensures that the network can detect and recognize features regardless of their position in an image.
2. **Locality** emphasizes the importance of capturing local features in the data. Instead of focusing on the entire image at once, CNNs assess small localized regions.

Convolutional layers are fundamental building blocks of Convolutional Neural. the convolutional layer also involves the padding and striding operations. In CNNs, pooling is a crucial down-sampling operation aimed at reducing the spatial dimensions of feature maps, thereby making the network more computationally efficient and less prone to overfitting.

The chapter describes a few modern CNN architectures.

1. **LeNet’s**
2. **AlexNet**
3. **VGGNet**
4. **GoogLeNet**
5. **ResNet**
6. **DenseNet**

The last section explores using PyHealth to classify chest X-ray images into various diseases, including Lung Opacity, COVID-19, and Viral Pneumonia.

1. **What improvements do you want to see in this chapter? Please elaborate on them (50 Points)**

The example in the textbook for analyzing chest X-Ray images and classify them using PyHealth was very interesting. I was able to try this locally in a local environment. I look forward to doing more of such examples in the future.

The chapter also explains different types of modern CNNs, this was very interesting. I am learning more about these CNN architecture myself.

1. **What are the typos in this chapter? (20 Points)**

I was not able to find any typo.

1. **Which part of the chapter do you like most? (10 Points)**

The section about different types of modern CNNs was very interesting. I recommend adding more to the list.

1. **What are the most useful things you learned from this chapter? (10 Points)**

The most useful thing I learned is the exercise in section 4.3 for analyzing chest X-Ray images. I tried the exercise myself and it was very helpful to add to the understanding from the textbook.