CONTI6128

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CAS Advanced - Day 6 ✏️

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                                                    SOC-47865884

1. What are the advantages of a CNN over a fully connected DNN
        for image classification ?

        🗑️

(i) First, consecutive layers are only partially connected and because
     it heavily reuses its weights, a CNN has many fewer parameters
     than a fully connected DNN, which makes it much faster to train,
     reduces the risk of overfitting and requires much less training
     data. Second, when a CNN has learned a kernel that can detect a
     particular feature, it can detect that feature anywhere on the
     image. In contrast, when a DNN learns a feature in one location, it
     can detect it only in that particular location. Since images
     typically have very repetitive features, CNNs are able to
     generalize much better than DNNs for image processing tasks
     such as classification, using fewer training examples. Finally, a
     DNN has no prior knowledge of how pixels are organized. It does
     not know that nearby pixels are close. A CNN's architecture
     embed this prior knowledge. Lower layers typically identify
     features in small areas of the images, while higher layers combine
     the lower-level features into larger features. This works well with
     most natural images, giving CNNs a decisive head start compared
     to DNNs.

2. Why would you want to add a max pooling layer rather than a convolutional layer with the same stride ?

(i) A max pooling layer has no parameters at all, whereas a convolutional layer has quite a few.

3. If you run out of memory while training a CNN, what are five things you could try to solve the problem ?

(i) Reduce the mini-batch size ; Reduce dimensionality using a larger stride in one or more layers ; Remove one or more layers ; Use 16-bit floats instead of 32-bit floats ; distribute the CNN across multiple devices.

4. When would you want to add a local response normalization layer ?

(i) Such a layer makes the neurons that most strongly activate inhibit neurons at the same location but in neighboring feature maps, which encourages different feature maps to specialize and pushes them apart, forcing them to explore a wider range of features. It is typically used in the lower layers to have a larger pool of low-level features that the upper layers can build upon.

5. Can you name the main innovations in AlexNet compared to LeNet-5 ? What abou tthe main innovations in GoogLeNet and ResNet ?

The main innovations in AlexNet compared to LeNet-5 are it is much larger and deeper and it stacks convolutional layers directly on top of each other instead of stacking a pooling layer on top of each convolutional layer. The main innovation in GoogLeNet is the

introduction of inception modules, which make it possible to have a much deeper net than previous CNN architectures, with fewer parameters. Finally, ResNet's main innovation is the introduciton of skip connections, which make it possible to go well beyond 100 layers.

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Multiple Choice   **True / False**   **Short Answer**

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