Use rectified signals. (rectify_emg_moving_average(X,20))
Use cost sensitive learning(1:5) for binary classification(0:others)
Drop some files out for test. Shuffle and split the rest data as 75% for training and 25% for validation.
Use residual block in conv1d structure.

# Drop Files[6,30,31,32,33,34,35]:

Class 0 : others

Train (acc 0.992)

| | Predicted 0 | Predicted others |
|---|---|---|
| Actual 0 | 5515 | 47 |
| Actual others | 1 | 524 |

Valid (acc 0.984)

| | Predicted 0 | Predicted others |
|---|---|---|
| Actual 0 | 1811 | 29 |
| Actual others | 2 | 188 |

Test (acc 0.920)

| | Predicted 0 | Predicted others |
|---|---|---|
| Actual 0 | 288 | 38 |
| Actual others | 4 | 197 |

Class 1 : 2 : 6

Train (acc 0.897)

| | Predicted 1 | Predicted 2 | Predicted 6 |
|---|---|---|---|
| Actual 1 | 82 | 9 | 31 |
| Actual 2 | 6 | 245 | 6 |
| Actual 6 | 0 | 3 | 153 |

Valid (acc 0.854)

| | Predicted 1 | Predicted 2 | Predicted 6 |
|---|---|---|---|
| Actual 1 | 20 | 4 | 7 |
| Actual 2 | 7 | 88 | 3 |
| Actual 6 | 0 | 5 | 45 |

Test (acc 0.761)

| | Predicted 1 | Predicted 2 | Predicted 6 |
|---|---|---|---|
| Actual 1 | 25 | 20 | 7 |
| Actual 2 | 10 | 46 | 1 |
| Actual 6 | 8 | 2 | 82 |

Class 2 : 6

Train (acc 0.971)

| | Predicted 2 | Predicted 6 |
|---|---|---|
| Actual 2 | 250 | 9 |
| Actual 6 | 3 | 158 |

Valid (acc 0.964)

| | Predicted 2 | Predicted 6 |
|---|---|---|
| Actual 2 | 92 | 4 |
| Actual 6 | 1 | 44 |

Test (acc 0.919)

| | Predicted 2 | Predicted 6 |
|---|---|---|
| Actual 2 | 53 | 4 |
| Actual 6 | 8 | 84 |

Class 1 : 6

Train (acc 0.825)

| | Predicted 1 | Predicted 6 |
|---|---|---|
| Actual 1 | 80 | 42 |
| Actual 6 | 5 | 142 |

Valid (acc 0.877)

| | Predicted 1 | Predicted 6 |
|---|---|---|
| Actual 1 | 22 | 9 |
| Actual 6 | 2 | 57 |

Test (acc 0.833)

| | Predicted 1 | Predicted 6 |
|---|---|---|
| Actual 1 | 36 | 16 |
| Actual 6 | 8 | 84 |

Class 1 : 2

Train (acc 0.871)

| | Predicted 1 | Predicted 2 |
|---|---|---|
| Actual 1 | 97 | 24 |
| Actual 2 | 25 | 235 |

Valid (acc 0.874)

| | Predicted 1 | Predicted 2 |
|---|---|---|
| Actual 1 | 23 | 9 |
| Actual 2 | 7 | 88 |

Test (acc 0.770)

| | Predicted 1 | Predicted 2 |
|---|---|---|
| Actual 1 | 42 | 10 |
| Actual 2 | 15 | 42 |

# Drop Files[7,30,31,32,33,34,35]:

Class 0 : others

Train (acc 0.978)

| | Predicted 0 | Predicted others |
|---|---|---|
| Actual 0 | 5478 | 121 |
| Actual others | 7 | 430 |

Valid (acc 0.974)

| | Predicted 0 | Predicted others |
|---|---|---|
| Actual 0 | 1808 | 45 |
| Actual others | 7 | 152 |

Test (acc 0.973)

| | Predicted 0 | Predicted others |
|---|---|---|
| Actual 0 | 271 | 5 |
| Actual others | 11 | 309 |

Class 1 : 2 : 6

Train (acc 0.890)

| | Predicted 1 | Predicted 2 | Predicted 6 |
|---|---|---|---|
| Actual 1 | 33 | 22 | 9 |
| Actual 2 | 10 | 221 | 1 |
| Actual 6 | 7 | 0 | 144 |

Valid (acc 0.885)

| | Predicted 1 | Predicted 2 | Predicted 6 |
|---|---|---|---|
| Actual 1 | 7 | 5 | 3 |
| Actual 2 | 3 | 90 | 2 |
| Actual 6 | 4 | 0 | 35 |

Test (acc 0.655)

| | Predicted 1 | Predicted 2 | Predicted 6 |
|---|---|---|---|
| Actual 1 | 39 | 37 | 50 |
| Actual 2 | 14 | 62 | 9 |
| Actual 6 | 0 | 0 | 108 |

Class 2 : 6

Train (acc 0.968)

| | Predicted 2 | Predicted 6 |
|---|---|---|
| Actual 2 | 242 | 2 |
| Actual 6 | 10 | 133 |

Valid (acc 0.961)

| | Predicted 2 | Predicted 6 |
|---|---|---|
| Actual 2 | 81 | 2 |
| Actual 6 | 3 | 44 |

Test (acc 0.953)

| | Predicted 2 | Predicted 6 |
|---|---|---|
| Actual 2 | 77 | 8 |
| Actual 6 | 1 | 107 |

Class 1 : 6

Train (acc 0.965)

| | Predicted 1 | Predicted 6 |
|---|---|---|
| Actual 1 | 53 | 6 |
| Actual 6 | 1 | 141 |

Valid (acc 0.882)

| | Predicted 1 | Predicted 6 |
|---|---|---|
| Actual 1 | 15 | 5 |
| Actual 6 | 3 | 45 |

Test (acc 0.756)

| | Predicted 1 | Predicted 6 |
|---|---|---|
| Actual 1 | 71 | 55 |
| Actual 6 | 2 | 106 |

Class 1 : 2

Train (acc 0.940)

| | Predicted 1 | Predicted 2 |
|---|---|---|
| Actual 1 | 53 | 5 |
| Actual 2 | 13 | 233 |

Valid (acc 0.901)

| | Predicted 1 | Predicted 2 |
|---|---|---|
| Actual 1 | 17 | 4 |
| Actual 2 | 6 | 75 |

Test (acc 0.715)

| | Predicted 1 | Predicted 2 |
|---|---|---|
| Actual 1 | 98 | 28 |
| Actual 2 | 32 | 53 |

# Drop Files[5,30,31,32,33,34,35]:

Class 0 : others

Train (acc 0.977)

| | Predicted 0 | Predicted others |
|---|---|---|
| Actual 0 | 5433 | 138 |
| Actual others | 0 | 591 |

Valid (acc 0.974)

| | Predicted 0 | Predicted others |
|---|---|---|
| Actual 0 | 1797 | 49 |
| Actual others | 3 | 206 |

Test (acc 0.946)

| | Predicted 0 | Predicted others |
|---|---|---|
| Actual 0 | 300 | 11 |
| Actual others | 12 | 104 |

Class 1 : 2 : 6

Train (acc 0.871)

| | Predicted 1 | Predicted 2 | Predicted 6 |
|---|---|---|---|
| Actual 1 | 97 | 21 | 28 |
| Actual 2 | 18 | 278 | 1 |
| Actual 6 | 6 | 3 | 147 |

Valid (acc 0.835)

| | Predicted 1 | Predicted 2 | Predicted 6 |
|---|---|---|---|
| Actual 1 | 31 | 8 | 7 |
| Actual 2 | 10 | 93 | 3 |
| Actual 6 | 5 | 0 | 43 |

Test (acc 0.456)

| | Predicted 1 | Predicted 2 | Predicted 6 |
|---|---|---|---|
| Actual 1 | 3 | 10 | 0 |
| Actual 2 | 3 | 5 | 1 |
| Actual 6 | 29 | 20 | 45 |

Class 2 : 6

Train (acc 0.980)

| | Predicted 2 | Predicted 6 |
|---|---|---|
| Actual 2 | 288 | 4 |
| Actual 6 | 5 | 158 |

Valid (acc 0.973)

| | Predicted 2 | Predicted 6 |
|---|---|---|
| Actual 2 | 108 | 3 |
| Actual 6 | 1 | 40 |

Test (acc 0.601)

| | Predicted 2 | Predicted 6 |
|---|---|---|
| Actual 2 | 6 | 3 |
| Actual 6 | 38 | 56 |

Class 1 : 6

Train (acc 0.902)

| | Predicted 1 | Predicted 6 |
|---|---|---|
| Actual 1 | 123 | 22 |
| Actual 6 | 7 | 145 |

Valid (acc 0.858)

| | Predicted 1 | Predicted 6 |
|---|---|---|
| Actual 1 | 38 | 9 |
| Actual 6 | 5 | 47 |

Test (acc 0.514)

| | Predicted 1 | Predicted 6 |
|---|---|---|
| Actual 1 | 13 | 0 |
| Actual 6 | 52 | 42 |

Class 1 : 2

Train (acc 0.946)

| | Predicted 1 | Predicted 2 |
|---|---|---|
| Actual 1 | 141 | 11 |
| Actual 2 | 13 | 281 |

Valid (acc 0.845)

| | Predicted 1 | Predicted 2 |
|---|---|---|
| Actual 1 | 30 | 10 |
| Actual 2 | 13 | 95 |

Test (acc 0.363)

| | Predicted 1 | Predicted 2 |
|---|---|---|
| Actual 1 | 0 | 13 |
| Actual 2 | 1 | 8 |

# Model:

```
def residual_block(x, i):
    tanh_out = layers.Conv1D(filters,
                             2,
                             dilation_rate = 2**i,
                             padding='causal',
                             name='dilated_conv_%d_tanh' % (2 ** i),
                             activation='tanh'
                             )(x)
    sigm_out = layers.Conv1D(filters,
                             2,
                             dilation_rate = 2**i,
                             padding='causal',
                             name='dilated_conv_%d_sigm' % (2 ** i),
                             activation='sigmoid'
                             )(x)
    z = layers.Multiply(name='gated_activation_%d' % (i))([tanh_out, sigm_out])
    skip = layers.Conv1D(filters, 1, name='skip_%d'%(i))(z)
    res = layers.Add(name='residual_block_%d' % (i))([skip, x])
    return res, skip

x = layers.Input(shape=(1024,8), name='original_input')
skip_connections = []
out = layers.Conv1D(filters, 2, dilation_rate=1, padding='causal', name='dilated_conv_1')(x)
for i in range(1, 6):
    out, skip = residual_block(out,i)
    skip_connections.append(skip)
out = layers.Add(name='skip_connections')(skip_connections)
out = layers.Activation('elu')(out)
out = layers.Conv1D(32, 3, strides = 1, padding='same', activation = 'relu')(out)
out = layers.MaxPooling1D(2, padding='same')(out)
out = layers.Conv1D(16, 7, padding='same', activation='elu')(out)
out = layers.MaxPooling1D(2, padding='same)(out)
out = layers.Conv1D(8, 3, activation='elu', padding='same')(out)
out = layers.GlobalAveragePooling1D()(out)
out = layers.Dense(2,activation='softmax')(out)
```

```
model = Model(x, out)
```