

Deep Learning Applications for Computer Vision

Lecture 17: Convolutional Neural Network
Tutorial with TensorFlow

The Data

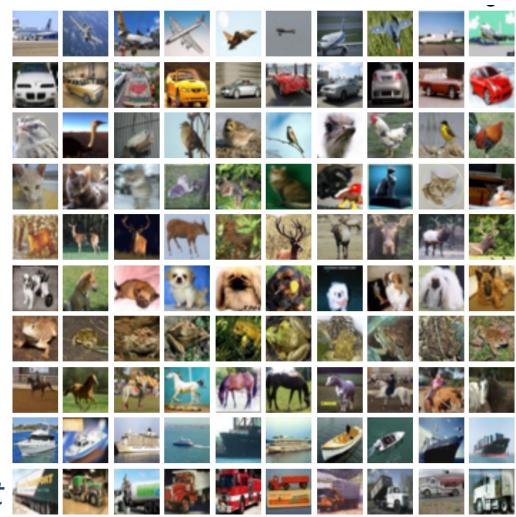
Last tutorial: CIFAR-10 data

Last model:

- Input layer
- Output layer

Today: CNN model in *TensorFlow*

- conv2D layers
- maxPooling2D layers
- build, train, assess, predict
- visualize learned filters



TensorFlow tutorial

File name:

- Build_train_CNN_CIFAR10.ipynb
- Build_train_CNN_CIFAR10_v2.ipynb

What have we learned?

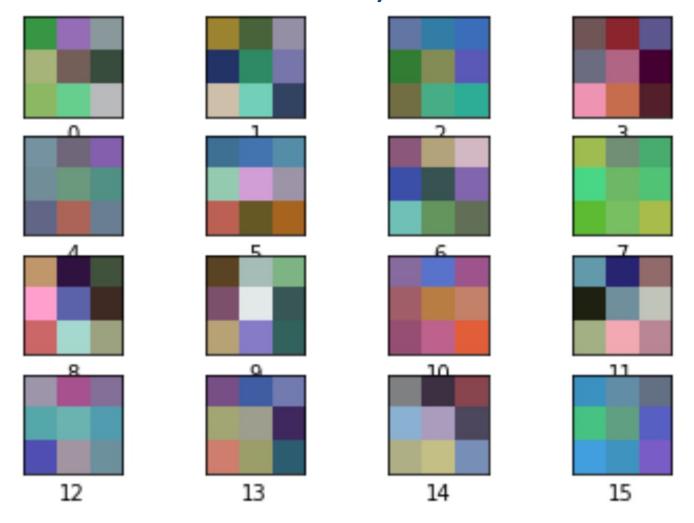
- 1. Import *TensorFlow* and **new** helper libraries
- 2. Load the data set.
- Pre-process data. Verify data shape and display
- 4. Build the network model
 - Sequential
 - Stack layers, one at a time
 - Every conv2D layer is followed by a MaxPooling2D layer
- 5. Choose Optimizer and loss function
- 6. Compile and train. Observe loss and accuracy over time
 - Accuracy improves with CNN
 - Accuracy improves with multiple conv2+MaxPooling2D layers
- 7. Run on *Testing Data*. Observe accuracy.
 - Look at testing accuracy vs training accuracy
- 8. Predict on new images
- 9. Visualize learned filters
 - In first convolutional layer
 - In later convolutional layers ???

System performance

- Time to train: on the order of seconds minutes
- Overall accuracy:
 - 74.6% on training data
 - 69.7% on testing data
- Number of parameters:
 - from 30K to more than 1 million

Visualizing the filters

For first convolutional layer



Visualizing the filters

- For second convolutional layer
 - does not have the shape of an image