Report

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nyhneil@work:~/convolutional-neural-network$ python3 cnn.py
Using TensorFlow backend.
Train image shape:    (49000, 32, 32, 3)
Train label shape:    (49000,)
Validate image shape: (1000, 32, 32, 3)
Validate label shape: (1000,)
Test image shape:     (10000, 32, 32, 3)
Test label shape:     (10000,)

############### Simple Model ########################
Iteration 0: loss = 2.226 and training accuracy = 20.65%, Validate loss = 1.075 and validate accuracy = 25.30%
Iteration 10: loss = 0.285 and training accuracy = 49.05%, Validate loss = 0.338 and validate accuracy = 42.90%
Iteration 20: loss = 0.214 and training accuracy = 59.20%, Validate loss = 0.268 and validate accuracy = 48.00%
Iteration 30: loss = 0.181 and training accuracy = 65.52%, Validate loss = 0.250 and validate accuracy = 52.00%
Iteration 40: loss = 0.163 and training accuracy = 69.73%, Validate loss = 0.253 and validate accuracy = 51.20%
Iteration 50: loss = 0.157 and training accuracy = 71.18%, Validate loss = 0.236 and validate accuracy = 55.30%
Iteration 60: loss = 0.146 and training accuracy = 73.48%, Validate loss = 0.234 and validate accuracy = 56.70%
Iteration 70: loss = 0.144 and training accuracy = 74.23%, Validate loss = 0.248 and validate accuracy = 52.20%
Iteration 80: loss = 0.143 and training accuracy = 74.93%, Validate loss = 0.245 and validate accuracy = 54.80%
Iteration 90: loss = 0.141 and training accuracy = 75.39%, Validate loss = 0.253 and validate accuracy = 55.70%
Testing loss = 0.261 and testing accuracy = 54.23%
Time = 892.2046 seconds.

############### Complex Model ########################
Iteration 0: loss = 1.955 and training accuracy = 17.09%, Validate loss = 0.367 and validate accuracy = 17.60%
Iteration 10: loss = 0.222 and training accuracy = 31.31%, Validate loss = 0.225 and validate accuracy = 29.50%
Iteration 20: loss = 0.209 and training accuracy = 36.12%, Validate loss = 0.215 and validate accuracy = 33.30%
Iteration 30: loss = 0.201 and training accuracy = 40.40%, Validate loss = 0.208 and validate accuracy = 35.00%
Iteration 40: loss = 0.196 and training accuracy = 43.05%, Validate loss = 0.205 and validate accuracy = 33.40%
Iteration 50: loss = 0.191 and training accuracy = 45.87%, Validate loss = 0.205 and validate accuracy = 31.80%
Iteration 60: loss = 0.187 and training accuracy = 47.85%, Validate loss = 0.207 and validate accuracy = 31.00%
Iteration 70: loss = 0.182 and training accuracy = 49.87%, Validate loss = 0.210 and validate accuracy = 30.00%
Iteration 80: loss = 0.176 and training accuracy = 52.78%, Validate loss = 0.211 and validate accuracy = 29.90%
Iteration 90: loss = 0.173 and training accuracy = 53.12%, Validate loss = 0.219 and validate accuracy = 27.50%
Testing loss = 0.224 and testing accuracy = 25.69%
Time = 2148.7769 seconds.
nyhneil@work:~/convolutional-neural-network$ vim cnn.py
```

without ngraph

```
nyhneil@work:~/convolutional-neural-network$ python3 cnn.py
Using TensorFlow backend.
Train image shape:    (49000, 32, 32, 3)
Train label shape:    (49000,)
Validate image shape: (1000, 32, 32, 3)
Validate label shape: (1000,)
Test image shape:     (10000, 32, 32, 3)
Test label shape:     (10000,)

############### Simple Model ########################
Iteration 0: loss = 2.213 and training accuracy = 19.38%, Validate loss = 1.077 and validate accuracy = 27.00%
Iteration 10: loss = 0.292 and training accuracy = 47.93%, Validate loss = 0.323 and validate accuracy = 42.80%
Iteration 20: loss = 0.225 and training accuracy = 56.96%, Validate loss = 0.269 and validate accuracy = 49.40%
Iteration 30: loss = 0.183 and training accuracy = 64.64%, Validate loss = 0.242 and validate accuracy = 53.00%
Iteration 40: loss = 0.167 and training accuracy = 68.25%, Validate loss = 0.238 and validate accuracy = 54.10%
Iteration 50: loss = 0.156 and training accuracy = 71.24%, Validate loss = 0.238 and validate accuracy = 55.70%
Iteration 60: loss = 0.148 and training accuracy = 73.02%, Validate loss = 0.243 and validate accuracy = 54.20%
Iteration 70: loss = 0.147 and training accuracy = 73.59%, Validate loss = 0.248 and validate accuracy = 53.10%
Iteration 80: loss = 0.137 and training accuracy = 76.01%, Validate loss = 0.254 and validate accuracy = 54.00%
Iteration 90: loss = 0.139 and training accuracy = 75.85%, Validate loss = 0.263 and validate accuracy = 52.60%
Testing loss = 0.258 and testing accuracy = 54.46%
Time = 1068.5533 seconds.

############### Complex Model ########################
Iteration 0: loss = 2.457 and training accuracy = 23.39%, Validate loss = 0.369 and validate accuracy = 29.00%
Iteration 10: loss = 0.182 and training accuracy = 60.55%, Validate loss = 0.202 and validate accuracy = 57.00%
Iteration 20: loss = 0.145 and training accuracy = 70.27%, Validate loss = 0.187 and validate accuracy = 60.40%
Iteration 30: loss = 0.118 and training accuracy = 77.23%, Validate loss = 0.190 and validate accuracy = 62.10%
Iteration 40: loss = 0.098 and training accuracy = 82.44%, Validate loss = 0.193 and validate accuracy = 61.30%
Iteration 50: loss = 0.086 and training accuracy = 85.12%, Validate loss = 0.202 and validate accuracy = 63.10%
Iteration 60: loss = 0.069 and training accuracy = 88.77%, Validate loss = 0.220 and validate accuracy = 63.70%
Iteration 70: loss = 0.054 and training accuracy = 92.02%, Validate loss = 0.238 and validate accuracy = 62.00%
Iteration 80: loss = 0.052 and training accuracy = 92.43%, Validate loss = 0.236 and validate accuracy = 63.00%
Iteration 90: loss = 0.041 and training accuracy = 94.60%, Validate loss = 0.241 and validate accuracy = 65.00%
Testing loss = 0.282 and testing accuracy = 62.81%
Time = 2280.8245 seconds.
```

with ngraph

```
nyhneil@work:~/convolutional-neural-network$ python3 cnn.py
Using TensorFlow backend.
Train image shape:    (49000, 32, 32, 3)
Train label shape:    (49000,)
Validate image shape: (1000, 32, 32, 3)
Validate label shape: (1000,)
Test image shape:     (10000, 32, 32, 3)
Test label shape:     (10000,)

############### Simple Model ########################
Iteration 0: loss = 2.230 and training accuracy = 20.46%, Validate loss = 1.070 and validate accuracy = 26.20%
Iteration 10: loss = 0.287 and training accuracy = 49.33%, Validate loss = 0.313 and validate accuracy = 44.80%
Iteration 20: loss = 0.211 and training accuracy = 59.63%, Validate loss = 0.258 and validate accuracy = 51.00%
Iteration 30: loss = 0.182 and training accuracy = 65.15%, Validate loss = 0.244 and validate accuracy = 53.00%
Iteration 40: loss = 0.167 and training accuracy = 68.70%, Validate loss = 0.234 and validate accuracy = 55.20%
Iteration 50: loss = 0.156 and training accuracy = 71.40%, Validate loss = 0.236 and validate accuracy = 55.30%
Iteration 60: loss = 0.149 and training accuracy = 73.09%, Validate loss = 0.241 and validate accuracy = 54.90%
Iteration 70: loss = 0.142 and training accuracy = 74.60%, Validate loss = 0.249 and validate accuracy = 53.80%
Iteration 80: loss = 0.135 and training accuracy = 76.11%, Validate loss = 0.255 and validate accuracy = 56.30%
Iteration 90: loss = 0.136 and training accuracy = 76.52%, Validate loss = 0.259 and validate accuracy = 55.60%
Testing loss = 0.275 and testing accuracy = 52.91%
Time = 1102.4782 seconds.

############### Complex Model ########################
Iteration 0: loss = 2.493 and training accuracy = 16.48%, Validate loss = 0.395 and validate accuracy = 16.80%
Iteration 10: loss = 0.223 and training accuracy = 33.41%, Validate loss = 0.226 and validate accuracy = 31.10%
Iteration 20: loss = 0.212 and training accuracy = 37.30%, Validate loss = 0.216 and validate accuracy = 33.40%
Iteration 30: loss = 0.204 and training accuracy = 39.56%, Validate loss = 0.210 and validate accuracy = 34.30%
Iteration 40: loss = 0.200 and training accuracy = 40.85%, Validate loss = 0.208 and validate accuracy = 33.60%
Iteration 50: loss = 0.196 and training accuracy = 43.43%, Validate loss = 0.207 and validate accuracy = 30.80%
Iteration 60: loss = 0.191 and training accuracy = 46.93%, Validate loss = 0.209 and validate accuracy = 31.50%
Iteration 70: loss = 0.186 and training accuracy = 49.09%, Validate loss = 0.210 and validate accuracy = 29.10%
Iteration 80: loss = 0.182 and training accuracy = 50.39%, Validate loss = 0.214 and validate accuracy = 29.20%
Iteration 90: loss = 0.175 and training accuracy = 52.69%, Validate loss = 0.221 and validate accuracy = 26.80%
Testing loss = 0.235 and testing accuracy = 24.22%
Time = 2324.1039 seconds.
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change inter and intra into 15 and 20 with ngraph

Conclusion:

As we can see, the simple model will perform better without ngraph especially for saving time. With ngraph, the complex modex' accuracy could be much higher than without ngraph. Therefor, complex model will perform better with ngraph. The third picture is that change intra_op_parallelism_threads to 20 and inter_op_parallelism_threads to 15 which results shows it will decrease significantly the accuracy in complex model with ngraph. In the meantime, it will increase running time on both simple model and complex model.