```
In [3]: runfile('D:/ISS/MTech2019/ISY5002/ISY5002-ISSM/ISSM_Assignment/ISSM_CA3/ISSM_CA3_GC_Test.py',
wdir='D:/ISS/MTech2019/ISY5002/ISY5002-ISSM/ISSM_Assignment/ISSM_CA3')
Training data:  (320, 32, 20, 20, 1) , Training ID:  (320,)
Testing data:  (80, 32, 20, 20, 1) , Testing ID:  (80,)

_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
input_3 (InputLayer)         (None, 32, 20, 20, 1)     0
_________________________________________________________________
conv3d_4 (Conv3D)            (None, 32, 20, 20, 16)    144
_________________________________________________________________
conv3d_5 (Conv3D)            (None, 16, 10, 20, 32)    4128
_________________________________________________________________
reshape_2 (Reshape)          (None, 16, 10, 20, 32)    0
_________________________________________________________________
conv3d_transpose_4 (Conv3DTr (None, 32, 20, 20, 32)    8224
_________________________________________________________________
conv3d_transpose_5 (Conv3DTr (None, 32, 20, 20, 1)     257
=================================================================
Total params: 12,753
Trainable params: 12,753
Non-trainable params: 0
_________________________________________________________________
Train on 320 samples, validate on 80 samples
Epoch 1/50
288/320 [==========================>...] - ETA: 0s - loss: 0.1160 - mean_squared_error: 0.1160
Epoch 00001: val_loss improved from inf to 0.11285, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 3ms/sample - loss: 0.1157 - mean_squared_error: 0.1157 - val_loss: 0.1128 -
val_mean_squared_error: 0.1128
Epoch 2/50
288/320 [==========================>...] - ETA: 0s - loss: 0.1108 - mean_squared_error: 0.1108
Epoch 00002: val_loss improved from 0.11285 to 0.10764, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.1105 - mean_squared_error: 0.1105 - val_loss: 0.1076 -
val_mean_squared_error: 0.1076
Epoch 3/50
288/320 [==========================>...] - ETA: 0s - loss: 0.1054 - mean_squared_error: 0.1054
Epoch 00003: val_loss improved from 0.10764 to 0.10172, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.1051 - mean_squared_error: 0.1051 - val_loss: 0.1017 -
val_mean_squared_error: 0.1017
Epoch 4/50
288/320 [==========================>...] - ETA: 0s - loss: 0.0986 - mean_squared_error: 0.0986
Epoch 00004: val_loss improved from 0.10172 to 0.09362, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0982 - mean_squared_error: 0.0982 - val_loss: 0.0936 -
val_mean_squared_error: 0.0936
Epoch 5/50
288/320 [==========================>...] - ETA: 0s - loss: 0.0898 - mean_squared_error: 0.0898
Epoch 00005: val_loss improved from 0.09362 to 0.08337, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0893 - mean_squared_error: 0.0893 - val_loss: 0.0834 -
val_mean_squared_error: 0.0834
Epoch 6/50
288/320 [==========================>...] - ETA: 0s - loss: 0.0784 - mean_squared_error: 0.0784
Epoch 00006: val_loss improved from 0.08337 to 0.07048, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0778 - mean_squared_error: 0.0778 - val_loss: 0.0705 -
val_mean_squared_error: 0.0705
Epoch 7/50
288/320 [==========================>...] - ETA: 0s - loss: 0.0649 - mean_squared_error: 0.0649
Epoch 00007: val_loss improved from 0.07048 to 0.05631, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0642 - mean_squared_error: 0.0642 - val_loss: 0.0563 -
val_mean_squared_error: 0.0563
Epoch 8/50
288/320 [==========================>...] - ETA: 0s - loss: 0.0505 - mean_squared_error: 0.0505
Epoch 00008: val_loss improved from 0.05631 to 0.04201, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0498 - mean_squared_error: 0.0498 - val_loss: 0.0420 -
val_mean_squared_error: 0.0420
Epoch 9/50
288/320 [==========================>...] - ETA: 0s - loss: 0.0366 - mean_squared_error: 0.0366
Epoch 00009: val_loss improved from 0.04201 to 0.02873, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0359 - mean_squared_error: 0.0359 - val_loss: 0.0287 -
val_mean_squared_error: 0.0287
Epoch 10/50
288/320 [==========================>...] - ETA: 0s - loss: 0.0240 - mean_squared_error: 0.0240
Epoch 00010: val_loss improved from 0.02873 to 0.01764, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0235 - mean_squared_error: 0.0235 - val_loss: 0.0176 -
val_mean_squared_error: 0.0176
Epoch 11/50
288/320 [==========================>...] - ETA: 0s - loss: 0.0144 - mean_squared_error: 0.0144
Epoch 00011: val_loss improved from 0.01764 to 0.01061, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0141 - mean_squared_error: 0.0141 - val_loss: 0.0106 -
val_mean_squared_error: 0.0106
Epoch 12/50
288/320 [==========================>...] - ETA: 0s - loss: 0.0091 - mean_squared_error: 0.0091
Epoch 00012: val_loss improved from 0.01061 to 0.00750, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0090 - mean_squared_error: 0.0090 - val_loss: 0.0075 -
val_mean_squared_error: 0.0075
Epoch 13/50
288/320 [==========================>...] - ETA: 0s - loss: 0.0069 - mean_squared_error: 0.0069
Epoch 00013: val_loss improved from 0.00750 to 0.00615, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0068 - mean_squared_error: 0.0068 - val_loss: 0.0061 -
val_mean_squared_error: 0.0061
Epoch 14/50
288/320 [==========================>...] - ETA: 0s - loss: 0.0058 - mean_squared_error: 0.0058
Epoch 00014: val_loss improved from 0.00615 to 0.00540, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0058 - mean_squared_error: 0.0058 - val_loss: 0.0054 -
val_mean_squared_error: 0.0054
Epoch 15/50
288/320 [==========================>...] - ETA: 0s - loss: 0.0052 - mean_squared_error: 0.0052
Epoch 00015: val_loss improved from 0.00540 to 0.00500, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0052 - mean_squared_error: 0.0052 - val_loss: 0.0050 -
val_mean_squared_error: 0.0050
Epoch 16/50
288/320 [==========================>...] - ETA: 0s - loss: 0.0049 - mean_squared_error: 0.0049
Epoch 00016: val_loss improved from 0.00500 to 0.00481, saving model to CA3ModelV1_model.hdf5
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320/320 [==============================] - 1s 2ms/sample - loss: 0.0049 - mean_squared_error: 0.0049 - val_loss: 0.0048 -
val_mean_squared_error: 0.0048
Epoch 17/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0048 - mean_squared_error: 0.0048
Epoch 00017: val_loss improved from 0.00481 to 0.00469, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0048 - mean_squared_error: 0.0048 - val_loss: 0.0047 -
val_mean_squared_error: 0.0047
Epoch 18/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0046 - mean_squared_error: 0.0046
Epoch 00018: val_loss improved from 0.00469 to 0.00458, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0046 - mean_squared_error: 0.0046 - val_loss: 0.0046 -
val_mean_squared_error: 0.0046
Epoch 19/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0045 - mean_squared_error: 0.0045
Epoch 00019: val_loss improved from 0.00458 to 0.00447, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0045 - mean_squared_error: 0.0045 - val_loss: 0.0045 -
val_mean_squared_error: 0.0045
Epoch 20/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0044 - mean_squared_error: 0.0044
Epoch 00020: val_loss improved from 0.00447 to 0.00436, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0044 - mean_squared_error: 0.0044 - val_loss: 0.0044 -
val_mean_squared_error: 0.0044
Epoch 21/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0043 - mean_squared_error: 0.0043
Epoch 00021: val_loss improved from 0.00436 to 0.00425, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0043 - mean_squared_error: 0.0043 - val_loss: 0.0042 -
val_mean_squared_error: 0.0042
Epoch 22/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0042 - mean_squared_error: 0.0042
Epoch 00022: val_loss improved from 0.00425 to 0.00414, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0042 - mean_squared_error: 0.0042 - val_loss: 0.0041 -
val_mean_squared_error: 0.0041
Epoch 23/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0041 - mean_squared_error: 0.0041
Epoch 00023: val_loss improved from 0.00414 to 0.00404, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0041 - mean_squared_error: 0.0041 - val_loss: 0.0040 -
val_mean_squared_error: 0.0040
Epoch 24/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0040 - mean_squared_error: 0.0040
Epoch 00024: val_loss improved from 0.00404 to 0.00392, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0040 - mean_squared_error: 0.0040 - val_loss: 0.0039 -
val_mean_squared_error: 0.0039
Epoch 25/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0039 - mean_squared_error: 0.0039
Epoch 00025: val_loss improved from 0.00392 to 0.00380, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0039 - mean_squared_error: 0.0039 - val_loss: 0.0038 -
val_mean_squared_error: 0.0038
Epoch 26/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0037 - mean_squared_error: 0.0037
Epoch 00026: val_loss improved from 0.00380 to 0.00367, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0037 - mean_squared_error: 0.0037 - val_loss: 0.0037 -
val_mean_squared_error: 0.0037
Epoch 27/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0036 - mean_squared_error: 0.0036
Epoch 00027: val_loss improved from 0.00367 to 0.00353, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0036 - mean_squared_error: 0.0036 - val_loss: 0.0035 -
val_mean_squared_error: 0.0035
Epoch 28/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0035 - mean_squared_error: 0.0035
Epoch 00028: val_loss improved from 0.00353 to 0.00338, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0035 - mean_squared_error: 0.0035 - val_loss: 0.0034 -
val_mean_squared_error: 0.0034
Epoch 29/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0033 - mean_squared_error: 0.0033
Epoch 00029: val_loss improved from 0.00338 to 0.00322, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0033 - mean_squared_error: 0.0033 - val_loss: 0.0032 -
val_mean_squared_error: 0.0032
Epoch 30/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0031 - mean_squared_error: 0.0031
Epoch 00030: val_loss improved from 0.00322 to 0.00304, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0031 - mean_squared_error: 0.0031 - val_loss: 0.0030 -
val_mean_squared_error: 0.0030
Epoch 31/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0030 - mean_squared_error: 0.0030
Epoch 00031: val_loss improved from 0.00304 to 0.00287, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0030 - mean_squared_error: 0.0030 - val_loss: 0.0029 -
val_mean_squared_error: 0.0029
Epoch 32/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0028 - mean_squared_error: 0.0028
Epoch 00032: val_loss improved from 0.00287 to 0.00269, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0028 - mean_squared_error: 0.0028 - val_loss: 0.0027 -
val_mean_squared_error: 0.0027
Epoch 33/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0026 - mean_squared_error: 0.0026
Epoch 00033: val_loss improved from 0.00269 to 0.00252, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0026 - mean_squared_error: 0.0026 - val_loss: 0.0025 -
val_mean_squared_error: 0.0025
Epoch 34/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0025 - mean_squared_error: 0.0025
Epoch 00034: val_loss improved from 0.00252 to 0.00236, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0024 - mean_squared_error: 0.0024 - val_loss: 0.0024 -
val_mean_squared_error: 0.0024
Epoch 35/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0023 - mean_squared_error: 0.0023
Epoch 00035: val_loss improved from 0.00236 to 0.00221, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0023 - mean_squared_error: 0.0023 - val_loss: 0.0022 -
val_mean_squared_error: 0.0022
Epoch 36/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0022 - mean_squared_error: 0.0022
Epoch 00036: val_loss improved from 0.00221 to 0.00206, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0021 - mean_squared_error: 0.0021 - val_loss: 0.0021 -
val_mean_squared_error: 0.0021
Epoch 37/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0020 - mean_squared_error: 0.0020
```

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Epoch 00037: val_loss improved from 0.00206 to 0.00192, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0020 - mean_squared_error: 0.0020 - val_loss: 0.0019 -
val_mean_squared_error: 0.0019
Epoch 38/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0019 - mean_squared_error: 0.0019
Epoch 00038: val_loss improved from 0.00192 to 0.00179, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0019 - mean_squared_error: 0.0019 - val_loss: 0.0018 -
val_mean_squared_error: 0.0018
Epoch 39/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0017 - mean_squared_error: 0.0017
Epoch 00039: val_loss improved from 0.00179 to 0.00167, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0017 - mean_squared_error: 0.0017 - val_loss: 0.0017 -
val_mean_squared_error: 0.0017
Epoch 40/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0016 - mean_squared_error: 0.0016
Epoch 00040: val_loss improved from 0.00167 to 0.00155, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0016 - mean_squared_error: 0.0016 - val_loss: 0.0015 -
val_mean_squared_error: 0.0015
Epoch 41/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0015 - mean_squared_error: 0.0015
Epoch 00041: val_loss improved from 0.00155 to 0.00143, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0015 - mean_squared_error: 0.0015 - val_loss: 0.0014 -
val_mean_squared_error: 0.0014
Epoch 42/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0014 - mean_squared_error: 0.0014
Epoch 00042: val_loss improved from 0.00143 to 0.00131, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0014 - mean_squared_error: 0.0014 - val_loss: 0.0013 -
val_mean_squared_error: 0.0013
Epoch 43/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0013 - mean_squared_error: 0.0013
Epoch 00043: val_loss improved from 0.00131 to 0.00120, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0013 - mean_squared_error: 0.0013 - val_loss: 0.0012 -
val_mean_squared_error: 0.0012
Epoch 44/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0012 - mean_squared_error: 0.0012
Epoch 00044: val_loss improved from 0.00120 to 0.00110, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0012 - mean_squared_error: 0.0012 - val_loss: 0.0011 -
val_mean_squared_error: 0.0011
Epoch 45/50
288/320 [=========================>...] - ETA: 0s - loss: 0.0011 - mean_squared_error: 0.0011
Epoch 00045: val_loss improved from 0.00110 to 0.00100, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 0.0011 - mean_squared_error: 0.0011 - val_loss: 9.9810e-04 -
val_mean_squared_error: 9.9810e-04
Epoch 46/50
288/320 [=========================>...] - ETA: 0s - loss: 9.6085e-04 - mean_squared_error: 9.6085e-04
Epoch 00046: val_loss improved from 0.00100 to 0.00091, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 9.5639e-04 - mean_squared_error: 9.5639e-04 - val_loss: 9.0746e-04
- val_mean_squared_error: 9.0746e-04
Epoch 47/50
288/320 [=========================>...] - ETA: 0s - loss: 8.7324e-04 - mean_squared_error: 8.7324e-04
Epoch 00047: val_loss improved from 0.00091 to 0.00082, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 8.6907e-04 - mean_squared_error: 8.6907e-04 - val_loss: 8.2417e-04
- val_mean_squared_error: 8.2417e-04
Epoch 48/50
288/320 [=========================>...] - ETA: 0s - loss: 7.9269e-04 - mean_squared_error: 7.9269e-04
Epoch 00048: val_loss improved from 0.00082 to 0.00075, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 7.8882e-04 - mean_squared_error: 7.8882e-04 - val_loss: 7.4669e-04
- val_mean_squared_error: 7.4669e-04
Epoch 49/50
288/320 [=========================>...] - ETA: 0s - loss: 7.1723e-04 - mean_squared_error: 7.1723e-04
Epoch 00049: val_loss improved from 0.00075 to 0.00067, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 7.1365e-04 - mean_squared_error: 7.1365e-04 - val_loss: 6.7493e-04
- val_mean_squared_error: 6.7493e-04
Epoch 50/50
288/320 [=========================>...] - ETA: 0s - loss: 6.4803e-04 - mean_squared_error: 6.4803e-04
Epoch 00050: val_loss improved from 0.00067 to 0.00061, saving model to CA3ModelV1_model.hdf5
320/320 [==============================] - 1s 2ms/sample - loss: 6.4481e-04 - mean_squared_error: 6.4481e-04 - val_loss: 6.0988e-04
- val_mean_squared_error: 6.0988e-04
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