```
C:\Users\wangyisu\PycharmProjects\MolClassifier\venv\Scripts\python.exe "C:\Program Files\JetBrains\PyCharm 2019.1.3\helpers\pydev\pydevconsole.py" --mode=client --port=51909

import sys; print('Python %s on %s' % (sys.version, sys.platform))
sys.path.extend(['C:\\Users\\wangyisu\\PycharmProjects\\MolClassifier', 'C:/Users/wangyisu/PycharmProjects/MolClassifier'])

PyDev console: starting.

Python 3.7.3 (default, Apr 24 2019, 15:29:51) [MSC v.1915 64 bit (AMD64)] on win32
>>> runfile('C:/Users/wangyisu/PycharmProjects/MolClassifier/Model/2016b_ResNet/train.py', wdir='C:/Users/wangyisu/PycharmProjects/MolClassifier/Model/2016b_ResNet')
Using TensorFlow backend.
[[0. 0. 0. ... 1. 0. 0.]
 [0. 0. 0. ... 0. 0. 0.]
 [0. 0. 0. ... 0. 0. 1.]
 ...
 [0. 0. 0. ... 0. 0. 1.]
 [0. 0. 0. ... 1. 0. 0.]
 [0. 0. 0. ... 1. 0. 0.]]
训练数据的维度 (600000, 2, 128)
输入信号的维度： [2, 128]
调制信号种类 ['8PSK', 'AM-DSB', 'BPSK', 'CPFSK', 'GFSK', 'PAM4', 'QAM16', 'QAM64', 'QPSK', 'WBFM']
C:\Users\wangyisu\PycharmProjects\MolClassifier\Utils\utils.py:97: UserWarning: Update your `Conv2D` call to the Keras 2 API: `Conv2D(50, (1, 1), name="resla_branch2a", data_format="channels_first", padding="valid", kernel_initializer="glorot_uniform")`
  name=conv_name_base + '2a',data_format="channels_first",padding='valid', init='glorot_uniform')(input_tensor_padding)
2020-03-05 23:44:55.747209: I tensorflow/core/platform/cpu_feature_guard.cc:142] Your CPU supports instructions that this TensorFlow binary was not compiled to use: AVX AVX2
2020-03-05 23:44:55.749011: I tensorflow/stream_executor/platform/default/dso_loader.cc:42] Successfully opened dynamic library nvcuda.dll
2020-03-05 23:44:55.785910: I tensorflow/core/common_runtime/gpu/
```

```
25 gpu_device.cc:1640] Found device 0 with properties:
26 name: GeForce GTX 1660 SUPER major: 7 minor: 5 memoryClockRate(GHz): 1
   .785
27 pciBusID: 0000:01:00.0
28 2020-03-05 23:44:55.786225: I tensorflow/stream_executor/platform/
   default/dlopen_checker_stub.cc:25] GPU libraries are statically linked
   , skip dlopen check.
29 2020-03-05 23:44:55.786784: I tensorflow/core/common_runtime/gpu/
   gpu_device.cc:1763] Adding visible gpu devices: 0
30 2020-03-05 23:44:56.321003: I tensorflow/core/common_runtime/gpu/
   gpu_device.cc:1181] Device interconnect StreamExecutor with strength 1
    edge matrix:
31 2020-03-05 23:44:56.321223: I tensorflow/core/common_runtime/gpu/
   gpu_device.cc:1187]      0
32 2020-03-05 23:44:56.321353: I tensorflow/core/common_runtime/gpu/
   gpu_device.cc:1200] 0:   N
33 2020-03-05 23:44:56.322108: I tensorflow/core/common_runtime/gpu/
   gpu_device.cc:1326] Created TensorFlow device (/job:localhost/replica:
   0/task:0/device:GPU:0 with 4640 MB memory) -> physical GPU (device: 0
   , name: GeForce GTX 1660 SUPER, pci bus id: 0000:01:00.0, compute
   capability: 7.5)
34 C:\Users\wangyisu\PycharmProjects\MolClassifier\Utils\utils.py:105:
   UserWarning: Update your `Conv2D` call to the Keras 2 API: `Conv2D(50
   , (1, 3), padding="valid", name="res1a_branch2b", data_format="
   channels_first", kernel_initializer="glorot_uniform")`
35   name=conv_name_base + '2b',data_format="channels_first", init='
   glorot_uniform')(x)
36 C:\Users\wangyisu\PycharmProjects\MolClassifier\Utils\utils.py:111:
   UserWarning: Update your `Conv2D` call to the Keras 2 API: `Conv2D(50
   , (1, 3), name="res1a_branch2c", data_format="channels_first", padding
   ="valid", kernel_initializer="glorot_uniform")`
37   x = Conv2D(filters3, (1, 3), name=conv_name_base + '2c',data_format
   ="channels_first", padding='valid', init='glorot_uniform')(x)  # (1, 1
   )
38 C:\Users\wangyisu\PycharmProjects\MolClassifier\Utils\utils.py:116:
   UserWarning: Update your `Conv2D` call to the Keras 2 API: `Conv2D(50
   , (1, 1), name="res1a_branch1", data_format="channels_first",
   kernel_initializer="glorot_uniform")`
39   name=conv_name_base + '1',data_format="channels_first", init='
   glorot_uniform')(input_tensor_padding)
```

```
C:\Users\wangyisu\PycharmProjects\MolClassifier\Utils\utils.py:48: UserWarning: Update your `Conv2D` call to the Keras 2 API: `Conv2D(50, (1, 1), name="res1b_branch2a", data_format="channels_first", kernel_initializer="glorot_uniform")`
  x = Conv2D(filters1, (1, 1), name=conv_name_base + '2a',data_format="channels_first", init='glorot_uniform')(x)
C:\Users\wangyisu\PycharmProjects\MolClassifier\Utils\utils.py:55: UserWarning: Update your `Conv2D` call to the Keras 2 API: `Conv2D(50, (1, 7), padding="valid", name="res1b_branch2b", data_format="channels_first", kernel_initializer="glorot_uniform")`
  padding='valid', name=conv_name_base + '2b',data_format="channels_first", init='glorot_uniform')(x)
C:\Users\wangyisu\PycharmProjects\MolClassifier\Utils\utils.py:61: UserWarning: Update your `Conv2D` call to the Keras 2 API: `Conv2D(50, (1, 3), name="res1b_branch2c", data_format="channels_first", kernel_initializer="glorot_uniform")`
  x = Conv2D(filters3, (1, 3), name=conv_name_base + '2c',data_format="channels_first", init='glorot_uniform')(x)  # (1, 1)
C:\Users\wangyisu\PycharmProjects\MolClassifier\Utils\utils.py:195: UserWarning: Update your `Dense` call to the Keras 2 API: `Dense(256, activation="relu", name="dense1", kernel_initializer="he_normal")`
  layer_dense1 = Dense(256, activation='relu', init='he_normal', name="dense1")(layer_Flatten)
C:\Users\wangyisu\PycharmProjects\MolClassifier\Utils\utils.py:199: UserWarning: Update your `Dense` call to the Keras 2 API: `Dense(10, name="dense2", kernel_initializer="he_normal")`
  layer_dense2 = Dense(len(classes), init='he_normal', name="dense2")(layer_dropout)
Model: "model_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
Connected to
=================================================================
input_1 (InputLayer)         (None, 1, 2, 128)         0

_________________________________________________________________
zero_padding2d_1 (ZeroPadding2D (None, 1, 2, 132)         0
```

```
input_1[0][0]
____________________________________________________________________________________________
____________________________
res1a_branch2a (Conv2D)          (None, 50, 2, 132)    100
zero_padding2d_1[0][0]
____________________________________________________________________________________________
____________________________
activation_1 (Activation)        (None, 50, 2, 132)    0
res1a_branch2a[0][0]
____________________________________________________________________________________________
____________________________
dropout_1 (Dropout)              (None, 50, 2, 132)    0
activation_1[0][0]
____________________________________________________________________________________________
____________________________
zero_padding2d_2 (ZeroPadding2D (None, 50, 2, 136)    0
dropout_1[0][0]
____________________________________________________________________________________________
____________________________
res1a_branch2b (Conv2D)          (None, 50, 2, 134)    7550
zero_padding2d_2[0][0]
____________________________________________________________________________________________
____________________________
activation_2 (Activation)        (None, 50, 2, 134)    0
res1a_branch2b[0][0]
____________________________________________________________________________________________
____________________________
dropout_2 (Dropout)              (None, 50, 2, 134)    0
activation_2[0][0]
____________________________________________________________________________________________
____________________________
res1a_branch2c (Conv2D)          (None, 50, 2, 132)    7550
dropout_2[0][0]
____________________________________________________________________________________________
____________________________
res1a_branch1 (Conv2D)           (None, 50, 2, 132)    100
zero_padding2d_1[0][0]
____________________________________________________________________________________________
____________________________
dropout_3 (Dropout)              (None, 50, 2, 132)    0
```

```
76 res1a_branch2c[0][0]
77 ____________________________________________________________________
   ____________________________________
78 dropout_4 (Dropout)              (None, 50, 2, 132)    0
   res1a_branch1[0][0]
79 ____________________________________________________________________
   ____________________________________
80 add_1 (Add)                      (None, 50, 2, 132)    0
   dropout_3[0][0]
81
   dropout_4[0][0]
82 ____________________________________________________________________
   ____________________________________
83 activation_3 (Activation)        (None, 50, 2, 132)    0
   add_1[0][0]
84 ____________________________________________________________________
   ____________________________________
85 zero_padding2d_3 (ZeroPadding2D (None, 50, 2, 136)    0
   activation_3[0][0]
86 ____________________________________________________________________
   ____________________________________
87 res1b_branch2a (Conv2D)          (None, 50, 2, 136)    2550
   zero_padding2d_3[0][0]
88 ____________________________________________________________________
   ____________________________________
89 activation_4 (Activation)        (None, 50, 2, 136)    0
   res1b_branch2a[0][0]
90 ____________________________________________________________________
   ____________________________________
91 dropout_5 (Dropout)              (None, 50, 2, 136)    0
   activation_4[0][0]
92 ____________________________________________________________________
   ____________________________________
93 res1b_branch2b (Conv2D)          (None, 50, 2, 130)    17550
   dropout_5[0][0]
94 ____________________________________________________________________
   ____________________________________
95 activation_5 (Activation)        (None, 50, 2, 130)    0
   res1b_branch2b[0][0]
96 ____________________________________________________________________
```

```
 96 ____________________________________
 97 dropout_6 (Dropout)              (None, 50, 2, 130)    0
    activation_5[0][0]
 98 ____________________________________________________________________________
    ____________________________________
 99 zero_padding2d_4 (ZeroPadding2D (None, 50, 2, 134)    0
    dropout_6[0][0]
100 ____________________________________________________________________________
    ____________________________________
101 res1b_branch2c (Conv2D)         (None, 50, 2, 132)    7550
    zero_padding2d_4[0][0]
102 ____________________________________________________________________________
    ____________________________________
103 dropout_7 (Dropout)              (None, 50, 2, 132)    0
    res1b_branch2c[0][0]
104 ____________________________________________________________________________
    ____________________________________
105 add_2 (Add)                      (None, 50, 2, 132)    0
    dropout_7[0][0]
106
    activation_3[0][0]
107 ____________________________________________________________________________
    ____________________________________
108 activation_6 (Activation)        (None, 50, 2, 132)    0
    add_2[0][0]
109 ____________________________________________________________________________
    ____________________________________
110 flatten_1 (Flatten)              (None, 13200)         0
    activation_6[0][0]
111 ____________________________________________________________________________
    ____________________________________
112 dense1 (Dense)                   (None, 256)           3379456
    flatten_1[0][0]
113 ____________________________________________________________________________
    ____________________________________
114 dropout_8 (Dropout)              (None, 256)           0
    dense1[0][0]
115 ____________________________________________________________________________
    ____________________________________
116 dense2 (Dense)                   (None, 10)            2570
```

```
116 dropout_8[0][0]
117 ____________________________________________________________________
    ____________________________
118 activation_7 (Activation)       (None, 10)           0
    dense2[0][0]
119 ____________________________________________________________________
    ____________________________
120 reshape_1 (Reshape)             (None, 10)           0
    activation_7[0][0]
121 ====================================================================
    ============================
122 Total params: 3,424,976
123 Trainable params: 3,424,976
124 Non-trainable params: 0
125 ____________________________________________________________________
    ____________________________
126 C:\Users\wangyisu\PycharmProjects\MolClassifier\Model\Utils\utils.py:
    48: UserWarning: The `nb_epoch` argument in `fit` has been renamed `
    epochs`.
127   keras.callbacks.EarlyStopping(monitor='val_loss', patience=5,
    verbose=0, mode='auto')
128 WARNING:tensorflow:From C:\Users\wangyisu\AppData\Local\Continuum\
    anaconda3\lib\site-packages\tensorflow\python\ops\math_grad.py:1250:
    add_dispatch_support.<locals>.wrapper (from tensorflow.python.ops.
    array_ops) is deprecated and will be removed in a future version.
129 Instructions for updating:
130 Use tf.where in 2.0, which has the same broadcast rule as np.where
131 WARNING:tensorflow:From C:\Users\wangyisu\AppData\Local\Continuum\
    anaconda3\lib\site-packages\keras\backend\tensorflow_backend.py:422:
    The name tf.global_variables is deprecated. Please use tf.compat.v1.
    global_variables instead.
132
133 Train on 600000 samples, validate on 600000 samples
134 Epoch 1/100
135  - 64s - loss: 1.7442 - val_loss: 1.6448
136 Epoch 2/100
137  - 62s - loss: 1.4533 - val_loss: 1.5581
138 Epoch 3/100
139  - 62s - loss: 1.3678 - val_loss: 1.4427
140 Epoch 4/100
```

```
141  - 62s - loss: 1.3355 - val_loss: 1.3325
142 Epoch 5/100
143  - 62s - loss: 1.2969 - val_loss: 1.2981
144 Epoch 6/100
145  - 62s - loss: 1.2803 - val_loss: 1.2768
146 Epoch 7/100
147  - 62s - loss: 1.2668 - val_loss: 1.1664
148 Epoch 8/100
149  - 62s - loss: 1.2597 - val_loss: 1.1982
150 Epoch 9/100
151  - 62s - loss: 1.2485 - val_loss: 1.1558
152 Epoch 10/100
153  - 62s - loss: 1.2424 - val_loss: 1.1771
154 Epoch 11/100
155  - 62s - loss: 1.2382 - val_loss: 1.1920
156 Epoch 12/100
157  - 61s - loss: 1.2339 - val_loss: 1.2598
158 Epoch 13/100
159  - 60s - loss: 1.2302 - val_loss: 1.1929
160 Epoch 14/100
161  - 61s - loss: 1.2258 - val_loss: 1.1607
162 Overall Accuracy:  0.10082826798477056
163 Overall Accuracy:  0.10771081117198984
164 Overall Accuracy:  0.11324024394307995
165 Overall Accuracy:  0.12326290057931219
166 Overall Accuracy:  0.14938922635338095
167 Overall Accuracy:  0.22285885605783004
168 Overall Accuracy:  0.33312315401719045
169 Overall Accuracy:  0.45903063099174934
170 Overall Accuracy:  0.5711334710468448
171 Overall Accuracy:  0.6576108803430256
172 Overall Accuracy:  0.7175949239601168
173 Overall Accuracy:  0.748069241011984
174 Overall Accuracy:  0.7537827142429583
175 Overall Accuracy:  0.7618558409279205
176 Overall Accuracy:  0.7629369004547416
177 Overall Accuracy:  0.7677419354838709
178 Overall Accuracy:  0.7656946940949337
179 Overall Accuracy:  0.7638082600762979
180 Overall Accuracy:  0.7636521333021984
```

```
181 Overall Accuracy:  0.7648219361310817
182 {-20: 0.10082826798477056, -18: 0.10771081117198984, -16: 0.
    11324024394307995, -14: 0.12326290057931219, -12: 0.14938922635338095
    , -10: 0.22285885605783004, -8: 0.33312315401719045, -6: 0.
    45903063099174934, -4: 0.5711334710468448, -2: 0.6576108803430256, 0
    : 0.7175949239601168, 2: 0.748069241011984, 4: 0.7537827142429583, 6
    : 0.7618558409279205, 8: 0.7629369004547416, 10: 0.7677419354838709,
    12: 0.7656946940949337, 14: 0.7638082600762979, 16: 0.
    7636521333021984, 18: 0.7648219361310817}
183 {-20: 0.10082826798477056, -18: 0.10771081117198984, -16: 0.
    11324024394307995, -14: 0.12326290057931219, -12: 0.14938922635338095
    , -10: 0.22285885605783004, -8: 0.33312315401719045, -6: 0.
    45903063099174934, -4: 0.5711334710468448, -2: 0.6576108803430256, 0
    : 0.7175949239601168, 2: 0.748069241011984, 4: 0.7537827142429583, 6
    : 0.7618558409279205, 8: 0.7629369004547416, 10: 0.7677419354838709,
    12: 0.7656946940949337, 14: 0.7638082600762979, 16: 0.
    7636521333021984, 18: 0.7648219361310817}
184
```