openmic-MEL-ML

March 2, 2020

[1]:
```
import librosa as lb
import librosa.display
import scipy
import json
import numpy as np
import sklearn
from sklearn.metrics import classification_report
from sklearn.model_selection import train_test_split
import os
import keras
from keras.utils import np_utils
from keras import layers
from keras import models
from keras.models import Sequential
from keras.layers import Dense, Conv2D, MaxPool2D , Flatten, Dropout
from keras.preprocessing.image import ImageDataGenerator
from model_builder import build_example
from plotter import plot_history
import matplotlib.pyplot as plt
```

```
Using TensorFlow backend.
```

[2]:
```
# CONSTANTS

DATA_DIR = "openmic-2018/"
CATEGORY_COUNT = 8
LEARNING_RATE = 0.00001
THRESHOLD = 0.5
```

[6]:
```
# LOAD DATA

OPENMIC = np.load(os.path.join(DATA_DIR, 'openmic-mel.npz'), allow_pickle=True)
print('OpenMIC keys: ' + str(list(OPENMIC.keys())))
X, Y_true, Y_mask, sample_key = OPENMIC['MEL'], OPENMIC['Y_true'],␣
 ↪OPENMIC['Y_mask'], OPENMIC['sample_key']
print('X has shape: ' + str(X.shape))
print('Y_true has shape: ' + str(Y_true.shape))
```

```
print('Y_mask has shape: ' + str(Y_mask.shape))
print('sample_key has shape: ' + str(sample_key.shape))
```

```
OpenMIC keys: ['MEL', 'Y_true', 'Y_mask', 'sample_key']
X has shape: (20000, 128, 430)
Y_true has shape: (20000, 20)
Y_mask has shape: (20000, 20)
sample_key has shape: (20000,)
```

[8]:
```
# LOAD LABELS

with open(os.path.join(DATA_DIR, 'class-map.json'), 'r') as f:
    INSTRUMENTS = json.load(f)
print('OpenMIC instruments: ' + str(INSTRUMENTS))
```

```
OpenMIC instruments: {'accordion': 0, 'banjo': 1, 'bass': 2, 'cello': 3,
'clarinet': 4, 'cymbals': 5, 'drums': 6, 'flute': 7, 'guitar': 8,
'mallet_percussion': 9, 'mandolin': 10, 'organ': 11, 'piano': 12, 'saxophone':
13, 'synthesizer': 14, 'trombone': 15, 'trumpet': 16, 'ukulele': 17, 'violin':
18, 'voice': 19}
```

[9]:
```
# SPLIT DATA (TRAIN - TEST - VAL)

# CHANGE X TO MEL
split_train, split_test, X_train, X_test, Y_true_train, Y_true_test,␣
↪Y_mask_train, Y_mask_test = train_test_split(sample_key, X, Y_true, Y_mask)
split_val, split_test, X_val, X_test, Y_true_val, Y_true_test, Y_mask_val,␣
↪Y_mask_test = train_test_split(split_test, X_test, Y_true_test, Y_mask_test,␣
↪test_size=0.5)
train_set = np.asarray(set(split_train))
test_set = np.asarray(set(split_test))
print('# Train: {}, # Val: {}, # Test: {}'.format(len(split_train),␣
↪len(split_test), len(split_val)))
```

```
# Train: 15000, # Val: 2500, # Test: 2500
```

[10]:
```
# DUPLICATE OF THE MODEL PREPROCESS

print(X_train.shape)
print(X_test.shape)

for instrument in INSTRUMENTS:

    # Map the instrument name to its column number
    inst_num = INSTRUMENTS[instrument]
```

```python
    print(instrument)

    # TRAIN
    train_inst = Y_mask_train[:, inst_num]
    X_train_inst = X_train[train_inst]
    X_train_inst = X_train_inst.astype('float16')
    shape = X_train_inst.shape
    X_train_inst = X_train_inst.reshape(shape[0],1, shape[1], shape[2])
    Y_true_train_inst = Y_true_train[train_inst, inst_num] >= THRESHOLD
    i = 0
    for val in Y_true_train_inst:
        i += val

    print('TRAIN: ' + str(i) + ' true of ' + str(len(Y_true_train_inst)) + ' ('␣
↪+ str(round(i / len(Y_true_train_inst ) * 100,2)) + ' %)' )


    # TEST
    test_inst = Y_mask_test[:, inst_num]
    X_test_inst = X_test[test_inst]
    X_test_inst = X_test_inst.astype('float16')
    shape = X_test_inst.shape
    X_test_inst = X_test_inst.reshape(shape[0],1, shape[1], shape[2])
    Y_true_test_inst = Y_true_test[test_inst, inst_num] >= THRESHOLD

    i = 0
    for val in Y_true_test_inst:
        i += val

    print('TEST: ' + str(i) + ' true of ' + str(len(Y_true_test_inst)) + ' (' +␣
↪str(round(i / len(Y_true_test_inst ) * 100,2)) + ' %)' )


    # VALIDATION
    val_inst = Y_mask_val[:, inst_num]
    X_val_inst = X_val[val_inst]
    X_val_inst = X_val_inst.astype('float16')
    shape = X_val_inst.shape
    X_val_inst = X_val_inst.reshape(shape[0],1, shape[1], shape[2])
    Y_true_val_inst = Y_true_val[val_inst, inst_num] >= THRESHOLD


    i = 0
    for val in Y_true_val_inst:
        i += val
    print('VALIDATION: ' + str(i) + ' true of ' + str(len(Y_true_val_inst)) + '␣
↪(' + str(round(i / len(Y_true_val_inst ) * 100,2)) + ' %)' )
```

```
(15000, 128, 430)
(2500, 128, 430)
accordion
TRAIN: 366 true of 1535 (23.84 %)
TEST: 66 true of 269 (24.54 %)
VALIDATION: 57 true of 267 (21.35 %)
banjo
TRAIN: 541 true of 1661 (32.57 %)
TEST: 99 true of 287 (34.49 %)
VALIDATION: 92 true of 270 (34.07 %)
bass
TRAIN: 400 true of 1417 (28.23 %)
TEST: 75 true of 227 (33.04 %)
VALIDATION: 74 true of 244 (30.33 %)
cello
TRAIN: 608 true of 1458 (41.7 %)
TEST: 110 true of 255 (43.14 %)
VALIDATION: 106 true of 236 (44.92 %)
clarinet
TRAIN: 400 true of 1790 (22.35 %)
TEST: 68 true of 291 (23.37 %)
VALIDATION: 65 true of 304 (21.38 %)
cymbals
TRAIN: 824 true of 1296 (63.58 %)
TEST: 156 true of 241 (64.73 %)
VALIDATION: 131 true of 198 (66.16 %)
drums
TRAIN: 835 true of 1332 (62.69 %)
TEST: 142 true of 215 (66.05 %)
VALIDATION: 129 true of 200 (64.5 %)
flute
TRAIN: 492 true of 1565 (31.44 %)
TEST: 74 true of 249 (29.72 %)
VALIDATION: 81 true of 270 (30.0 %)
guitar
TRAIN: 826 true of 1215 (67.98 %)
TEST: 150 true of 214 (70.09 %)
VALIDATION: 162 true of 221 (73.3 %)
mallet_percussion
TRAIN: 533 true of 1348 (39.54 %)
TEST: 101 true of 225 (44.89 %)
VALIDATION: 99 true of 229 (43.23 %)
mandolin
TRAIN: 648 true of 1868 (34.69 %)
TEST: 103 true of 301 (34.22 %)
VALIDATION: 94 true of 295 (31.86 %)
organ
TRAIN: 452 true of 1438 (31.43 %)
```

```
TEST: 70 true of 234 (29.91 %)
VALIDATION: 81 true of 218 (37.16 %)
piano
TRAIN: 879 true of 1292 (68.03 %)
TEST: 154 true of 220 (70.0 %)
VALIDATION: 137 true of 208 (65.87 %)
saxophone
TRAIN: 846 true of 1750 (48.34 %)
TEST: 133 true of 293 (45.39 %)
VALIDATION: 156 true of 322 (48.45 %)
synthesizer
TRAIN: 819 true of 1202 (68.14 %)
TEST: 140 true of 199 (70.35 %)
VALIDATION: 132 true of 201 (65.67 %)
trombone
TRAIN: 657 true of 2060 (31.89 %)
TEST: 105 true of 348 (30.17 %)
VALIDATION: 101 true of 352 (28.69 %)
trumpet
TRAIN: 849 true of 2200 (38.59 %)
TEST: 142 true of 348 (40.8 %)
VALIDATION: 155 true of 368 (42.12 %)
ukulele
TRAIN: 559 true of 1819 (30.73 %)
TEST: 95 true of 314 (30.25 %)
VALIDATION: 84 true of 292 (28.77 %)
violin
TRAIN: 881 true of 1535 (57.39 %)
TEST: 141 true of 229 (61.57 %)
VALIDATION: 151 true of 269 (56.13 %)
voice
TRAIN: 744 true of 1181 (63.0 %)
TEST: 121 true of 191 (63.35 %)
VALIDATION: 123 true of 192 (64.06 %)
```

[15]:
```
# VALAMI FANCY ADATKIÍRÁS
len(Y_true_val_inst)
```

[15]: 193

[15]:
```
# This dictionary will include the classifiers for each model
models = dict()

# We'll iterate over all istrument classes, and fit a model for each one
# After training, we'll print a classification report for each instrument
for instrument in INSTRUMENTS:

    # Map the instrument name to its column number
```

```
    inst_num = INSTRUMENTS[instrument]

    # Step 1: sub-sample the data

    # First, we need to select down to the data for which we have annotations
    # This is what the mask arrays are for
    train_inst = Y_mask_train[:, inst_num]
    test_inst = Y_mask_test[:, inst_num]

    # Here, we're using the Y_mask_train array to slice out only the training␣
↪examples
    # for which we have annotations for the given class
    X_train_inst = X_train[train_inst]

    # Step 3: simplify the data by averaging over time

    # Let's arrange the data for a sklearn Random Forest model
    # Instead of having time-varying features, we'll summarize each track by␣
↪its mean feature vector over time
    X_train_inst_sklearn = np.mean(X_train_inst, axis=1)

    # Again, we slice the labels to the annotated examples
    # We thresold the label likelihoods at 0.5 to get binary labels
    Y_true_train_inst = Y_true_train[train_inst, inst_num] >= 0.5


    # Repeat the above slicing and dicing but for the test set
    X_test_inst = X_test[test_inst]
    X_test_inst_sklearn = np.mean(X_test_inst, axis=1)
    Y_true_test_inst = Y_true_test[test_inst, inst_num] >= 0.5

    # Step 3.
    # Initialize a new classifier
    clf = RandomForestClassifier(max_depth=8, n_estimators=100, random_state=0)

    # Step 4.
    clf.fit(X_train_inst_sklearn, Y_true_train_inst)

    # Step 5.
    # Finally, we'll evaluate the model on both train and test
    Y_pred_train = clf.predict(X_train_inst_sklearn)
    Y_pred_test = clf.predict(X_test_inst_sklearn)

    print('-' * 52)
    print(instrument)
    print('\tTRAIN')
    print(classification_report(Y_true_train_inst, Y_pred_train))
```

```python
    print(Y_true_train_inst[3])
    print(Y_pred_train[3])
    print('\tTEST')
    print(classification_report(Y_true_test_inst, Y_pred_test))

    print(Y_true_test_inst.shape)
    print(Y_pred_test.shape)

    # Store the classifier in our dictionary
    models[instrument] = clf
```

```
----------------------------------------------------
accordion
        TRAIN
              precision    recall  f1-score   support

       False       0.82      1.00      0.90      1169
        True       1.00      0.31      0.48       366

    accuracy                           0.84      1535
   macro avg       0.91      0.66      0.69      1535
weighted avg       0.87      0.84      0.80      1535

False
False
        TEST
              precision    recall  f1-score   support

       False       0.76      1.00      0.86       203
        True       1.00      0.02      0.03        66

    accuracy                           0.76       269
   macro avg       0.88      0.51      0.45       269
weighted avg       0.82      0.76      0.66       269

(269,)
(269,)
----------------------------------------------------
banjo
        TRAIN
              precision    recall  f1-score   support

       False       0.87      1.00      0.93      1120
        True       1.00      0.70      0.82       541

    accuracy                           0.90      1661
   macro avg       0.94      0.85      0.88      1661
```

```
weighted avg       0.91      0.90      0.90      1661

True
False
        TEST
              precision    recall  f1-score   support

       False       0.65      0.98      0.78       188
        True       0.00      0.00      0.00        99

    accuracy                           0.64       287
   macro avg       0.33      0.49      0.39       287
weighted avg       0.43      0.64      0.51       287

(287,)
(287,)
----------------------------------------------------
bass
        TRAIN
              precision    recall  f1-score   support

       False       0.87      1.00      0.93      1017
        True       1.00      0.62      0.76       400

    accuracy                           0.89      1417
   macro avg       0.93      0.81      0.85      1417
weighted avg       0.91      0.89      0.88      1417

False
False
        TEST
              precision    recall  f1-score   support

       False       0.67      0.97      0.79       152
        True       0.33      0.03      0.05        75

    accuracy                           0.66       227
   macro avg       0.50      0.50      0.42       227
weighted avg       0.56      0.66      0.55       227

(227,)
(227,)
----------------------------------------------------
cello
        TRAIN
              precision    recall  f1-score   support

       False       0.97      0.80      0.88       850
```

```
        True       0.78      0.96      0.86       608

    accuracy                           0.87      1458
   macro avg       0.87      0.88      0.87      1458
weighted avg       0.89      0.87      0.87      1458

False
False
        TEST
              precision    recall  f1-score   support

       False       0.69      0.64      0.67       145
        True       0.57      0.63      0.60       110

    accuracy                           0.64       255
   macro avg       0.63      0.63      0.63       255
weighted avg       0.64      0.64      0.64       255

(255,)
(255,)
----------------------------------------------------
clarinet
        TRAIN
              precision    recall  f1-score   support

       False       0.84      1.00      0.91      1390
        True       1.00      0.32      0.48       400

    accuracy                           0.85      1790
   macro avg       0.92      0.66      0.70      1790
weighted avg       0.87      0.85      0.82      1790

False
False
        TEST
              precision    recall  f1-score   support

       False       0.77      1.00      0.87       223
        True       0.00      0.00      0.00        68

    accuracy                           0.77       291
   macro avg       0.38      0.50      0.43       291
weighted avg       0.59      0.77      0.66       291

(291,)
(291,)

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```

```
packages\sklearn\metrics\classification.py:1437: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples.
  'precision', 'predicted', average, warn_for)

-----------------------------------------------------
cymbals
        TRAIN
              precision    recall  f1-score   support

       False       0.94      0.96      0.95       472
        True       0.98      0.97      0.97       824

    accuracy                           0.97      1296
   macro avg       0.96      0.97      0.96      1296
weighted avg       0.97      0.97      0.97      1296

True
True
        TEST
              precision    recall  f1-score   support

       False       0.78      0.71      0.74        85
        True       0.85      0.89      0.87       156

    accuracy                           0.83       241
   macro avg       0.81      0.80      0.80       241
weighted avg       0.82      0.83      0.82       241

(241,)
(241,)
-----------------------------------------------------
drums
        TRAIN
              precision    recall  f1-score   support

       False       0.93      0.91      0.92       497
        True       0.95      0.96      0.95       835

    accuracy                           0.94      1332
   macro avg       0.94      0.94      0.94      1332
weighted avg       0.94      0.94      0.94      1332

True
True
        TEST
              precision    recall  f1-score   support
```

```
       False       0.79      0.73      0.76        73
        True       0.86      0.90      0.88       142

    accuracy                           0.84       215
   macro avg       0.83      0.81      0.82       215
weighted avg       0.84      0.84      0.84       215

(215,)
(215,)
----------------------------------------------------
flute
        TRAIN
              precision    recall  f1-score   support

       False       0.80      1.00      0.89      1073
        True       1.00      0.44      0.61       492

    accuracy                           0.82      1565
   macro avg       0.90      0.72      0.75      1565
weighted avg       0.86      0.82      0.80      1565

False
False
        TEST
              precision    recall  f1-score   support

       False       0.70      1.00      0.83       175
        True       0.00      0.00      0.00        74

    accuracy                           0.70       249
   macro avg       0.35      0.50      0.41       249
weighted avg       0.49      0.70      0.58       249

(249,)
(249,)

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packages\sklearn\metrics\classification.py:1437: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples.
  'precision', 'predicted', average, warn_for)

----------------------------------------------------
guitar
        TRAIN
              precision    recall  f1-score   support

       False       1.00      0.57      0.73       389
```

```
        True       0.83      1.00      0.91       826

    accuracy                           0.86      1215
   macro avg       0.92      0.79      0.82      1215
weighted avg       0.89      0.86      0.85      1215

True
True
        TEST
              precision    recall  f1-score   support

       False       0.45      0.08      0.13        64
        True       0.71      0.96      0.82       150

    accuracy                           0.70       214
   macro avg       0.58      0.52      0.47       214
weighted avg       0.63      0.70      0.61       214

(214,)
(214,)
----------------------------------------------------
mallet_percussion
        TRAIN
              precision    recall  f1-score   support

       False       0.93      0.99      0.96       815
        True       0.99      0.89      0.94       533

    accuracy                           0.95      1348
   macro avg       0.96      0.94      0.95      1348
weighted avg       0.95      0.95      0.95      1348

True
False
        TEST
              precision    recall  f1-score   support

       False       0.58      0.82      0.68       124
        True       0.55      0.27      0.36       101

    accuracy                           0.57       225
   macro avg       0.57      0.54      0.52       225
weighted avg       0.57      0.57      0.54       225

(225,)
(225,)
----------------------------------------------------
mandolin
```

```
        TRAIN
              precision    recall  f1-score   support

       False       0.81      1.00      0.89      1220
        True       1.00      0.55      0.71       648

    accuracy                           0.84      1868
   macro avg       0.90      0.77      0.80      1868
weighted avg       0.87      0.84      0.83      1868

False
False
        TEST
              precision    recall  f1-score   support

       False       0.65      0.98      0.79       198
        True       0.00      0.00      0.00       103

    accuracy                           0.65       301
   macro avg       0.33      0.49      0.39       301
weighted avg       0.43      0.65      0.52       301

(301,)
(301,)
----------------------------------------------------
organ
        TRAIN
              precision    recall  f1-score   support

       False       0.88      0.99      0.93       986
        True       0.96      0.70      0.81       452

    accuracy                           0.90      1438
   macro avg       0.92      0.84      0.87      1438
weighted avg       0.90      0.90      0.89      1438

True
False
        TEST
              precision    recall  f1-score   support

       False       0.74      0.96      0.84       164
        True       0.70      0.23      0.34        70

    accuracy                           0.74       234
   macro avg       0.72      0.59      0.59       234
weighted avg       0.73      0.74      0.69       234
```

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(234,)
(234,)
---------------------------------------------------
piano
        TRAIN
              precision    recall  f1-score   support

       False       1.00      0.90      0.95       413
        True       0.96      1.00      0.98       879

    accuracy                           0.97      1292
   macro avg       0.98      0.95      0.96      1292
weighted avg       0.97      0.97      0.97      1292

True
True
        TEST
              precision    recall  f1-score   support

       False       0.84      0.71      0.77        66
        True       0.88      0.94      0.91       154

    accuracy                           0.87       220
   macro avg       0.86      0.83      0.84       220
weighted avg       0.87      0.87      0.87       220

(220,)
(220,)
---------------------------------------------------
saxophone
        TRAIN
              precision    recall  f1-score   support

       False       0.99      0.89      0.94       904
        True       0.90      0.99      0.94       846

    accuracy                           0.94      1750
   macro avg       0.94      0.94      0.94      1750
weighted avg       0.95      0.94      0.94      1750

True
True
        TEST
              precision    recall  f1-score   support

       False       0.66      0.53      0.59       160
        True       0.54      0.68      0.60       133
```

```
   accuracy                           0.59       293
  macro avg       0.60      0.60      0.59       293
weighted avg       0.61      0.59      0.59       293

(293,)
(293,)
----------------------------------------------------
synthesizer
        TRAIN
              precision    recall  f1-score   support

       False       0.98      0.96      0.97       383
        True       0.98      0.99      0.98       819

    accuracy                           0.98      1202
   macro avg       0.98      0.97      0.97      1202
weighted avg       0.98      0.98      0.98      1202

True
True
        TEST
              precision    recall  f1-score   support

       False       0.35      0.19      0.24        59
        True       0.71      0.86      0.78       140

    accuracy                           0.66       199
   macro avg       0.53      0.52      0.51       199
weighted avg       0.61      0.66      0.62       199

(199,)
(199,)
----------------------------------------------------
trombone
        TRAIN
              precision    recall  f1-score   support

       False       0.82      1.00      0.90      1403
        True       1.00      0.52      0.69       657

    accuracy                           0.85      2060
   macro avg       0.91      0.76      0.79      2060
weighted avg       0.88      0.85      0.83      2060

False
False
        TEST
              precision    recall  f1-score   support
```

```
       False       0.71      0.99      0.83       243
        True       0.75      0.06      0.11       105

    accuracy                           0.71       348
   macro avg       0.73      0.52      0.47       348
weighted avg       0.72      0.71      0.61       348

(348,)
(348,)
----------------------------------------------------
trumpet
        TRAIN
              precision    recall  f1-score   support

       False       0.88      1.00      0.93      1351
        True       1.00      0.78      0.87       849

    accuracy                           0.91      2200
   macro avg       0.94      0.89      0.90      2200
weighted avg       0.92      0.91      0.91      2200

False
False
        TEST
              precision    recall  f1-score   support

       False       0.65      0.94      0.77       206
        True       0.75      0.27      0.40       142

    accuracy                           0.67       348
   macro avg       0.70      0.61      0.59       348
weighted avg       0.69      0.67      0.62       348

(348,)
(348,)
----------------------------------------------------
ukulele
        TRAIN
              precision    recall  f1-score   support

       False       0.80      1.00      0.89      1260
        True       1.00      0.45      0.62       559

    accuracy                           0.83      1819
   macro avg       0.90      0.72      0.75      1819
weighted avg       0.86      0.83      0.81      1819
```

```
False
False
        TEST
              precision    recall  f1-score   support

       False       0.70      1.00      0.82       219
        True       1.00      0.02      0.04        95

    accuracy                           0.70       314
   macro avg       0.85      0.51      0.43       314
weighted avg       0.79      0.70      0.59       314

(314,)
(314,)
----------------------------------------------------
violin
        TRAIN
              precision    recall  f1-score   support

       False       1.00      0.58      0.74       654
        True       0.76      1.00      0.87       881

    accuracy                           0.82      1535
   macro avg       0.88      0.79      0.80      1535
weighted avg       0.86      0.82      0.81      1535

False
True
        TEST
              precision    recall  f1-score   support

       False       0.57      0.30      0.39        88
        True       0.66      0.86      0.75       141

    accuracy                           0.64       229
   macro avg       0.61      0.58      0.57       229
weighted avg       0.62      0.64      0.61       229

(229,)
(229,)
----------------------------------------------------
voice
        TRAIN
              precision    recall  f1-score   support

       False       1.00      0.76      0.87       437
        True       0.88      1.00      0.93       744
```

```
    accuracy                           0.91      1181
   macro avg       0.94      0.88      0.90      1181
weighted avg       0.92      0.91      0.91      1181

True
True
        TEST
              precision    recall  f1-score   support

       False       0.85      0.67      0.75        70
        True       0.83      0.93      0.88       121

    accuracy                           0.84       191
   macro avg       0.84      0.80      0.82       191
weighted avg       0.84      0.84      0.83       191

(191,)
(191,)
```

[8]:
```python
import matplotlib.pyplot as plt
from pylab import plot, show, figure, imshow, xlim, ylim, title


def plot_history():
    plt.figure(figsize=(9,4))
    plt.subplot(1,2,1)
    plt.plot(history.history['acc'])
    plt.plot(history.history['val_acc'])
    plt.title('Model accuracy')
    plt.ylabel('Accuracy')
    plt.xlabel('Epoch')
    plt.legend(['Train accuracy', 'Validation accuracy'], loc='upper left')
    plt.subplot(1,2,2)
    plt.plot(history.history['loss'])
    plt.plot(history.history['val_loss'])
    plt.title('Model loss')
    plt.ylabel('Loss')
    plt.xlabel('Epoch')
    plt.legend(['Train loss', 'Validation loss'], loc='upper left')
    plt.show()
```

[ ]:
```python
"""
    # Step 3: simplify the data by averaging over time
    # Instead of having time-varying features, we'll summarize each track by␣
 ↪its mean feature vector over time
    X_train_inst_sklearn = np.mean(X_train_inst, axis=1)
    X_test_inst_sklearn = np.mean(X_test_inst, axis=1)
    X_train_inst_sklearn = X_train_inst_sklearn.astype('float32')
```

```
    X_train_inst_sklearn = lb.util.normalize(X_train_inst_sklearn)
"""

np.savez('models.npz',model=)
```