```
import warnings
warnings.filterwarnings('ignore')

import numpy as np
import pandas as pd
import tensorflow as tf
from keras import layers
from keras import models
```

```
The default version of TensorFlow in Colab will soon switch to TensorFlow 2.x.
We recommend you upgrade now or ensure your notebook will continue to use TensorFlow 1.x via the
%tensorflow_version 1.x magic: more info.

Using TensorFlow backend.
```

```
from google.colab import drive
drive.mount('/gdrive')
%cd /gdrive/My\ Drive/Colab\ Notebooks
```

```
Go to this URL in a browser: https://accounts.google.com/o/oauth2/auth?client_id=9473189

Enter your authorization code:
··········
Mounted at /gdrive
/gdrive/My Drive/Colab Notebooks
```

```
import pickle
f_link = "features.pkl"
pickle_in = open(f_link,"rb")
features = pickle.load(pickle_in)
features
```

	feature	chroma_cens	chroma_cens.1	chroma_cens.2	chroma_cens.3	chrom
3	2	7.1806526184e+00	5.2303090096e+00	2.4932080507e-01	1.3476201296e+00	1.48247
4	3	1.8889633417e+00	7.6053929329e-01	3.4529656172e-01	2.2952005863e+00	1.65403
5	5	5.2756297588e-01	-7.7654317021e-02	-2.7961030602e-01	6.8588310480e-01	1.93756
6	10	3.7022454739e+00	-2.9119303823e-01	2.1967420578e+00	-2.3444947600e-01	1.36736
7	20	-1.9383698702e-01	-1.9852678478e-01	2.0154602826e-01	2.5855624676e-01	7.75203
...	...	...	...	...	...	
106572	155316	-0.490129	0.463834	2.32197	-0.0843522	
106573	155317	-0.461559	-0.229601	-0.496632	-0.422033	
106574	155318	0.552473	-0.110498	-0.532014	0.263131	
106575	155319	-0.176901	0.187208	-0.0506639	0.368843	
106576	155320	0.489665	1.86242	0.854461	-0.103666	

106574 rows × 519 columns

```
1 mfcc = features[['feature', 'mfcc']]
2 mfcc.index.name = 'track_id'
3 mfcc.head()
```

track_id	feature	mfcc
3	2	3.8567891121e+00
4	3	4.2967548370e+00
5	5	2.6245169640e+00
6	10	5.0768928528e+00
7	20	1.1880131721e+01

```
1 g_link = "genre_id_map.pkl"
2 pickle_in = open(g_link,"rb")
3 genre_map = pickle.load(pickle_in)
4 genre_map
```

	track_id	track_genres
0	2	[{'genre_id': '21', 'genre_title': 'Hip-Hop', ...
1	3	[{'genre_id': '21', 'genre_title': 'Hip-Hop', ...
2	5	[{'genre_id': '21', 'genre_title': 'Hip-Hop', ...
3	10	[{'genre_id': '10', 'genre_title': 'Pop', 'gen...
4	20	[{'genre_id': '76', 'genre_title': 'Experiment...
...	...	...
109722	155316	[{'genre_id': '25', 'genre_title': 'Punk', 'ge...
109723	155317	[{'genre_id': '25', 'genre_title': 'Punk', 'ge...
109724	155318	[{'genre_id': '25', 'genre_title': 'Punk', 'ge...
109725	155319	[{'genre_id': '25', 'genre_title': 'Punk', 'ge...
109726	155320	[{'genre_id': '10', 'genre_title': 'Pop', 'gen...

109727 rows × 2 columns

```
1 genre_ids = pickle.load(open('genre_labels.pkl', 'rb'))
2 len(genre_map)
3 # genre_ids[109726]
```

```
109727
```

Yikes there's a 3k track discrepancy here... let's try joining them

```
1 mfcc_genres = pd.merge(genre_map, mfcc, how="inner", on="track_id")
```

```
1 mfcc_genres[106000:106001]
```

	track_id	track_genres	feature	mfcc

```
1 mfcc_genres
```

	track_id	track_genres	feature	mfcc
0	3	[{'genre_id': '21', 'genre_title': 'Hip-Hop', ...	2	3.8567891121e+00
1	5	[{'genre_id': '21', 'genre_title': 'Hip-Hop', ...	5	2.6245169640e+00
2	10	[{'genre_id': '10', 'genre_title': 'Pop', 'gen...	46	2.4247612953e+00
3	20	[{'genre_id': '76', 'genre_title': 'Experiment...	142	1.2579523325e+00
4	26	[{'genre_id': '76', 'genre_title': 'Experiment...	149	2.4809233844e-01
...	...	...	...	...
72025	106572	[{'genre_id': '38', 'genre_title': 'Experiment...	155316	4.89515
72026	106573	[{'genre_id': '38', 'genre_title': 'Experiment...	155317	0.040857
72027	106574	[{'genre_id': '38', 'genre_title': 'Experiment...	155318	0.581889
72028	106575	[{'genre_id': '38', 'genre_title': 'Experiment...	155319	5.1645
72029	106576	[{'genre_id': '5', 'genre_title': 'Classical',...	155320	4.61946

72030 rows × 4 columns

```
for row in range(0, len(mfcc_genres)):
  try:
    dic = eval(mfcc_genres['track_genres'][row])
    genre_id = dic[0]['genre_id']
    mfcc_genres['track_genres'][row] = genre_id
  except:
    print("\trow", row, "bad")

  if row % 1000 == 0:
    print(row, '/', len(mfcc_genres))
```

```
0 / 72030
        row 380 bad
        row 938 bad
        row 941 bad
        row 942 bad
1000 / 72030
        row 1730 bad
2000 / 72030
        row 2010 bad
        row 2740 bad
        row 2759 bad
        row 2760 bad
        row 2761 bad
3000 / 72030
        row 3115 bad
        row 3127 bad
        row 3353 bad
        row 3354 bad
        row 3355 bad
        row 3356 bad
        row 3405 bad
        row 3553 bad
        row 3632 bad
        row 3762 bad
        row 3763 bad
        row 3764 bad
        row 3765 bad
        row 3960 bad
        row 3998 bad
4000 / 72030
        row 4417 bad
        row 4766 bad
        row 4767 bad
        row 4778 bad
        row 4779 bad
        row 4780 bad
        row 4801 bad
        row 4813 bad
        row 4910 bad
        row 4911 bad
        row 4912 bad
        row 4914 bad
        row 4915 bad
        row 4921 bad
        row 4940 bad
        row 4956 bad
        row 4958 bad
        row 4972 bad
        row 4973 bad
        row 4976 bad
        row 4978 bad
        row 4991 bad
        row 4997 bad
5000 / 72030
        row 5133 bad
        row 5134 bad
        row 5135 bad
        row 5142 bad
        row 5143 bad
        row 5149 bad
        row 5269 bad
        row 5271 bad
```

```
        row 5274 bad
        row 5275 bad
        row 5276 bad
        row 5337 bad
        row 5339 bad
        row 5340 bad
        row 5341 bad
        row 5496 bad
        row 5498 bad
        row 5525 bad
        row 5592 bad
        row 5594 bad
        row 5605 bad
        row 5644 bad
        row 5645 bad
        row 5654 bad
        row 5683 bad
        row 5953 bad
        row 5985 bad
        row 5986 bad
6000 / 72030
        row 6015 bad
        row 6180 bad
        row 6181 bad
        row 6362 bad
        row 6498 bad
        row 6499 bad
        row 6500 bad
        row 6501 bad
        row 6503 bad
        row 6504 bad
        row 6532 bad
        row 6534 bad
        row 6535 bad
        row 6542 bad
        row 6543 bad
        row 6582 bad
        row 6595 bad
        row 6794 bad
        row 6861 bad
        row 6862 bad
        row 6947 bad
        row 6950 bad
        row 6965 bad
        row 6966 bad
        row 6968 bad
7000 / 72030
        row 7123 bad
        row 7136 bad
        row 7685 bad
8000 / 72030
        row 8313 bad
        row 8314 bad
        row 8343 bad
        row 8345 bad
        row 8347 bad
        row 8348 bad
        row 8349 bad
        row 8350 bad
        row 8352 bad
        row 8353 bad
        row 8445 bad
```

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        row 8446 bad
        row 8506 bad
        row 8588 bad
        row 8605 bad
        row 8695 bad
        row 8697 bad
        row 8698 bad
        row 8811 bad
        row 8847 bad
        row 8848 bad
        row 8893 bad
        row 8897 bad
9000 / 72030
        row 9039 bad
        row 9040 bad
        row 9041 bad
        row 9047 bad
        row 9048 bad
        row 9049 bad
        row 9050 bad
        row 9076 bad
        row 9087 bad
        row 9535 bad
        row 9536 bad
        row 9537 bad
        row 9538 bad
        row 9546 bad
        row 9570 bad
        row 9571 bad
        row 9574 bad
        row 9575 bad
        row 9576 bad
        row 9577 bad
        row 9578 bad
10000 / 72030
        row 10554 bad
        row 10565 bad
        row 10566 bad
        row 10614 bad
        row 10773 bad
11000 / 72030
        row 11114 bad
        row 11115 bad
        row 11300 bad
        row 11332 bad
        row 11333 bad
        row 11364 bad
        row 11372 bad
        row 11373 bad
        row 11374 bad
        row 11375 bad
        row 11376 bad
        row 11660 bad
        row 11720 bad
        row 11864 bad
        row 11983 bad
        row 11986 bad
        row 11987 bad
12000 / 72030
        row 12062 bad
        row 12066 bad
        row 12068 bad
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row 12071 bad
row 12072 bad
row 12099 bad
row 12102 bad
row 12103 bad
row 12104 bad
row 12105 bad
row 12106 bad
row 12431 bad
row 12570 bad
row 12628 bad
row 12666 bad
row 12699 bad
row 12700 bad
row 12791 bad
row 12832 bad
row 12854 bad
row 12935 bad
row 12988 bad
13000 / 72030
row 13026 bad
row 13027 bad
row 13028 bad
row 13029 bad
row 13030 bad
row 13031 bad
row 13032 bad
row 13033 bad
row 13034 bad
row 13035 bad
row 13036 bad
row 13038 bad
row 13039 bad
row 13138 bad
row 13139 bad
row 13140 bad
row 13141 bad
row 13142 bad
row 13143 bad
row 13144 bad
row 13145 bad
row 13146 bad
row 13147 bad
row 13148 bad
row 13412 bad
row 13414 bad
row 13454 bad
row 13468 bad
row 13489 bad
row 13533 bad
row 13534 bad
row 13535 bad
row 13536 bad
row 13537 bad
row 13643 bad
row 13748 bad
row 13750 bad
row 13751 bad
row 13752 bad
row 13770 bad
row 13832 bad
row 13833 bad

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        row 13845 bad
        row 13860 bad
        row 13864 bad
14000 / 72030
        row 14434 bad
        row 14468 bad
        row 14469 bad
        row 14470 bad
        row 14567 bad
        row 14607 bad
        row 14751 bad
        row 14752 bad
        row 14753 bad
        row 14768 bad
        row 14784 bad
        row 14797 bad
        row 14916 bad
        row 14930 bad
15000 / 72030
        row 15001 bad
        row 15052 bad
        row 15066 bad
        row 15069 bad
        row 15070 bad
        row 15072 bad
        row 15073 bad
        row 15101 bad
        row 15548 bad
        row 15549 bad
        row 15731 bad
        row 15852 bad
        row 15877 bad
        row 15890 bad
        row 15901 bad
        row 15963 bad
        row 15964 bad
16000 / 72030
        row 16005 bad
        row 16039 bad
        row 16119 bad
        row 16294 bad
        row 16319 bad
        row 16320 bad
        row 16321 bad
        row 16322 bad
        row 16407 bad
        row 16408 bad
        row 16409 bad
        row 16462 bad
        row 16463 bad
        row 16464 bad
        row 16465 bad
        row 16466 bad
        row 16467 bad
        row 16468 bad
        row 16469 bad
        row 16470 bad
        row 16471 bad
        row 16472 bad
        row 16473 bad
        row 16474 bad
        row 16475 bad
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        row 16476 bad
        row 16480 bad
        row 16481 bad
        row 16482 bad
        row 16483 bad
        row 16484 bad
        row 16485 bad
        row 16486 bad
        row 16551 bad
        row 16552 bad
        row 16553 bad
        row 16554 bad
        row 16571 bad
        row 16572 bad
        row 16573 bad
        row 16574 bad
        row 16575 bad
        row 16576 bad
        row 16577 bad
        row 16578 bad
        row 16579 bad
        row 16580 bad
        row 16758 bad
        row 16771 bad
        row 16781 bad
        row 16784 bad
        row 16845 bad
        row 16927 bad
        row 16958 bad
        row 16959 bad
        row 16960 bad
        row 16961 bad
17000 / 72030
        row 17015 bad
        row 17016 bad
        row 17083 bad
        row 17218 bad
        row 17234 bad
        row 17307 bad
        row 17308 bad
        row 17317 bad
        row 17520 bad
        row 17658 bad
        row 17691 bad
        row 17734 bad
        row 17735 bad
        row 17743 bad
        row 17791 bad
        row 17792 bad
        row 17793 bad
        row 17802 bad
        row 17803 bad
        row 17804 bad
        row 17910 bad
        row 17911 bad
18000 / 72030
        row 18010 bad
        row 18011 bad
        row 18012 bad
        row 18152 bad
        row 18155 bad
        row 18157 bad
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        row 18346 bad
        row 18348 bad
        row 18739 bad
        row 18742 bad
        row 18769 bad
        row 18770 bad
        row 18837 bad
        row 18842 bad
        row 18858 bad
        row 18918 bad
        row 18931 bad
        row 18938 bad
        row 18983 bad
        row 18984 bad
19000 / 72030
        row 19250 bad
        row 19251 bad
        row 19252 bad
        row 19253 bad
        row 19254 bad
        row 19255 bad
        row 19256 bad
        row 19257 bad
        row 19258 bad
        row 19259 bad
        row 19260 bad
        row 19261 bad
        row 19262 bad
        row 19263 bad
        row 19264 bad
        row 19265 bad
        row 19266 bad
        row 19267 bad
        row 19268 bad
        row 19269 bad
        row 19270 bad
        row 19271 bad
        row 19272 bad
        row 19273 bad
        row 19274 bad
        row 19300 bad
        row 19301 bad
        row 19302 bad
        row 19472 bad
        row 19559 bad
        row 19740 bad
        row 19741 bad
        row 19840 bad
        row 19843 bad
        row 19844 bad
        row 19845 bad
        row 19846 bad
        row 19847 bad
        row 19848 bad
        row 19849 bad
        row 19850 bad
        row 19851 bad
        row 19852 bad
        row 19853 bad
        row 19863 bad
20000 / 72030
        row 20096 bad
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row 20098 bad
row 20103 bad
row 20104 bad
row 20301 bad
row 20329 bad
row 20332 bad
row 20333 bad
row 20383 bad
row 20491 bad
row 20492 bad
row 20493 bad
row 20554 bad
row 20557 bad
row 20558 bad
row 20628 bad
row 20702 bad
row 20792 bad
row 20793 bad
row 20794 bad
row 20795 bad
row 20796 bad
row 20797 bad
row 20798 bad
row 20799 bad
row 20800 bad
row 20801 bad
row 20802 bad
row 20803 bad
row 20804 bad
row 20805 bad
row 20806 bad
row 20860 bad
row 20861 bad
row 20898 bad
21000 / 72030
row 21120 bad
row 21134 bad
row 21158 bad
row 21159 bad
row 21262 bad
row 21371 bad
row 21443 bad
row 21454 bad
row 21455 bad
row 21478 bad
row 21479 bad
row 21480 bad
row 21663 bad
row 21680 bad
row 21926 bad
row 21928 bad
row 21931 bad
row 21934 bad
row 21972 bad
22000 / 72030
row 22283 bad
row 22288 bad
row 22289 bad
row 22311 bad
row 22312 bad
row 22338 bad
row 22346 bad

row 22347 bad
row 22372 bad
row 22448 bad
row 22477 bad
row 22478 bad
row 22528 bad
row 22529 bad
row 22548 bad
row 22560 bad
row 22561 bad
row 22584 bad
row 22705 bad
row 22913 bad
row 22964 bad
23000 / 72030
row 23011 bad
row 23012 bad
row 23018 bad
row 23043 bad
row 23099 bad
row 23261 bad
row 23358 bad
row 23379 bad
row 23521 bad
row 23522 bad
row 23523 bad
row 23524 bad
row 23525 bad
row 23526 bad
row 23529 bad
row 23556 bad
row 23585 bad
row 23820 bad
row 23822 bad
row 23848 bad
row 23935 bad
row 23989 bad
row 23990 bad
row 23991 bad
row 23992 bad
row 23993 bad
row 23994 bad
24000 / 72030
row 24412 bad
row 24426 bad
row 24464 bad
row 24612 bad
row 24686 bad
25000 / 72030
row 25189 bad
row 25417 bad
row 25595 bad
row 25596 bad
row 25643 bad
row 25644 bad
row 25645 bad
row 25646 bad
row 25647 bad
row 25648 bad
row 25649 bad
26000 / 72030
row 26646 bad
row 26648 bad

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        row 26787 bad
27000 / 72030
        row 27471 bad
        row 27472 bad
        row 27473 bad
        row 27474 bad
        row 27475 bad
        row 27476 bad
        row 27477 bad
        row 27478 bad
        row 27479 bad
        row 27480 bad
        row 27481 bad
        row 27482 bad
        row 27483 bad
        row 27484 bad
        row 27485 bad
        row 27486 bad
        row 27487 bad
        row 27488 bad
        row 27610 bad
        row 27612 bad
        row 27867 bad
        row 27968 bad
28000 / 72030
        row 28080 bad
        row 28311 bad
        row 28323 bad
        row 28619 bad
        row 28620 bad
        row 28621 bad
        row 28727 bad
        row 28728 bad
        row 28729 bad
        row 28730 bad
        row 28731 bad
        row 28732 bad
        row 28745 bad
        row 28746 bad
        row 28747 bad
        row 28748 bad
        row 28749 bad
        row 28750 bad
        row 28765 bad
        row 28766 bad
        row 28908 bad
        row 28909 bad
        row 29000 bad
29000 / 72030
        row 29001 bad
        row 29147 bad
        row 29472 bad
        row 29493 bad
        row 29524 bad
        row 29607 bad
        row 29654 bad
        row 29677 bad
        row 29788 bad
        row 29789 bad
        row 29798 bad
        row 29851 bad
        row 29852 bad
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        row 29870 bad
        row 29909 bad
        row 29910 bad
30000 / 72030
        row 30053 bad
        row 30257 bad
        row 30258 bad
        row 30280 bad
        row 30373 bad
        row 30374 bad
        row 30375 bad
        row 30376 bad
        row 30377 bad
        row 30396 bad
        row 30397 bad
        row 30398 bad
        row 30399 bad
        row 30400 bad
        row 30412 bad
        row 30760 bad
        row 30784 bad
        row 30914 bad
        row 30915 bad
        row 30916 bad
        row 30917 bad
        row 30918 bad
        row 30993 bad
        row 30994 bad
        row 30995 bad
        row 30997 bad
        row 30998 bad
31000 / 72030
        row 31010 bad
        row 31011 bad
        row 31079 bad
        row 31378 bad
        row 31382 bad
        row 31461 bad
        row 31462 bad
        row 31463 bad
        row 31524 bad
        row 31575 bad
        row 31975 bad
32000 / 72030
        row 32007 bad
        row 32008 bad
        row 32009 bad
        row 32267 bad
        row 32268 bad
        row 32274 bad
        row 32296 bad
        row 32304 bad
        row 32316 bad
        row 32317 bad
        row 32318 bad
        row 32650 bad
        row 32652 bad
        row 32653 bad
        row 32654 bad
        row 32664 bad
        row 32665 bad
        row 32677 bad
```

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        row 32678 bad
        row 32679 bad
        row 32680 bad
        row 32681 bad
        row 32682 bad
        row 32836 bad
        row 32868 bad
        row 32885 bad
        row 32886 bad
        row 32888 bad
        row 32889 bad
        row 32891 bad
        row 32892 bad
        row 32893 bad
        row 32894 bad
        row 32895 bad
        row 32896 bad
        row 32897 bad
        row 32898 bad
        row 32899 bad
        row 32956 bad
        row 32993 bad
        row 32994 bad
33000 / 72030
        row 33131 bad
        row 33132 bad
        row 33133 bad
        row 33134 bad
        row 33135 bad
        row 33136 bad
        row 33137 bad
        row 33216 bad
        row 33217 bad
        row 33282 bad
        row 33283 bad
        row 33284 bad
        row 33285 bad
        row 33286 bad
        row 33287 bad
        row 33460 bad
        row 33557 bad
        row 33627 bad
        row 33664 bad
        row 33665 bad
        row 33716 bad
34000 / 72030
        row 34241 bad
        row 34266 bad
        row 34481 bad
        row 34482 bad
        row 34559 bad
        row 34571 bad
        row 34587 bad
        row 34588 bad
        row 34803 bad
        row 34804 bad
        row 34811 bad
        row 34833 bad
        row 34960 bad
        row 34963 bad
35000 / 72030
        row 35019 bad
```

```
        row 35043 bad
        row 35070 bad
        row 35071 bad
        row 35072 bad
        row 35073 bad
        row 35074 bad
        row 35075 bad
        row 35076 bad
        row 35077 bad
        row 35350 bad
        row 35359 bad
        row 35572 bad
        row 35599 bad
        row 35600 bad
36000 / 72030
        row 36013 bad
        row 36247 bad
        row 36248 bad
        row 36250 bad
        row 36251 bad
        row 36252 bad
        row 36253 bad
        row 36254 bad
        row 36255 bad
        row 36256 bad
        row 36257 bad
        row 36258 bad
        row 36259 bad
        row 36308 bad
        row 36550 bad
        row 36955 bad
        row 36956 bad
        row 36957 bad
        row 36958 bad
        row 36959 bad
        row 36960 bad
37000 / 72030
        row 37008 bad
        row 37015 bad
        row 37043 bad
        row 37293 bad
        row 37311 bad
        row 37446 bad
        row 37447 bad
        row 37583 bad
        row 37584 bad
        row 37585 bad
        row 37590 bad
        row 37591 bad
        row 37605 bad
        row 37642 bad
        row 37660 bad
        row 37661 bad
        row 37662 bad
        row 37678 bad
        row 37680 bad
        row 37774 bad
38000 / 72030
        row 38015 bad
        row 38016 bad
        row 38017 bad
        row 38029 bad
```

row 38159 bad
row 38167 bad
row 38192 bad
row 38643 bad
row 38644 bad
row 38645 bad
row 38646 bad
row 38647 bad
row 38648 bad
row 38649 bad
row 38650 bad
row 38651 bad
row 38652 bad
row 38653 bad
row 38654 bad
row 38655 bad
row 38656 bad
row 38657 bad
row 38658 bad
row 38659 bad
row 38660 bad
row 38661 bad
row 38662 bad
row 38663 bad
row 38664 bad
row 38665 bad
row 38666 bad
row 38667 bad
row 38668 bad
row 38669 bad
row 38670 bad
row 38671 bad
row 38672 bad
row 38673 bad
row 38674 bad
row 38675 bad
row 38676 bad
row 38677 bad
row 38766 bad
row 38797 bad
row 38831 bad
row 38853 bad
row 38998 bad
row 38999 bad
row 39000 bad
39000 / 72030
row 39040 bad
row 39041 bad
row 39180 bad
row 39181 bad
row 39213 bad
row 39229 bad
row 39301 bad
row 39308 bad
row 39362 bad
row 39441 bad
row 39442 bad
row 39486 bad
row 39615 bad
row 39616 bad
row 39724 bad
row 39751 bad

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        row 39752 bad
        row 39888 bad
        row 39942 bad
        row 39943 bad
        row 39944 bad
        row 39945 bad
40000 / 72030
        row 40153 bad
        row 40154 bad
        row 40199 bad
        row 40201 bad
        row 40213 bad
        row 40314 bad
        row 40315 bad
        row 40355 bad
        row 40520 bad
        row 40521 bad
        row 40558 bad
        row 40638 bad
        row 40660 bad
        row 40749 bad
        row 40750 bad
        row 40751 bad
        row 40752 bad
        row 40753 bad
        row 40754 bad
        row 40755 bad
        row 40756 bad
        row 40757 bad
        row 40758 bad
        row 40759 bad
        row 40760 bad
        row 40761 bad
        row 40762 bad
        row 40838 bad
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41000 / 72030
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42000 / 72030
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43000 / 72030
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44000 / 72030
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47000 / 72030
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58000 / 72030
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62000 / 72030
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64000 / 72030
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65000 / 72030
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68000 / 72030
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72000 / 72030
```

```
1 mfcc_genres[71604:72030]
```

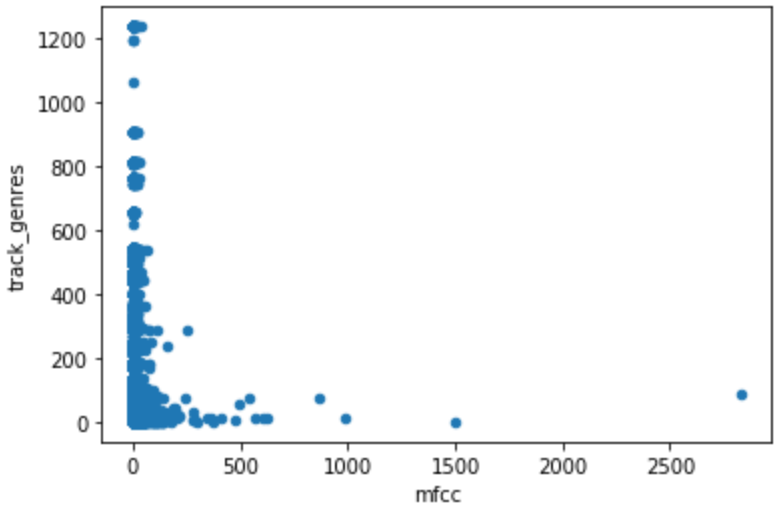
	track_id	track_genres	feature	mfcc
71604	105931	58	154555	14.7591
71605	105932	58	154556	4.45799
71606	105933	58	154557	1.22656
71607	105934	58	154558	7.48816
71608	105935	58	154559	5.33462
...	...	...	...	...
72025	106572	38	155316	4.89515
72026	106573	38	155317	0.040857
72027	106574	38	155318	0.581889
72028	106575	38	155319	5.1645
72029	106576	5	155320	4.61946

426 rows × 4 columns

let's try training with just the genre_ids as labels and mfcc as data

```
 1 import matplotlib.pyplot as plt
 2 %matplotlib inline
 3
 4 # first let's plot the genre_id vs. mfcc
 5 # X = mfcc_genres['track_genres']
 6 # y = mfcc_genres['mfcc']
 7
 8 # plt.scatter(X, y, c=y, cmap='RdBu')
 9 mfcc_genres['track_genres'] = pd.to_numeric(mfcc_genres['track_genre
10 mfcc_genres['mfcc'] = pd.to_numeric(mfcc_genres['mfcc'])
11
12 mfcc_genres.plot.scatter('mfcc', 'track_genres')
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7fa81401f518>
```




```
1 t sklearn.model_selection as model_selection
2
3 s = mfcc_genres['track_genres'][:300]
4 = mfcc_genres['mfcc'][:300]
5 train, data_test, label_train, label_test = model_selection.train_te
```

```
1 print(len(data_train), len(data_test), len(label_train), len(label_t
2 data.head()
```

```
225 75 225 75
0    3.856789
1    2.624517
2    2.424761
3    1.257952
4    0.248092
Name: mfcc, dtype: float64
```

```
1 from keras.utils.np_utils import to_categorical
2
3 one_hot_train_labels = to_categorical(label_train)
4 one_hot_test_labels = to_categorical(label_test)
5
6 one_hot_train_labels.shape, data.shape
```

```
((225, 90), (300,))
```

```
1 del = models.Sequential()
2 del.add(layers.Dense(32, activation='relu', input_shape=(1, )))
3 del.add(layers.Dense(16, activation='relu'))
4
5 tput = 161 # num of output neurons
6 del.add(layers.Dense(output, activation='sigmoid')) # all genres
```

```
WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_
```

```
model.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
dense_1 (Dense)              (None, 32)                64
_________________________________________________________________
dense_2 (Dense)              (None, 16)                528
_________________________________________________________________
dense_3 (Dense)              (None, 161)               2737
=================================================================
Total params: 3,329
Trainable params: 3,329
Non-trainable params: 0
_________________________________________________________________
```

```
model.compile(optimizer='rmsprop', loss='sparse_categorical_crossent
```

```
WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/optimizers.py:793:

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_
```

```
# x_train = np.array([np.array(i) for i in data_train])
# x_test = np.array([np.array(i) for i in data_test])
# print(x_train.shape, "because this is the number of attributes (ir
# print(x_train)

# y_train = np.asarray(one_hot_train_labels, dtype=np.float32)
# y_test = np.asarray(one_hot_test_labels, dtype=np.float32)
# print(y_train.shape, "because this is the result of the row split,

history = model.fit(data_train, label_train, epochs=10, batch_size=5
```

```
WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/tensorflow_core/python/op
Instructions for updating:
Use tf.where in 2.0, which has the same broadcast rule as np.where
WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_

Train on 150 samples, validate on 75 samples
Epoch 1/10
WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_

WARNING:tensorflow:From /usr/local/lib/python3.6/dist-packages/keras/backend/tensorflow_

150/150 [==============================] - 5s 34ms/step - loss: 5.0912 - acc: 0.0000e+00
Epoch 2/10
150/150 [==============================] - 0s 85us/step - loss: 5.0785 - acc: 0.0200 - v
Epoch 3/10
150/150 [==============================] - 0s 62us/step - loss: 5.0699 - acc: 0.0333 - v
Epoch 4/10
150/150 [==============================] - 0s 61us/step - loss: 5.0625 - acc: 0.0333 - v
Epoch 5/10
150/150 [==============================] - 0s 62us/step - loss: 5.0560 - acc: 0.0600 - v
Epoch 6/10
150/150 [==============================] - 0s 48us/step - loss: 5.0497 - acc: 0.0800 - v
Epoch 7/10
150/150 [==============================] - 0s 56us/step - loss: 5.0438 - acc: 0.0933 - v
Epoch 8/10
150/150 [==============================] - 0s 52us/step - loss: 5.0379 - acc: 0.1000 - v
Epoch 9/10
150/150 [==============================] - 0s 51us/step - loss: 5.0319 - acc: 0.1067 - v
Epoch 10/10
150/150 [==============================] - 0s 52us/step - loss: 5.0258 - acc: 0.1133 - v
```

```
 1 model = models.Sequential()
 2 model.add(layers.Dense(16, activation='relu', input_shape=(1, )))
 3 model.add(layers.Dense(64, activation='relu'))
 4 model.add(layers.Dense(64, activation='relu'))
 5 model.add(layers.Dense(32, activation='relu'))
 6 model.add(layers.Dense(161, activation='softmax'))
 7
 8 model.summary()
 9
10 # output = 161 # num of output neurons
11 # model.add(layers.Dense(output, activation='softmax')) # all genres
12
13 model.compile(optimizer='rmsprop', loss='sparse_categorical_crossent
14
15 history = model.fit(data_train, label_train, epochs=10, batch_size=5
```

```
l_5"
_________________________________________________________________
Output Shape              Param #
=================================================================
(None, 16)                32
_________________________________________________________________
(None, 64)                1088
_________________________________________________________________
(None, 64)                4160
_________________________________________________________________
(None, 32)                2080
_________________________________________________________________
(None, 161)               5313
=================================================================
673
 12,673
ams: 0
_________________________________________________________________
les, validate on 75 samples

======================] - 0s 2ms/step - loss: 5.0701 - acc: 0.0000e+00 - val_loss: 5.034

======================] - 0s 37us/step - loss: 5.0182 - acc: 0.0444 - val_loss: 4.9956 -

======================] - 0s 42us/step - loss: 4.9769 - acc: 0.0844 - val_loss: 4.9581 -

======================] - 0s 35us/step - loss: 4.9373 - acc: 0.0889 - val_loss: 4.9171 -

======================] - 0s 36us/step - loss: 4.8945 - acc: 0.0933 - val_loss: 4.8707 -

======================] - 0s 37us/step - loss: 4.8455 - acc: 0.0933 - val_loss: 4.8220 -

======================] - 0s 39us/step - loss: 4.7949 - acc: 0.0933 - val_loss: 4.7703 -

======================] - 0s 47us/step - loss: 4.7401 - acc: 0.0933 - val_loss: 4.7154 -

======================] - 0s 42us/step - loss: 4.6819 - acc: 0.0933 - val_loss: 4.6576 -

======================] - 0s 48us/step - loss: 4.6204 - acc: 0.0933 - val_loss: 4.5951 -
```

```
model = models.Sequential()
model.add(layers.Dense(16, activation='relu', input_shape=(1, )))
model.add(layers.Dense(64, activation='relu'))
model.add(layers.Dense(32, activation='relu'))
model.add(layers.Dense(161, activation='softmax'))

model.summary()

# output = 161 # num of output neurons
# model.add(layers.Dense(output, activation='softmax')) # all genres

model.compile(optimizer='rmsprop', loss='sparse_categorical_crossent

history = model.fit(data_train, label_train, epochs=100, batch_size=
```

```
Model: "sequential_10"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
dense_37 (Dense)             (None, 16)                32
_________________________________________________________________
dense_38 (Dense)             (None, 64)                1088
_________________________________________________________________
dense_39 (Dense)             (None, 32)                2080
_________________________________________________________________
dense_40 (Dense)             (None, 161)               5313
=================================================================
Total params: 8,513
Trainable params: 8,513
Non-trainable params: 0
_________________________________________________________________
Train on 225 samples, validate on 75 samples
Epoch 1/100
225/225 [==============================] - 1s 2ms/step - loss: 5.1785 - acc: 0.0000e+00
Epoch 2/100
225/225 [==============================] - 0s 37us/step - loss: 5.0652 - acc: 0.0089 - v
Epoch 3/100
225/225 [==============================] - 0s 35us/step - loss: 4.9888 - acc: 0.0267 - v
Epoch 4/100
225/225 [==============================] - 0s 38us/step - loss: 4.9221 - acc: 0.0311 - v
Epoch 5/100
225/225 [==============================] - 0s 36us/step - loss: 4.8609 - acc: 0.0711 - v
Epoch 6/100
225/225 [==============================] - 0s 34us/step - loss: 4.8035 - acc: 0.1511 - v
Epoch 7/100
225/225 [==============================] - 0s 37us/step - loss: 4.7495 - acc: 0.1467 - v
Epoch 8/100
225/225 [==============================] - 0s 40us/step - loss: 4.6982 - acc: 0.1467 - v
Epoch 9/100
225/225 [==============================] - 0s 49us/step - loss: 4.6485 - acc: 0.1467 - v
Epoch 10/100
225/225 [==============================] - 0s 39us/step - loss: 4.5989 - acc: 0.1467 - v
Epoch 11/100
225/225 [==============================] - 0s 37us/step - loss: 4.5502 - acc: 0.1467 - v
Epoch 12/100
225/225 [==============================] - 0s 35us/step - loss: 4.5021 - acc: 0.1467 - v
Epoch 13/100
225/225 [==============================] - 0s 41us/step - loss: 4.4509 - acc: 0.1467 - v
Epoch 14/100
225/225 [==============================] - 0s 36us/step - loss: 4.4004 - acc: 0.1467 - v
Epoch 15/100
225/225 [==============================] - 0s 35us/step - loss: 4.3507 - acc: 0.1467 - v
Epoch 16/100
225/225 [==============================] - 0s 36us/step - loss: 4.3026 - acc: 0.1467 - v
Epoch 17/100
225/225 [==============================] - 0s 36us/step - loss: 4.2558 - acc: 0.1467 - v
Epoch 18/100
225/225 [==============================] - 0s 38us/step - loss: 4.2093 - acc: 0.1467 - v
Epoch 19/100
225/225 [==============================] - 0s 35us/step - loss: 4.1639 - acc: 0.1467 - v
Epoch 20/100
225/225 [==============================] - 0s 40us/step - loss: 4.1198 - acc: 0.1467 - v
Epoch 21/100
225/225 [==============================] - 0s 41us/step - loss: 4.0766 - acc: 0.1467 - v
Epoch 22/100
225/225 [==============================] - 0s 49us/step - loss: 4.0326 - acc: 0.1467 - v
Epoch 23/100
```

```
225/225 [==============================] - 0s 46us/step - loss: 3.9895 - acc: 0.1467 - v
Epoch 24/100
225/225 [==============================] - 0s 58us/step - loss: 3.9473 - acc: 0.1689 - v
Epoch 25/100
225/225 [==============================] - 0s 38us/step - loss: 3.9059 - acc: 0.1467 - v
Epoch 26/100
225/225 [==============================] - 0s 42us/step - loss: 3.8646 - acc: 0.2000 - v
Epoch 27/100
225/225 [==============================] - 0s 50us/step - loss: 3.8226 - acc: 0.1467 - v
Epoch 28/100
225/225 [==============================] - 0s 47us/step - loss: 3.7819 - acc: 0.1911 - v
Epoch 29/100
225/225 [==============================] - 0s 47us/step - loss: 3.7426 - acc: 0.1422 - v
Epoch 30/100
225/225 [==============================] - 0s 43us/step - loss: 3.7042 - acc: 0.1911 - v
Epoch 31/100
225/225 [==============================] - 0s 46us/step - loss: 3.6660 - acc: 0.1689 - v
Epoch 32/100
225/225 [==============================] - 0s 50us/step - loss: 3.6292 - acc: 0.2000 - v
Epoch 33/100
225/225 [==============================] - 0s 50us/step - loss: 3.5930 - acc: 0.1600 - v
Epoch 34/100
225/225 [==============================] - 0s 39us/step - loss: 3.5586 - acc: 0.2089 - v
Epoch 35/100
225/225 [==============================] - 0s 60us/step - loss: 3.5239 - acc: 0.1600 - v
Epoch 36/100
225/225 [==============================] - 0s 47us/step - loss: 3.4903 - acc: 0.2089 - v
Epoch 37/100
225/225 [==============================] - 0s 53us/step - loss: 3.4559 - acc: 0.1644 - v
Epoch 38/100
225/225 [==============================] - 0s 49us/step - loss: 3.4238 - acc: 0.2133 - v
Epoch 39/100
225/225 [==============================] - 0s 42us/step - loss: 3.3913 - acc: 0.1644 - v
Epoch 40/100
225/225 [==============================] - 0s 40us/step - loss: 3.3618 - acc: 0.2089 - v
Epoch 41/100
225/225 [==============================] - 0s 42us/step - loss: 3.3322 - acc: 0.1600 - v
Epoch 42/100
225/225 [==============================] - 0s 47us/step - loss: 3.3059 - acc: 0.2133 - v
Epoch 43/100
225/225 [==============================] - 0s 58us/step - loss: 3.2765 - acc: 0.1600 - v
Epoch 44/100
225/225 [==============================] - 0s 48us/step - loss: 3.2519 - acc: 0.2178 - v
Epoch 45/100
225/225 [==============================] - 0s 45us/step - loss: 3.2239 - acc: 0.1600 - v
Epoch 46/100
225/225 [==============================] - 0s 47us/step - loss: 3.2009 - acc: 0.2222 - v
Epoch 47/100
225/225 [==============================] - 0s 48us/step - loss: 3.1744 - acc: 0.1600 - v
Epoch 48/100
225/225 [==============================] - 0s 38us/step - loss: 3.1532 - acc: 0.2222 - v
Epoch 49/100
225/225 [==============================] - 0s 41us/step - loss: 3.1282 - acc: 0.1600 - v
Epoch 50/100
225/225 [==============================] - 0s 40us/step - loss: 3.1089 - acc: 0.2222 - v
Epoch 51/100
225/225 [==============================] - 0s 40us/step - loss: 3.0849 - acc: 0.1600 - v
Epoch 52/100
225/225 [==============================] - 0s 35us/step - loss: 3.0669 - acc: 0.2178 - v
Epoch 53/100
225/225 [==============================] - 0s 48us/step - loss: 3.0437 - acc: 0.1644 - v
Epoch 54/100
```

```
225/225 [==============================] - 0s 41us/step - loss: 3.0271 - acc: 0.2178 - v
Epoch 55/100
225/225 [==============================] - 0s 41us/step - loss: 3.0057 - acc: 0.1644 - v
Epoch 56/100
225/225 [==============================] - 0s 53us/step - loss: 2.9909 - acc: 0.2178 - v
Epoch 57/100
225/225 [==============================] - 0s 37us/step - loss: 2.9705 - acc: 0.1644 - v
Epoch 58/100
225/225 [==============================] - 0s 46us/step - loss: 2.9530 - acc: 0.2267 - v
Epoch 59/100
225/225 [==============================] - 0s 57us/step - loss: 2.9355 - acc: 0.1644 - v
Epoch 60/100
225/225 [==============================] - 0s 40us/step - loss: 2.9193 - acc: 0.2222 - v
Epoch 61/100
225/225 [==============================] - 0s 57us/step - loss: 2.9030 - acc: 0.1644 - v
Epoch 62/100
225/225 [==============================] - 0s 40us/step - loss: 2.8908 - acc: 0.2178 - v
Epoch 63/100
225/225 [==============================] - 0s 49us/step - loss: 2.8753 - acc: 0.1689 - v
Epoch 64/100
225/225 [==============================] - 0s 37us/step - loss: 2.8680 - acc: 0.2178 - v
Epoch 65/100
225/225 [==============================] - 0s 39us/step - loss: 2.8491 - acc: 0.1689 - v
Epoch 66/100
225/225 [==============================] - 0s 51us/step - loss: 2.8354 - acc: 0.2178 - v
Epoch 67/100
225/225 [==============================] - 0s 42us/step - loss: 2.8217 - acc: 0.1689 - v
Epoch 68/100
225/225 [==============================] - 0s 44us/step - loss: 2.8092 - acc: 0.2222 - v
Epoch 69/100
225/225 [==============================] - 0s 50us/step - loss: 2.7976 - acc: 0.1733 - v
Epoch 70/100
225/225 [==============================] - 0s 40us/step - loss: 2.7861 - acc: 0.2222 - v
Epoch 71/100
225/225 [==============================] - 0s 47us/step - loss: 2.7776 - acc: 0.1778 - v
Epoch 72/100
225/225 [==============================] - 0s 49us/step - loss: 2.7667 - acc: 0.2267 - v
Epoch 73/100
225/225 [==============================] - 0s 43us/step - loss: 2.7542 - acc: 0.1689 - v
Epoch 74/100
225/225 [==============================] - 0s 39us/step - loss: 2.7467 - acc: 0.2267 - v
Epoch 75/100
225/225 [==============================] - 0s 53us/step - loss: 2.7335 - acc: 0.2044 - v
Epoch 76/100
225/225 [==============================] - 0s 46us/step - loss: 2.7291 - acc: 0.2222 - v
Epoch 77/100
225/225 [==============================] - 0s 38us/step - loss: 2.7187 - acc: 0.2267 - v
Epoch 78/100
225/225 [==============================] - 0s 51us/step - loss: 2.7120 - acc: 0.1644 - v
Epoch 79/100
225/225 [==============================] - 0s 46us/step - loss: 2.7077 - acc: 0.2222 - v
Epoch 80/100
225/225 [==============================] - 0s 39us/step - loss: 2.6960 - acc: 0.1689 - v
Epoch 81/100
225/225 [==============================] - 0s 39us/step - loss: 2.7006 - acc: 0.2222 - v
Epoch 82/100
225/225 [==============================] - 0s 44us/step - loss: 2.6847 - acc: 0.1689 - v
Epoch 83/100
225/225 [==============================] - 0s 40us/step - loss: 2.6828 - acc: 0.2222 - v
Epoch 84/100
225/225 [==============================] - 0s 46us/step - loss: 2.6666 - acc: 0.1733 - v
Epoch 85/100
```

```
225/225 [==============================] - 0s 60us/step - loss: 2.6651 - acc: 0.2222 - v
Epoch 86/100
225/225 [==============================] - 0s 64us/step - loss: 2.6540 - acc: 0.1733 - v
Epoch 87/100
225/225 [==============================] - 0s 60us/step - loss: 2.6534 - acc: 0.2222 - v
Epoch 88/100
225/225 [==============================] - 0s 44us/step - loss: 2.6414 - acc: 0.1956 - v
Epoch 89/100
225/225 [==============================] - 0s 42us/step - loss: 2.6403 - acc: 0.2222 - v
Epoch 90/100
225/225 [==============================] - 0s 45us/step - loss: 2.6310 - acc: 0.1867 - v
Epoch 91/100
225/225 [==============================] - 0s 36us/step - loss: 2.6310 - acc: 0.2222 - v
Epoch 92/100
225/225 [==============================] - 0s 41us/step - loss: 2.6204 - acc: 0.1911 - v
Epoch 93/100
225/225 [==============================] - 0s 40us/step - loss: 2.6197 - acc: 0.2222 - v
Epoch 94/100
225/225 [==============================] - 0s 34us/step - loss: 2.6106 - acc: 0.1911 - v
Epoch 95/100
225/225 [==============================] - 0s 43us/step - loss: 2.6107 - acc: 0.2267 - v
Epoch 96/100
225/225 [==============================] - 0s 37us/step - loss: 2.6009 - acc: 0.1956 - v
Epoch 97/100
225/225 [==============================] - 0s 50us/step - loss: 2.6017 - acc: 0.2222 - v
Epoch 98/100
225/225 [==============================] - 0s 40us/step - loss: 2.5921 - acc: 0.1867 - v
Epoch 99/100
225/225 [==============================] - 0s 43us/step - loss: 2.5939 - acc: 0.2267 - v
Epoch 100/100
225/225 [==============================] - 0s 34us/step - loss: 2.5840 - acc: 0.1911 - v
```

```
1 predictions = model.predict(data_train)
```

```
1 np.argmax(predictions[0]) # class w highest prob
```

```
89
```

```
1 np.sum(predictions[0])
```

```
1.0
```

```
1 predictions[0].shape
```

```
(161,)
```

```
1 # genre_map[['track_genres'] == '89']
2 # genre_map
3 gid_label = genre_map
4 gid_label['track_genres'][0]
5
6 for row in range(0, len(gid_label)):
7   try:
8     genre_list = eval(gid_label['track_genres'][row])
9     gid_label['track_genres'][row] = genre_list
```

```
10   except:
11     x = 0
12 gid_label
```

	track_id	track_genres
0	2	21
1	3	21
2	5	21
3	10	10
4	20	76
...	...	...
109722	155316	[{'genre_id': '25', 'genre_title': 'Punk', 'ge...
109723	155317	[{'genre_id': '25', 'genre_title': 'Punk', 'ge...
109724	155318	[{'genre_id': '25', 'genre_title': 'Punk', 'ge...
109725	155319	[{'genre_id': '25', 'genre_title': 'Punk', 'ge...
109726	155320	[{'genre_id': '10', 'genre_title': 'Pop', 'gen...

109727 rows × 2 columns

```
1 genres = pd.read_csv("raw_genres.csv")
2 genres
```

	genre_id	genre_color	genre_handle	genre_parent_id	genre_title
0	1	#006666	Avant-Garde	38.0	Avant-Garde
1	2	#CC3300	International	NaN	International
2	3	#000099	Blues	NaN	Blues
3	4	#990099	Jazz	NaN	Jazz
4	5	#8A8A65	Classical	NaN	Classical
...	...	...	...	...	...
159	1032	#CC3300	Turkish	102.0	Turkish
160	1060	#CC3300	tango	46.0	Tango
161	1156	#CC3300	Fado	130.0	Fado
162	1193	#D4A017	Christmas	763.0	Christmas
163	1235	#000000	Instrumental	NaN	Instrumental

164 rows × 5 columns

Double-click (or enter) to edit

```
1 genres = genres[["genre_id", "genre_title"]]
```

```
1 genres
```

	genre_id	genre_title
0	1	Avant-Garde
1	2	International
2	3	Blues
3	4	Jazz
4	5	Classical
...	...	...
159	1032	Turkish
160	1060	Tango
161	1156	Fado
162	1193	Christmas
163	1235	Instrumental

164 rows × 2 columns

```
1 genres.set_index('genre_id').to_dict()
```

```
1
```