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Teaching

Advanced Mining Learning, Sep-Dec 2021

Advanced Machine Learning

Sep–Dec, 2021

Assignment 1: DNNs and CNNs

31 October, 2021
Due ~~14 November~~ 19 November, 2021

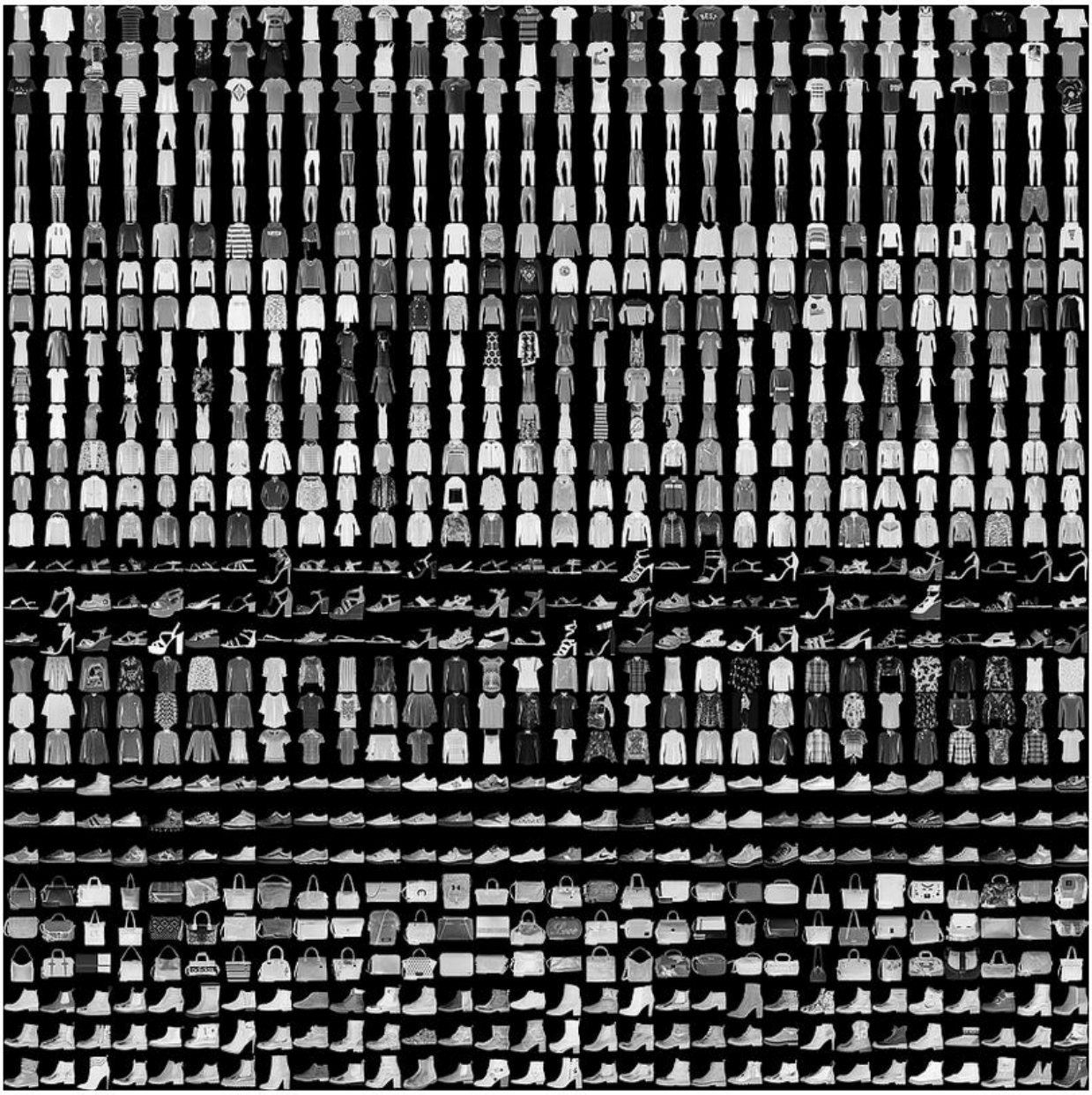
The Task

1. In Lectures 4 and 6, we explored DNNs and CNNs for MNIST. By scrambling the images, we observed that DNNs do not seem to use visual information, wheras CNNs do.

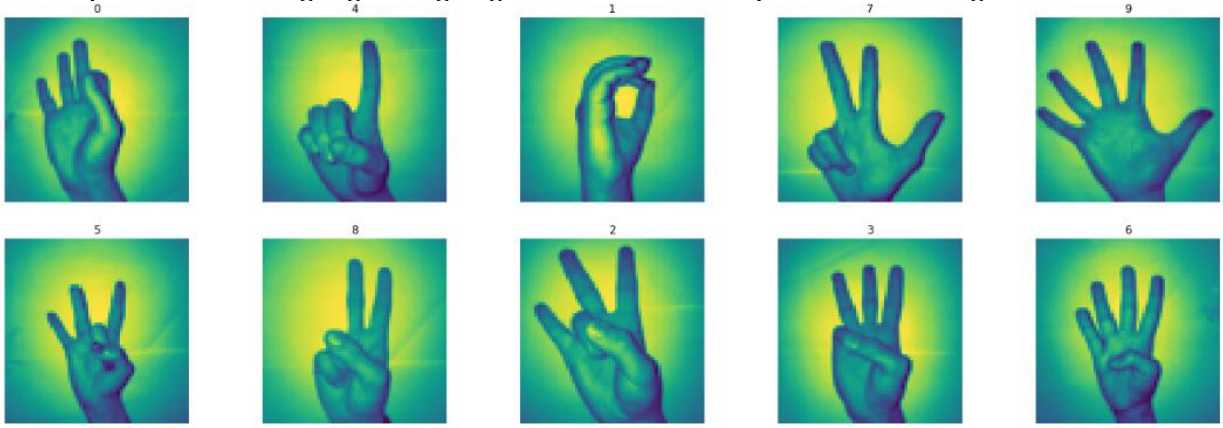
   Try a similar experiment with the following datasets and report your findings.

   - The Fashion MNIST Dataset contains 60,000 training images and 10,000 training images, each 28×28 pixels, representing ten classes of clothing. Here are examples of

the images.



- The Sign Language Digits Dataset contains 2062 64×64 pixel images of the digits 0 to 9 represented using sign language. Here are examples of the images.



2. The parity function takes as input a vector of 2n bits and checks if the number of 0's (and 1's) in the input is even. It is more convenient to think of the input as a vector $(x_1, x_2, ..., x_{2n})$ where each $x_i \in \{-1,+1\}$. The parity function then reports the product $x_1x_2...x_{2n}$, which is +1 if the parity is even and -1 if it is odd.

- Try to train a DNN for the parity function on 64-bit inputs. Use randomly generated training sets of sizes 2000 and 5000 and test the results on a suitable validation set.
- Manually design a good network for the parity function and compare its results with respect to the DNNs that were learned from training data.

Solving the Task

- Submit three separate Python notebooks that contain your code and the outcomes of your experiments, with suitable explanations.
    1. One with the DNN vs CNN experiments for the Fashion MNIST and Sign Language Digits datasets.
    2. One with the DNNs that learn the parity function from training data.
    3. One with the manually constructed network for the parity function.
- You may use Kaggle or Colab for this. In this case, you can also submit a link to your notebook via Moodle.
- You may work alone or in groups of two. Each group makes a single submission to Moodle. Use either person's Moodle account to submit. The submission should mention the names of the two partners.

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