```
Working directory is "c:\Users\deanr\Productivity\Shares\temp_stocks_crypto_analysis_python_keras_tensorflow"
Loaded input file
```

Imports & data setup DONE

```
Reloading NeuralNet
```

Start single train

```
[BTC] Using trading pair btcusd
[ETH] Using trading pair ethusd
[LTC] Using trading pair ltcusd
The input feed locations for the features are:
Feed location 'dense': ['market_volume_fraction']
Feed location 'rnn': []
Feed location 'conv': ['logDiff', 'vix1', 'vix2', 'vix3', 'rsi0_24', 'rsi1_96', 'dvg0_24', 'dvg1_72', 'dvg2_312', 'dvg3_1176', 'dvg4_4320',
'vsMarket0_1', 'vsMarket1_24', 'vsMarket2_168', 'vsMarket3_1440', 'volNom']
```

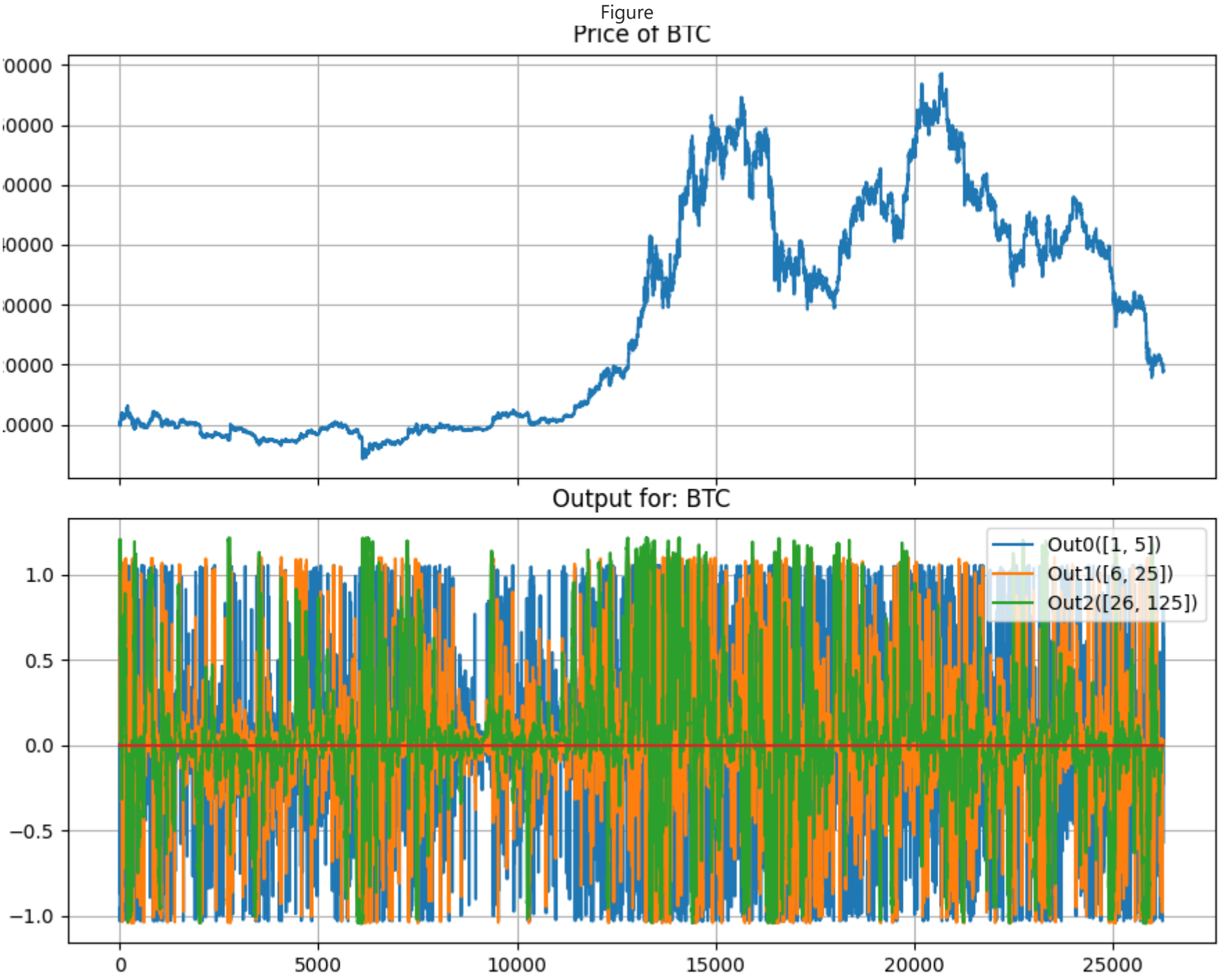
In + Out data **0.90 quantile**

```
             time       high        low      close   volume_nom    volume_usd  \
BTC  1.647170e+09  54930.480  54330.570  54659.900   483.650828  2.998032e+07
ETH  1.647170e+09   3525.560   3482.671   3507.645  6348.721171  1.503116e+07
LTC  1.647170e+09    197.954    195.280    196.622  4736.647300  1.517391e+06

     market_volume_fraction  change_vs_market   logDiff      vix1  ...  \
BTC                0.690029          1.002520  0.514546  0.670453  ...
ETH                0.225210          1.004256  0.687594  1.065818  ...
LTC                0.024515          1.006067  0.770092  1.371774  ...

     dvg3_1176  dvg4_4320  vsMarket0_1  vsMarket1_24  vsMarket2_168  \
BTC   0.722872   0.962599     0.817748      0.826975       0.848948
ETH   1.065001   1.132615     0.819164      0.835653       0.880673
LTC   0.847638   0.904785     0.820641      0.837290       0.876710

     vsMarket3_1440  volNom     out_0     out_1     out_2
BTC        0.923792     1.0  0.486366  0.485405  0.524787
ETH        1.076311     1.0  0.785432  0.815813  0.845109
LTC        0.912175     1.0  0.857770  0.821665  0.783502

[3 rows x 27 columns]
```

In + Out data **0.10 quantile**

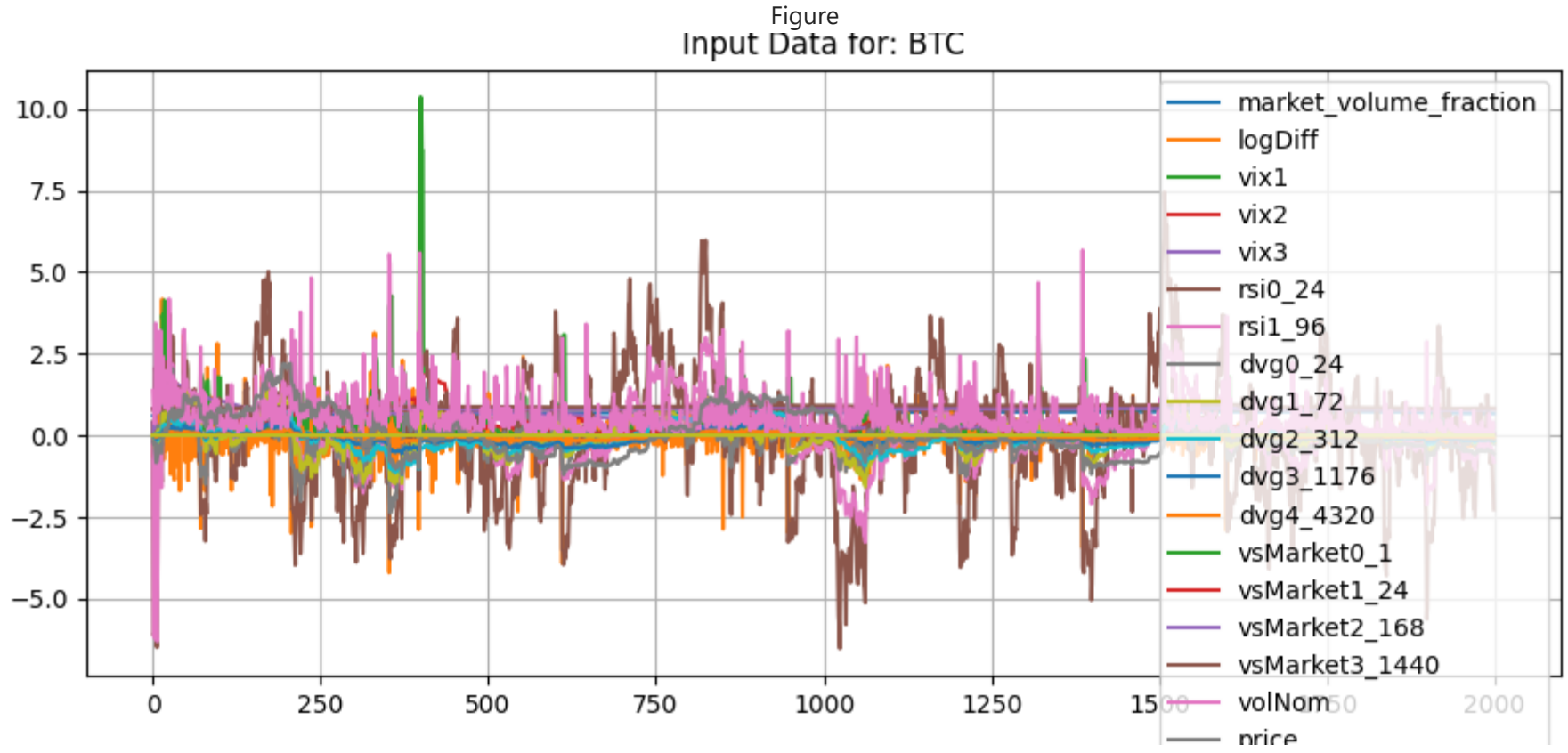
```
             time      high      low     close  volume_nom    volume_usd  \
BTC  1.571486e+09  8078.310  7997.31  8042.540   39.516289  2.117590e+06
ETH  1.571486e+09   171.057   169.07   170.089  370.342763  4.159237e+05
LTC  1.571486e+09    44.030    43.72    43.890  194.487415  5.446111e+04

     market_volume_fraction  change_vs_market   logDiff      vix1  ...  \
BTC                0.237663          0.997476 -0.510311  0.019150  ...
ETH                0.121098          0.995899 -0.679347  0.038349  ...
LTC                0.007163          0.993804 -0.767015  0.047704  ...

     dvg3_1176  dvg4_4320  vsMarket0_1  vsMarket1_24  vsMarket2_168  \
BTC  -0.526738  -0.300130     0.813634      0.804461       0.784134
ETH  -0.613270  -0.319328     0.812347      0.799141       0.767932
LTC  -0.742525  -0.447227     0.810638      0.793313       0.749982

     vsMarket3_1440    volNom     out_0     out_1     out_2
BTC        0.728817  0.081704 -0.470599 -0.468789 -0.438209
ETH        0.692313  0.058333 -0.721167 -0.707244 -0.681237
LTC        0.623031  0.041060 -0.843400 -0.810554 -0.772093

[3 rows x 27 columns]
```

Figure




```
Input data (samples=3, timeSteps=26280)
Output data shape = (3, 26280, 3)
```

Figure



Configuration

Input data

Coins: BTC, ETH, LTC for 26280 hrs (3.00 years)### Input features
VIX: 3 ranges, up to 336 hrs
RSI lengths of 24, 96, hrs
Divergence lengths of 24, 72, 312, 1176, 4320, hrs
vsMarket lengths of 1, 24, 168, 1440, hrs

Input handling

Data split training=0.8, validation=0.2, testing=0.0
Data fed to conv: ema, dvg, volNom, logDiff, rsi, vix, vsMarket
Data fed to dense: market_volume_fraction

Output (target) data

Time ranges: [[1, 5], [6, 25], [26, 125]] hrs. (excl 50)
Ternarise=1. Selectivity=2

Neural net (model)

FilterNet convolution, (serial)
dilation=[1, 2, 4, 8, 16, 32, 64, 128], filterCnt=[80, 75, 70, 65, 60, 50, 40, 30], kernelSz=10

Bottleneck to width 128
RNN type: **gru**. LayerWidths = [128]

Dense LayerWidths=[128, 64, 32]

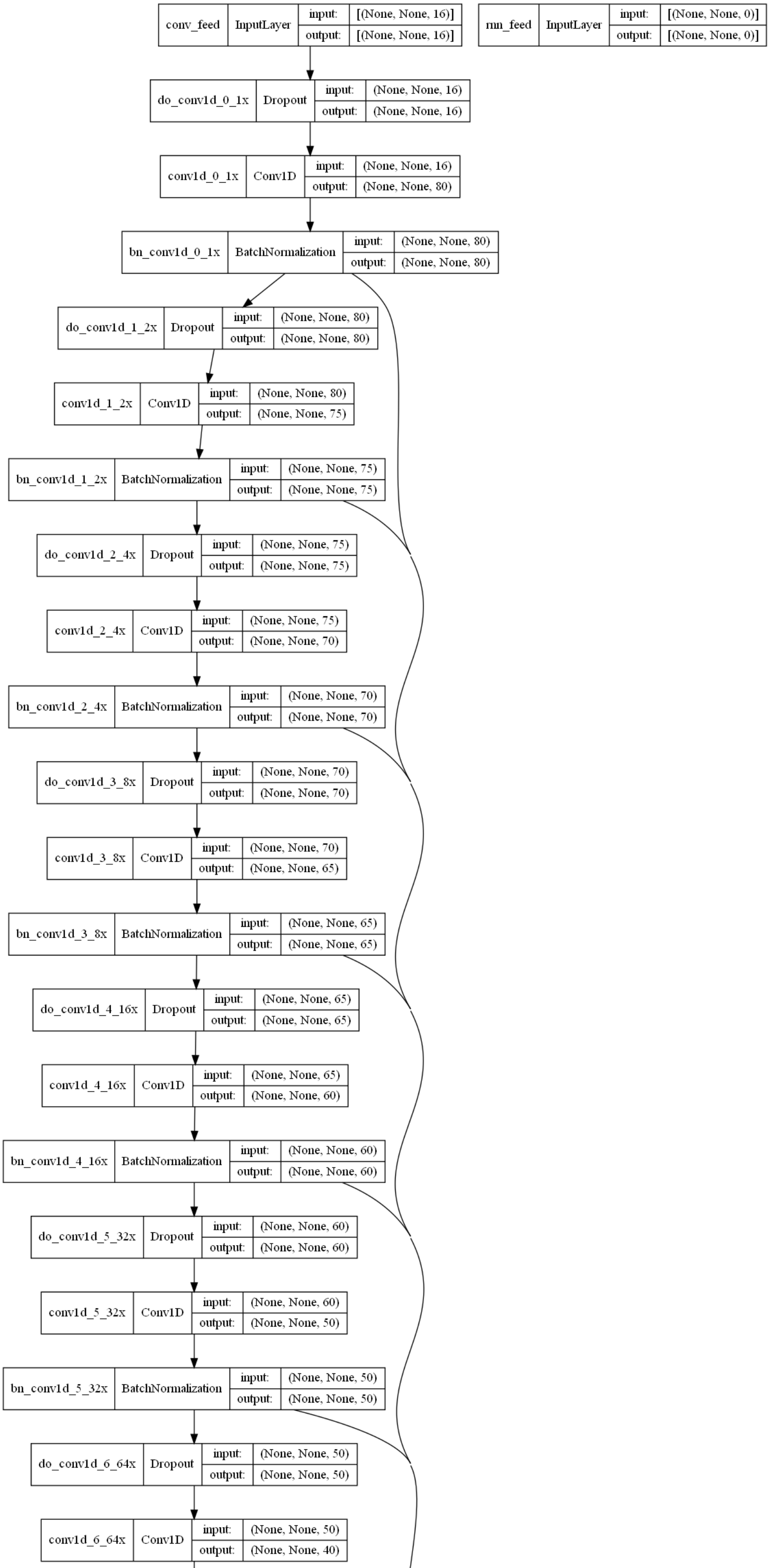
Model properties
BatchNorm ON (all layers)
L2 regularizer. Rate=0.0001
Dropout rate = 0.2

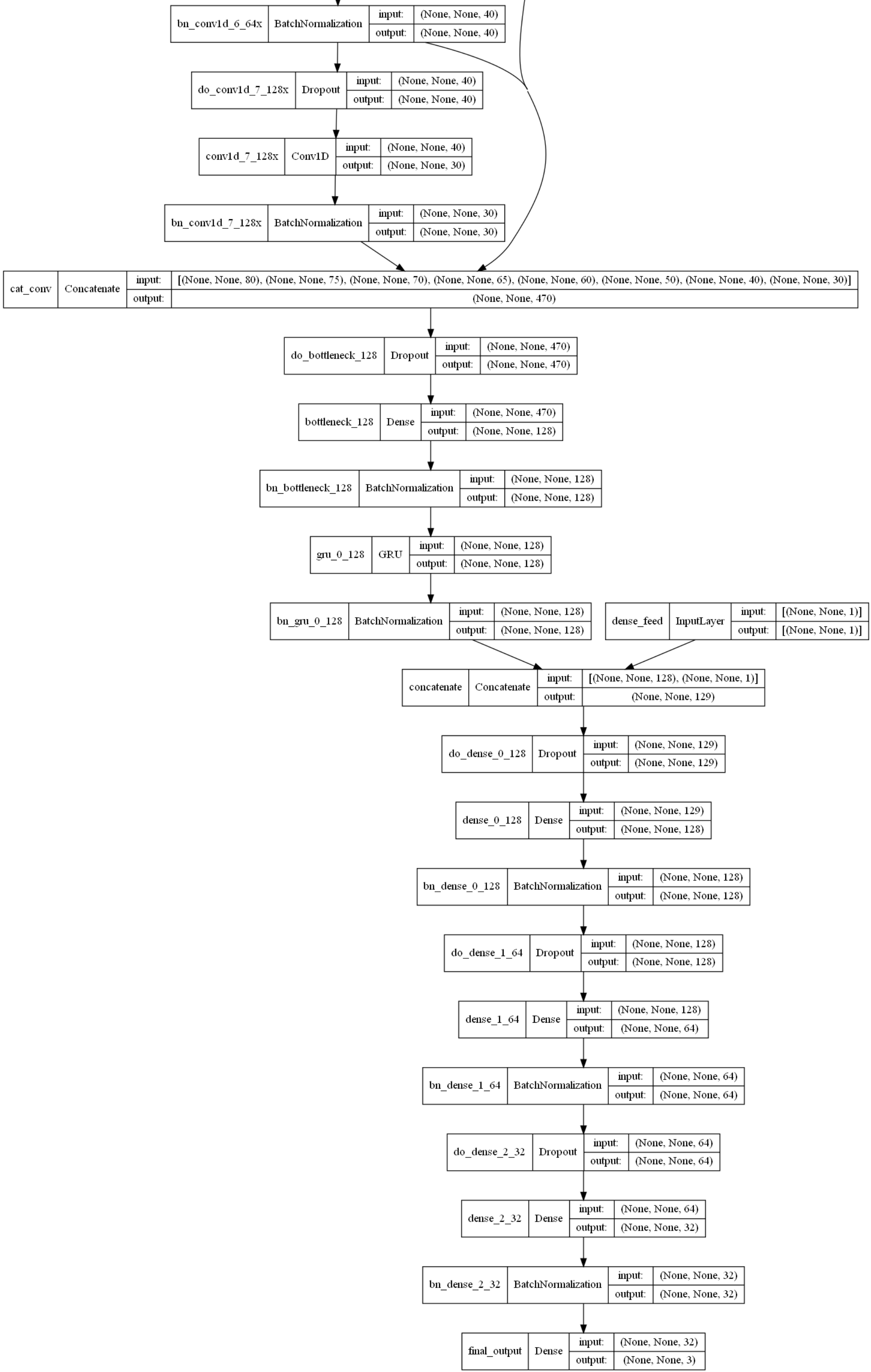
Training process

Train for **100 epochs**
Optimiser=**adam**, learning rate=0.002

```
Model: "custom_model"
__________________________________________________________________________________________________
 Layer (type)                   Output Shape         Param #     Connected to
==================================================================================================
 conv_feed (InputLayer)         [(None, None, 16)]   0           []

 do_conv1d_0_1x (Dropout)       (None, None, 16)     0           ['conv_feed[0][0]']

 conv1d_0_1x (Conv1D)           (None, None, 80)     12880       ['do_conv1d_0_1x[0][0]']

 bn_conv1d_0_1x (BatchNormaliza  (None, None, 80)    320         ['conv1d_0_1x[0][0]']
 tion)

 do_conv1d_1_2x (Dropout)       (None, None, 80)     0           ['bn_conv1d_0_1x[0][0]']

 conv1d_1_2x (Conv1D)           (None, None, 75)     60075       ['do_conv1d_1_2x[0][0]']

 bn_conv1d_1_2x (BatchNormaliza  (None, None, 75)    300         ['conv1d_1_2x[0][0]']
 tion)

 do_conv1d_2_4x (Dropout)       (None, None, 75)     0           ['bn_conv1d_1_2x[0][0]']

 conv1d_2_4x (Conv1D)           (None, None, 70)     52570       ['do_conv1d_2_4x[0][0]']

 bn_conv1d_2_4x (BatchNormaliza  (None, None, 70)    280         ['conv1d_2_4x[0][0]']
 tion)

 do_conv1d_3_8x (Dropout)       (None, None, 70)     0           ['bn_conv1d_2_4x[0][0]']

 conv1d_3_8x (Conv1D)           (None, None, 65)     45565       ['do_conv1d_3_8x[0][0]']

 bn_conv1d_3_8x (BatchNormaliza  (None, None, 65)    260         ['conv1d_3_8x[0][0]']
 tion)

 do_conv1d_4_16x (Dropout)      (None, None, 65)     0           ['bn_conv1d_3_8x[0][0]']

 conv1d_4_16x (Conv1D)          (None, None, 60)     39060       ['do_conv1d_4_16x[0][0]']

 bn_conv1d_4_16x (BatchNormaliz  (None, None, 60)    240         ['conv1d_4_16x[0][0]']
 ation)

 do_conv1d_5_32x (Dropout)      (None, None, 60)     0           ['bn_conv1d_4_16x[0][0]']

 conv1d_5_32x (Conv1D)          (None, None, 50)     30050       ['do_conv1d_5_32x[0][0]']

 bn_conv1d_5_32x (BatchNormaliz  (None, None, 50)    200         ['conv1d_5_32x[0][0]']
 ation)

 do_conv1d_6_64x (Dropout)      (None, None, 50)     0           ['bn_conv1d_5_32x[0][0]']

 conv1d_6_64x (Conv1D)          (None, None, 40)     20040       ['do_conv1d_6_64x[0][0]']

 bn_conv1d_6_64x (BatchNormaliz  (None, None, 40)    160         ['conv1d_6_64x[0][0]']
 ation)

 do_conv1d_7_128x (Dropout)     (None, None, 40)     0           ['bn_conv1d_6_64x[0][0]']

 conv1d_7_128x (Conv1D)         (None, None, 30)     12030       ['do_conv1d_7_128x[0][0]']

 bn_conv1d_7_128x (BatchNormali  (None, None, 30)    120         ['conv1d_7_128x[0][0]']
 zation)

 cat_conv (Concatenate)         (None, None, 470)    0           ['bn_conv1d_0_1x[0][0]',
                                                                  'bn_conv1d_1_2x[0][0]',
                                                                  'bn_conv1d_2_4x[0][0]',
                                                                  'bn_conv1d_3_8x[0][0]',
                                                                  'bn_conv1d_4_16x[0][0]',
                                                                  'bn_conv1d_5_32x[0][0]',
                                                                  'bn_conv1d_6_64x[0][0]',
                                                                  'bn_conv1d_7_128x[0][0]']

 do_bottleneck_128 (Dropout)    (None, None, 470)    0           ['cat_conv[0][0]']

 bottleneck_128 (Dense)         (None, None, 128)    60288       ['do_bottleneck_128[0][0]']

 bn_bottleneck_128 (BatchNormal  (None, None, 128)   512         ['bottleneck_128[0][0]']
 ization)

 gru_0_128 (GRU)                (None, None, 128)    99072       ['bn_bottleneck_128[0][0]']

 bn_gru_0_128 (BatchNormalizati  (None, None, 128)   512         ['gru_0_128[0][0]']
 on)

 dense_feed (InputLayer)        [(None, None, 1)]    0           []

 concatenate (Concatenate)      (None, None, 129)    0           ['bn_gru_0_128[0][0]',
                                                                  'dense_feed[0][0]']

 do_dense_0_128 (Dropout)       (None, None, 129)    0           ['concatenate[0][0]']

 dense_0_128 (Dense)            (None, None, 128)    16640       ['do_dense_0_128[0][0]']

 bn_dense_0_128 (BatchNormaliza  (None, None, 128)   512         ['dense_0_128[0][0]']
```

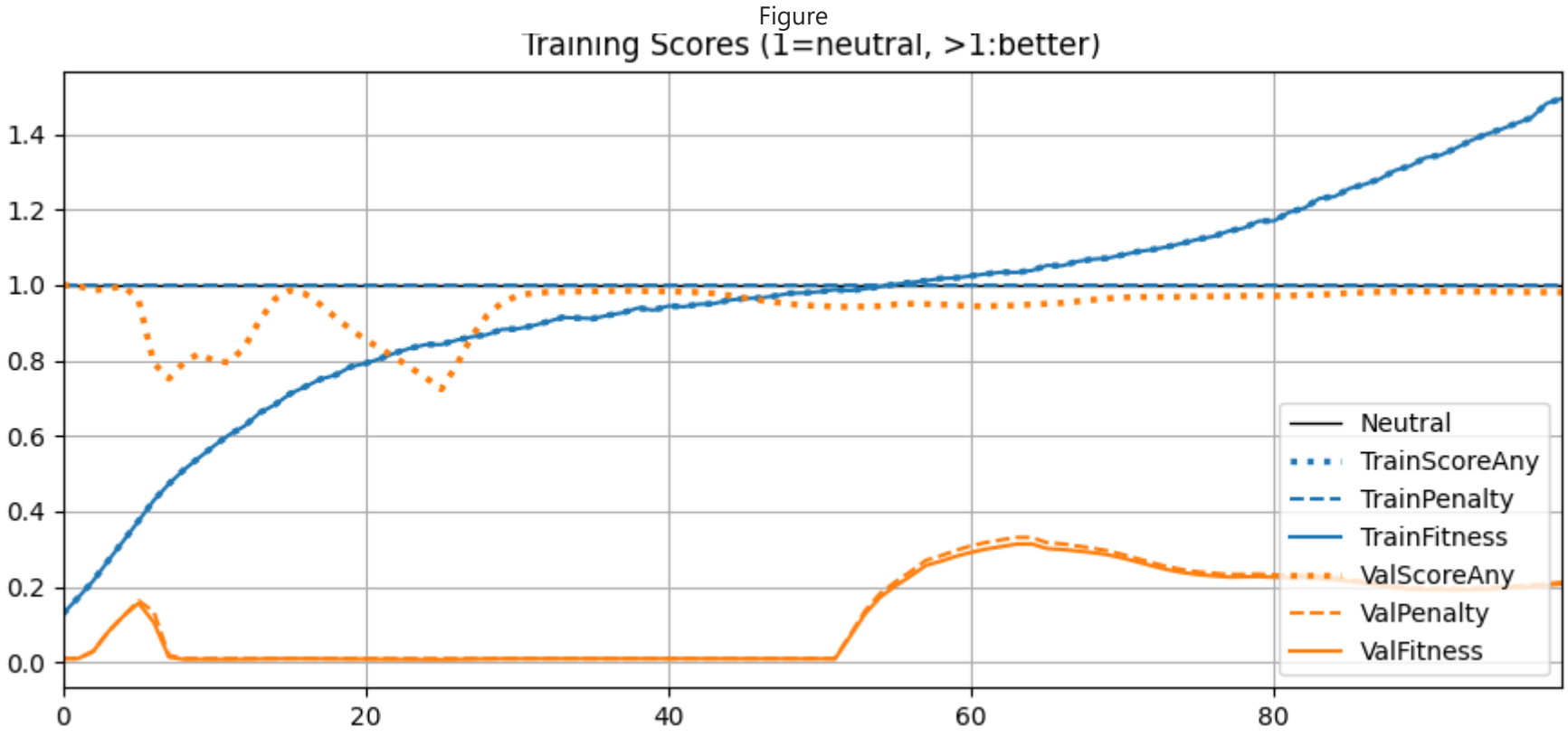
```
 tion)

 do_dense_1_64 (Dropout)        (None, None, 128)    0           ['bn_dense_0_128[0][0]']

 dense_1_64 (Dense)             (None, None, 64)     8256        ['do_dense_1_64[0][0]']

 bn_dense_1_64 (BatchNormalizat  (None, None, 64)    256         ['dense_1_64[0][0]']
 ion)

 do_dense_2_32 (Dropout)        (None, None, 64)     0           ['bn_dense_1_64[0][0]']

 dense_2_32 (Dense)             (None, None, 32)     2080        ['do_dense_2_32[0][0]']

 bn_dense_2_32 (BatchNormalizat  (None, None, 32)    128         ['dense_2_32[0][0]']
 ion)

 rnn_feed (InputLayer)          [(None, None, 0)]    0           []

 final_output (Dense)           (None, None, 3)      99          ['bn_dense_2_32[0][0]']

==================================================================================================
Total params: 462,505
Trainable params: 460,605
Non-trainable params: 1,900
__________________________________________________________________________________________________
```

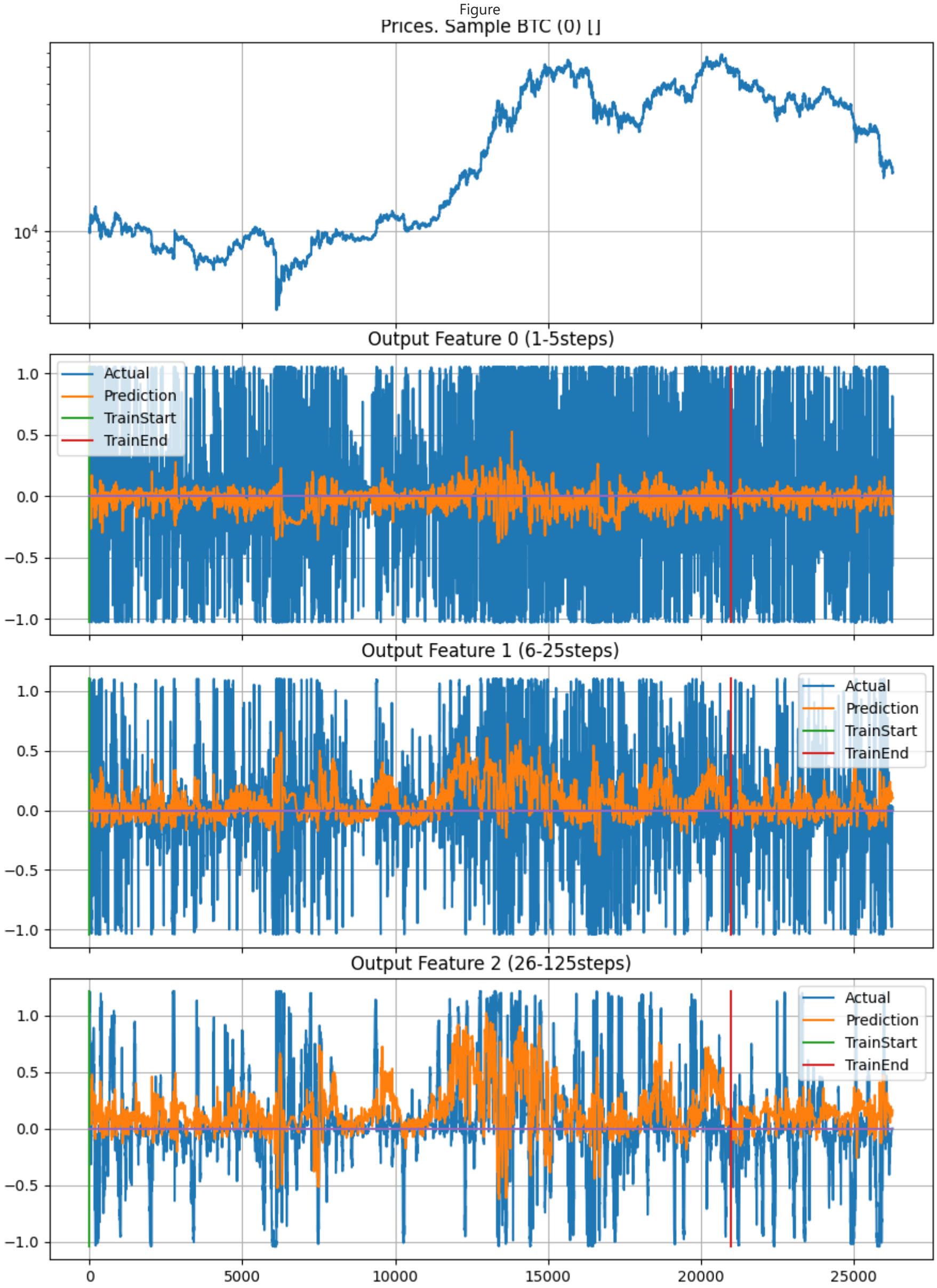

conv_feed | InputLayer | input: [(None, None, 16)] | output: [(None, None, 16)]
rnn_feed | InputLayer | input: [(None, None, 0)] | output: [(None, None, 0)]
do_conv1d_0_1x | Dropout | input: (None, None, 16) | output: (None, None, 16)
conv1d_0_1x | Conv1D | input: (None, None, 16) | output: (None, None, 80)
bn_conv1d_0_1x | BatchNormalization | input: (None, None, 80) | output: (None, None, 80)
do_conv1d_1_2x | Dropout | input: (None, None, 80) | output: (None, None, 80)
conv1d_1_2x | Conv1D | input: (None, None, 80) | output: (None, None, 75)
bn_conv1d_1_2x | BatchNormalization | input: (None, None, 75) | output: (None, None, 75)
do_conv1d_2_4x | Dropout | input: (None, None, 75) | output: (None, None, 75)
conv1d_2_4x | Conv1D | input: (None, None, 75) | output: (None, None, 70)
bn_conv1d_2_4x | BatchNormalization | input: (None, None, 70) | output: (None, None, 70)
do_conv1d_3_8x | Dropout | input: (None, None, 70) | output: (None, None, 70)
conv1d_3_8x | Conv1D | input: (None, None, 70) | output: (None, None, 65)
bn_conv1d_3_8x | BatchNormalization | input: (None, None, 65) | output: (None, None, 65)
do_conv1d_4_16x | Dropout | input: (None, None, 65) | output: (None, None, 65)
conv1d_4_16x | Conv1D | input: (None, None, 65) | output: (None, None, 60)
bn_conv1d_4_16x | BatchNormalization | input: (None, None, 60) | output: (None, None, 60)
do_conv1d_5_32x | Dropout | input: (None, None, 60) | output: (None, None, 60)
conv1d_5_32x | Conv1D | input: (None, None, 60) | output: (None, None, 50)
bn_conv1d_5_32x | BatchNormalization | input: (None, None, 50) | output: (None, None, 50)
do_conv1d_6_64x | Dropout | input: (None, None, 50) | output: (None, None, 50)
conv1d_6_64x | Conv1D | input: (None, None, 50) | output: (None, None, 40)


bn_conv1d_6_64x BatchNormalization input: (None, None, 40) output: (None, None, 40)
do_conv1d_7_128x Dropout input: (None, None, 40) output: (None, None, 40)
conv1d_7_128x Conv1D input: (None, None, 40) output: (None, None, 30)
bn_conv1d_7_128x BatchNormalization input: (None, None, 30) output: (None, None, 30)
cat_conv Concatenate input: [(None, None, 80), (None, None, 75), (None, None, 70), (None, None, 65), (None, None, 60), (None, None, 50), (None, None, 40), (None, None, 30)] output: (None, None, 470)
do_bottleneck_128 Dropout input: (None, None, 470) output: (None, None, 470)
bottleneck_128 Dense input: (None, None, 470) output: (None, None, 128)
bn_bottleneck_128 BatchNormalization input: (None, None, 128) output: (None, None, 128)
gru_0_128 GRU input: (None, None, 128) output: (None, None, 128)
bn_gru_0_128 BatchNormalization input: (None, None, 128) output: (None, None, 128)
dense_feed InputLayer input: [(None, None, 1)] output: [(None, None, 1)]
concatenate Concatenate input: [(None, None, 128), (None, None, 1)] output: (None, None, 129)
do_dense_0_128 Dropout input: (None, None, 129) output: (None, None, 129)
dense_0_128 Dense input: (None, None, 129) output: (None, None, 128)
bn_dense_0_128 BatchNormalization input: (None, None, 128) output: (None, None, 128)
do_dense_1_64 Dropout input: (None, None, 128) output: (None, None, 128)
dense_1_64 Dense input: (None, None, 128) output: (None, None, 64)
bn_dense_1_64 BatchNormalization input: (None, None, 64) output: (None, None, 64)
do_dense_2_32 Dropout input: (None, None, 64) output: (None, None, 64)
dense_2_32 Dense input: (None, None, 64) output: (None, None, 32)
bn_dense_2_32 BatchNormalization input: (None, None, 32) output: (None, None, 32)
final_output Dense input: (None, None, 32) output: (None, None, 3)

```
Starting training. Max 100 epochs
Epoch TrainSqSc TrainScAny ValSqSc ValScAny ValPenalty ValFitness ProcTime Remaining
    0     0.113      0.128   0.985    1.000      0.010      0.010    6.85s   0:11:25 - New best!
    1     0.149      0.171   0.961    0.998      0.010      0.010    1.01s   0:06:29
    2     0.188      0.216   0.893    0.986      0.029      0.029    1.12s   0:04:53 - New best!
    3     0.232      0.270   0.788    0.990      0.082      0.081    1.05s   0:01:43 - New best!
    4     0.272      0.322   0.646    0.998      0.123      0.123    1.07s   0:01:44 - New best!
    5     0.313      0.375   0.492    0.960      0.163      0.157    1.06s   0:01:41 - New best!
   10     0.510      0.574   0.209    0.798      0.010      0.008    1.01s   0:01:34
   20     0.729      0.793   0.401    0.855      0.010      0.009    1.09s   0:01:23
   30     0.828      0.884   0.616    0.971      0.010      0.010    1.12s   0:01:13
   40     0.882      0.945   0.648    0.983      0.010      0.010    1.18s   0:01:08
Epoch TrainSqSc TrainScAny ValSqSc ValScAny ValPenalty ValFitness ProcTime Remaining
   50     0.919      0.983   0.767    0.945      0.010      0.009    1.11s   0:00:55
   54     0.931      0.996   0.806    0.944      0.183      0.173    1.08s   0:00:51 - New best!
   55     0.933      1.002   0.814    0.949      0.214      0.203    1.07s   0:00:47 - New best!
   56     0.939      1.007   0.821    0.950      0.241      0.229    1.08s   0:00:47 - New best!
   57     0.940      1.012   0.825    0.950      0.270      0.257    1.03s   0:00:46 - New best!
   58     0.942      1.018   0.829    0.949      0.283      0.268    1.03s   0:00:44 - New best!
   59     0.945      1.019   0.833    0.947      0.297      0.281    1.05s   0:00:42 - New best!
   60     0.951      1.024   0.837    0.944      0.309      0.292    1.05s   0:00:42 - New best!
   61     0.950      1.030   0.841    0.944      0.318      0.300    1.14s   0:00:42 - New best!
   62     0.952      1.034   0.846    0.945      0.325      0.307    1.11s   0:00:42 - New best!
Epoch TrainSqSc TrainScAny ValSqSc ValScAny ValPenalty ValFitness ProcTime Remaining
   63     0.956      1.034   0.850    0.946      0.331      0.313    1.07s   0:00:41 - New best!
   64     0.957      1.038   0.855    0.949      0.331      0.314    1.07s   0:00:39 - New best!
   70     0.980      1.080   0.889    0.967      0.286      0.276    1.18s   0:00:34
   80     1.020      1.170   0.921    0.971      0.232      0.226    1.04s   0:00:21
   90     1.082      1.338   0.940    0.983      0.197      0.193    1.04s   0:00:10
   99     1.142      1.494   0.938    0.981      0.212      0.208    0.96s   0:00:01
Training Time (h:m:s)=  0:01:53.  112.7s
```

Figure






```
Scores (1:neutral, >1 :better than neutral)
Train Score: 0.959
Test Score: 0.928
```

Make & train DONE