GROUP 7

MUSIC GENERATION USING LSTM /RNN

WHAT IS MUSIC??

- Music is storytelling. Melodies are memories.
- Passed down through time in a kind of oral tradition, the music that we make today carries with it embeddings of the culture and people of times long past.
- Ever since the dawn of culture, music has been part of our lives. .
- Over the years, a long series of musical innovations appeared and changed the world of music.

- Musical motifs are not the product of an individual artist, but rather a reinterpretation of the musical ideas that have been presented to them, for them to reinterpret and pass along to others.
- In this way, writing music can be thought of as less of a process of authorship and instead a practice of remix.
- ARE WE SOLVING ANY GLOBAL PROBLEM ?

  NO

- ARE WE SOLVING A FIRST WORLD PROBLEM???

  YES

- It takes almost 48 hours on an average for a music producer
- to find the right tracks ,analyse them and to remix or alter them.

INDUSTRY SURVEY :

- A recent analysis performed by Goldman Sachs predicted that the music industry will grow into nearly $41 Billion by 2030 - most of it ($34 billion) is expected to be generated from streaming services like YouTube or Spotify.
- Streaming technology may seem like a great modern way to monetize music.
- With these costs, music producers simply can't afford to take any risks.
- This eventually leads for less musical innovation and more similarity between new pop songs. But this business situation has another interesting outcome:
- it's the perfect substrate for AI generated music.
- THIS IS WHERE WE STEP IN !!:D

Problem Statement

- Generating Music!
- Helping Musicians compose music on the go, and aid in resolving certain sections
- Accompanying music for jamming and performances

Workflow

- Data Preparation
- Creating training sets
- Selecting the model
- Inputting the training sets into the models
- Generating our music

Data Description

- Music generated can be stored as MIDI files, basically digital music files.
- MIDI files can be converted to notes, as well as it can be played directly.
- These MIDI files consists of the notes, pitches, octave of the particular note, and chords if any.

```
0, 0, Header, 1, 1, 480
1, 0, Start_track
1, 0, Title_t, "Guitar"
1, 0, Program_c, 0, 24
1, 0, Tempo, 1052631
1, 0, Time_signature, 4, 2, 24, 8
1, 0, Note_on_c, 0, 52, 80
1, 0, Note_on_c, 0, 45, 72
1, 160, Note_off_c, 0, 52, 64
1, 160, Note_on_c, 0, 57, 80
1, 320, Note_off_c, 0, 57, 64
1, 320, Note_on_c, 0, 60, 80
1, 480, Note_off_c, 0, 60, 64
1, 480, Note_on_c, 0, 52, 80
1, 640, Note_off_c, 0, 52, 64
1, 640, Note_on_c, 0, 57, 80
1, 800, Note_off_c, 0, 57, 64
1, 800, Note_on_c, 0, 60, 80
1, 960, Note_off_c, 0, 60, 64
1, 960, Note_on_c, 0, 52, 80
1, 1120, Note_off_c, 0, 52, 64
1, 1120, Note_on_c, 0, 57, 80
1, 1280, Note_off_c, 0, 57, 64
1, 1280, Note_on_c, 0, 60, 80
1, 1440, Note_off_c, 0, 60, 64
1, 1440, Note_on_c, 0, 52, 80
1, 1600, Note_off_c, 0, 52, 64
1, 1600, Note_on_c, 0, 57, 80
1, 1760, Note_off_c, 0, 57, 64
1, 1760, Note_on_c, 0, 60, 80
1, 1920, Note_off_c, 0, 45, 64
1, 1920, Note_off_c, 0, 60, 64
1, 1920, Note_on_c, 0, 52, 80
1, 1920, Note_on_c, 0, 43, 72
1, 2080, Note_off_c, 0, 52, 64
1, 2080, Note_on_c, 0, 57, 80
1, 2240, Note_off_c, 0, 57, 64
1, 2240, Note_on_c, 0, 60, 80
```

Data preparation

Taking a MIDI file, we start with turning these into a format which can be read and manipulated easily.

We get an array of all the needed information.

Example:

<music21.note.Note F> 72.0

<music21.chord.Chord A2 E3> 72.0

<music21.note.Note E> 72.5

<music21.chord.Chord B-2 F3> 73.0

<music21.note.Note F>73.0

The LSTM architecture

Layer (type)	Output Shape	Param #
lstm_1 (LSTM)	(None, 80, 512)	1052672
dropout_1 (Dropout)	(None, 80, 512)	0
lstm_2 (LSTM)	(None, 80, 512)	2099200
dropout_2 (Dropout)	(None, 80, 512)	0
lstm_3 (LSTM)	(None, 512)	2099200
dense_1 (Dense)	(None, 256)	131328
dropout_3 (Dropout)	(None, 256)	0
dense_2 (Dense)	(None, 80)	20560
activation_1 (Activation)	(None, 80)	0

Total params: 5,402,960
Trainable params: 5,402,960
Non-trainable params: 0

Experiment 1

- HUGE dataset
- Time for 1 Epoch: 4 hours
- Time for parsing: 7 hours

700 file dataset of Classical and Jazz music from the Yamaha ePiano Competition!

OUTPUT

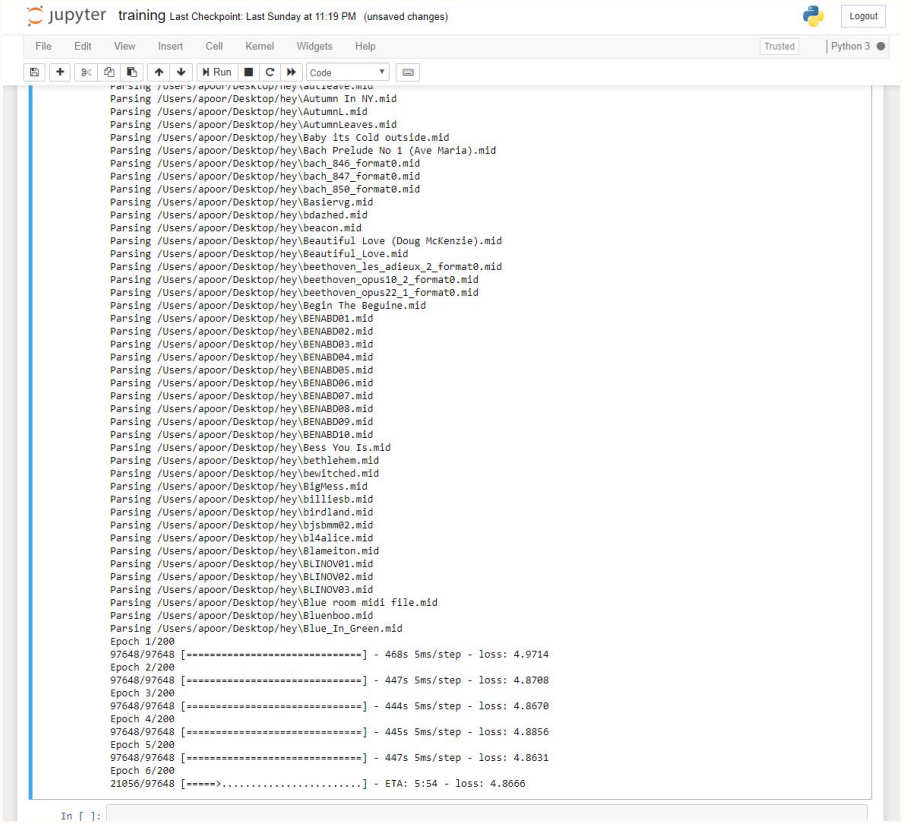
Experiment 2

- Diverse songs but limited dataset to decrease training

- Time for 1 Epoch: 10 minutes
- Time for parsing: 3 hours

700 file dataset of Classical and Jazz music from the Yamaha ePiano Competition!

Training


jupyter training Last Checkpoint: Last Sunday at 11:19 PM (unsaved changes)
Logout
File Edit View Insert Cell Kernel Widgets Help
Trusted
Python 3
Run
Code
Parsing /Users/apoor/Desktop/hey\Autumn In NY.mid
Parsing /Users/apoor/Desktop/hey\AutumnL.mid
Parsing /Users/apoor/Desktop/hey\AutumnLeaves.mid
Parsing /Users/apoor/Desktop/hey\Baby its Cold outside.mid
Parsing /Users/apoor/Desktop/hey\Bach Prelude No 1 (Ave Maria).mid
Parsing /Users/apoor/Desktop/hey\bach_846_format0.mid
Parsing /Users/apoor/Desktop/hey\bach_847_format0.mid
Parsing /Users/apoor/Desktop/hey\bach_850_format0.mid
Parsing /Users/apoor/Desktop/hey\Basiervg.mid
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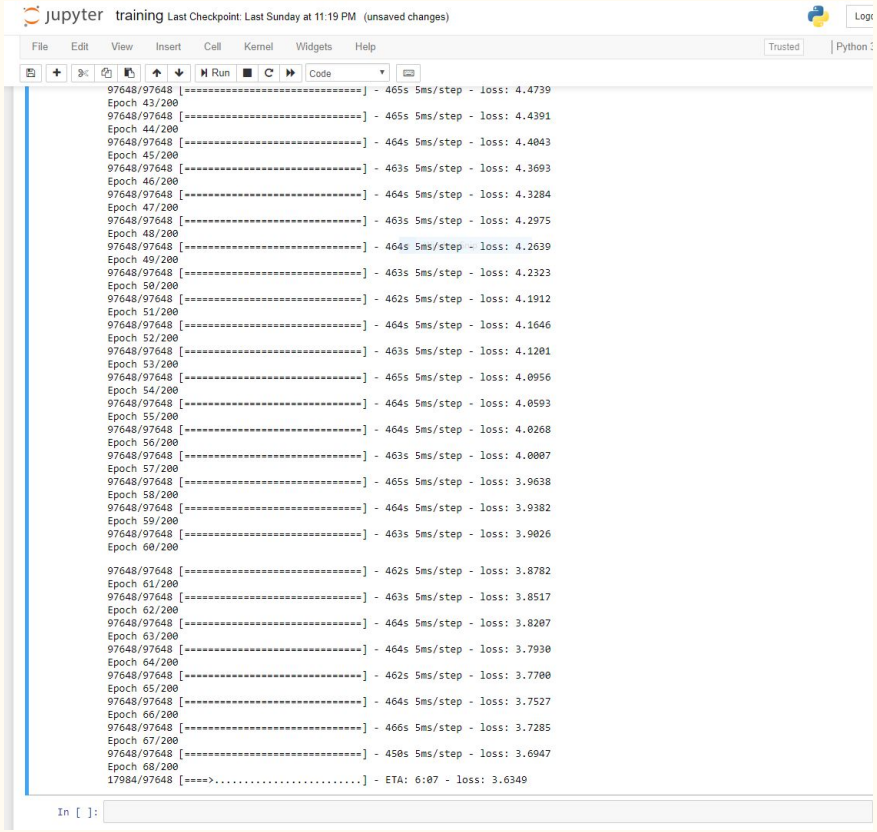
Parsing /Users/apoor/Desktop/hey\beacon.mid
Parsing /Users/apoor/Desktop/hey\Beautiful Love (Doug McKenzie).mid
Parsing /Users/apoor/Desktop/hey\Beautiful_Love.mid
Parsing /Users/apoor/Desktop/hey\beethoven_les_adieux_2_format0.mid
Parsing /Users/apoor/Desktop/hey\beethoven_opus10_2_format0.mid
Parsing /Users/apoor/Desktop/hey\beethoven_opus22_1_format0.mid
Parsing /Users/apoor/Desktop/hey\Begin The Beguine.mid
Parsing /Users/apoor/Desktop/hey\BENABD01.mid
Parsing /Users/apoor/Desktop/hey\BENABD02.mid
Parsing /Users/apoor/Desktop/hey\BENABD03.mid
Parsing /Users/apoor/Desktop/hey\BENABD04.mid
Parsing /Users/apoor/Desktop/hey\BENABD05.mid
Parsing /Users/apoor/Desktop/hey\BENABD06.mid
Parsing /Users/apoor/Desktop/hey\BENABD07.mid
Parsing /Users/apoor/Desktop/hey\BENABD08.mid
Parsing /Users/apoor/Desktop/hey\BENABD09.mid
Parsing /Users/apoor/Desktop/hey\BENABD10.mid
Parsing /Users/apoor/Desktop/hey\Bess You Is.mid
Parsing /Users/apoor/Desktop/hey\bethlehem.mid
Parsing /Users/apoor/Desktop/hey\bewitched.mid
Parsing /Users/apoor/Desktop/hey\BigMess.mid
Parsing /Users/apoor/Desktop/hey\billiesb.mid
Parsing /Users/apoor/Desktop/hey\birdland.mid
Parsing /Users/apoor/Desktop/hey\bjsbmm02.mid
Parsing /Users/apoor/Desktop/hey\blkalice.mid
Parsing /Users/apoor/Desktop/hey\Blameiton.mid
Parsing /Users/apoor/Desktop/hey\BLINOV01.mid
Parsing /Users/apoor/Desktop/hey\BLINOV02.mid
Parsing /Users/apoor/Desktop/hey\BLINOV03.mid
Parsing /Users/apoor/Desktop/hey\Blue room midi file.mid
Parsing /Users/apoor/Desktop/hey\Bluenboo.mid
Parsing /Users/apoor/Desktop/hey\Blue_In_Green.mid
Epoch 1/200
97648/97648 [==============================] - 468s 5ms/step - loss: 4.9714
Epoch 2/200
97648/97648 [==============================] - 447s 5ms/step - loss: 4.8708
Epoch 3/200
97648/97648 [==============================] - 444s 5ms/step - loss: 4.8670
Epoch 4/200
97648/97648 [==============================] - 445s 5ms/step - loss: 4.8856
Epoch 5/200
97648/97648 [==============================] - 447s 5ms/step - loss: 4.8631
Epoch 6/200
21056/97648 [=====>........................] - ETA: 5:54 - loss: 4.8666
In [ ]:


jupyter training Last Checkpoint: Last Sunday at 11:19 PM (unsaved changes)
File Edit View Insert Cell Kernel Widgets Help
Trusted
Run
Code
97648/97648 [==============================] - 465s 5ms/step - loss: 4.4739
Epoch 43/200
97648/97648 [==============================] - 465s 5ms/step - loss: 4.4391
Epoch 44/200
97648/97648 [==============================] - 464s 5ms/step - loss: 4.4043
Epoch 45/200
97648/97648 [==============================] - 463s 5ms/step - loss: 4.3693
Epoch 46/200
97648/97648 [==============================] - 464s 5ms/step - loss: 4.3284
Epoch 47/200
97648/97648 [==============================] - 463s 5ms/step - loss: 4.2975
Epoch 48/200
97648/97648 [==============================] - 464s 5ms/step - loss: 4.2639
Epoch 49/200
97648/97648 [==============================] - 463s 5ms/step - loss: 4.2323
Epoch 50/200
97648/97648 [==============================] - 462s 5ms/step - loss: 4.1912
Epoch 51/200
97648/97648 [==============================] - 464s 5ms/step - loss: 4.1646
Epoch 52/200
97648/97648 [==============================] - 463s 5ms/step - loss: 4.1201
Epoch 53/200
97648/97648 [==============================] - 465s 5ms/step - loss: 4.0956
Epoch 54/200
97648/97648 [==============================] - 464s 5ms/step - loss: 4.0593
Epoch 55/200
97648/97648 [==============================] - 464s 5ms/step - loss: 4.0268
Epoch 56/200
97648/97648 [==============================] - 463s 5ms/step - loss: 4.0007
Epoch 57/200
97648/97648 [==============================] - 465s 5ms/step - loss: 3.9638
Epoch 58/200
97648/97648 [==============================] - 464s 5ms/step - loss: 3.9382
Epoch 59/200
97648/97648 [==============================] - 463s 5ms/step - loss: 3.9026
Epoch 60/200
97648/97648 [==============================] - 462s 5ms/step - loss: 3.8782
Epoch 61/200
97648/97648 [==============================] - 463s 5ms/step - loss: 3.8517
Epoch 62/200
97648/97648 [==============================] - 464s 5ms/step - loss: 3.8207
Epoch 63/200
97648/97648 [==============================] - 464s 5ms/step - loss: 3.7930
Epoch 64/200
97648/97648 [==============================] - 462s 5ms/step - loss: 3.7700
Epoch 65/200
97648/97648 [==============================] - 464s 5ms/step - loss: 3.7527
Epoch 66/200
97648/97648 [==============================] - 466s 5ms/step - loss: 3.7285
Epoch 67/200
97648/97648 [==============================] - 450s 5ms/step - loss: 3.6947
Epoch 68/200
17984/97648 [====>.........................] - ETA: 6:07 - loss: 3.6349
In [ ]:

OUTPUT

Experiment 3

- Instead of using a wide and diverse data-set. We decide to train on a single musician with a smaller, contained data-set to achieve better results.

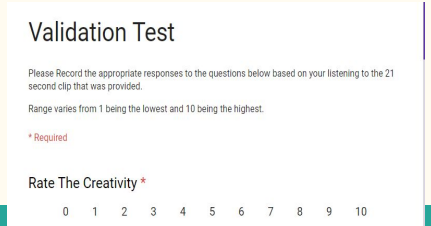
- Time for 1 Epoch: 3 minutes
- Time for Parsing: 1 hour

OUTPUT

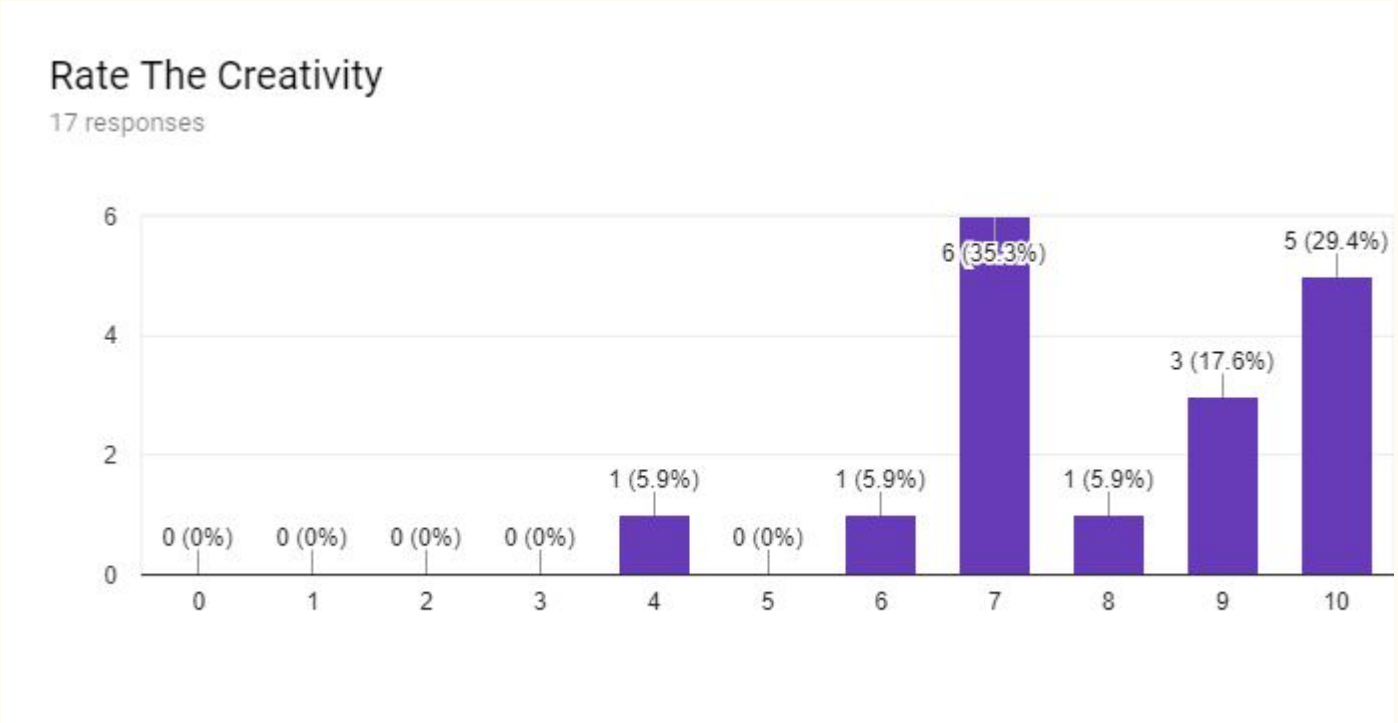
Test

- Validation tests are means to figure out if the product fulfils its intended use when deployed in an appropriate environment.
- Different People have different tastes in Music. Hence we carried out a survey to figure out what the general feeling was about our output.
- The Survey consisted of 4 questions :

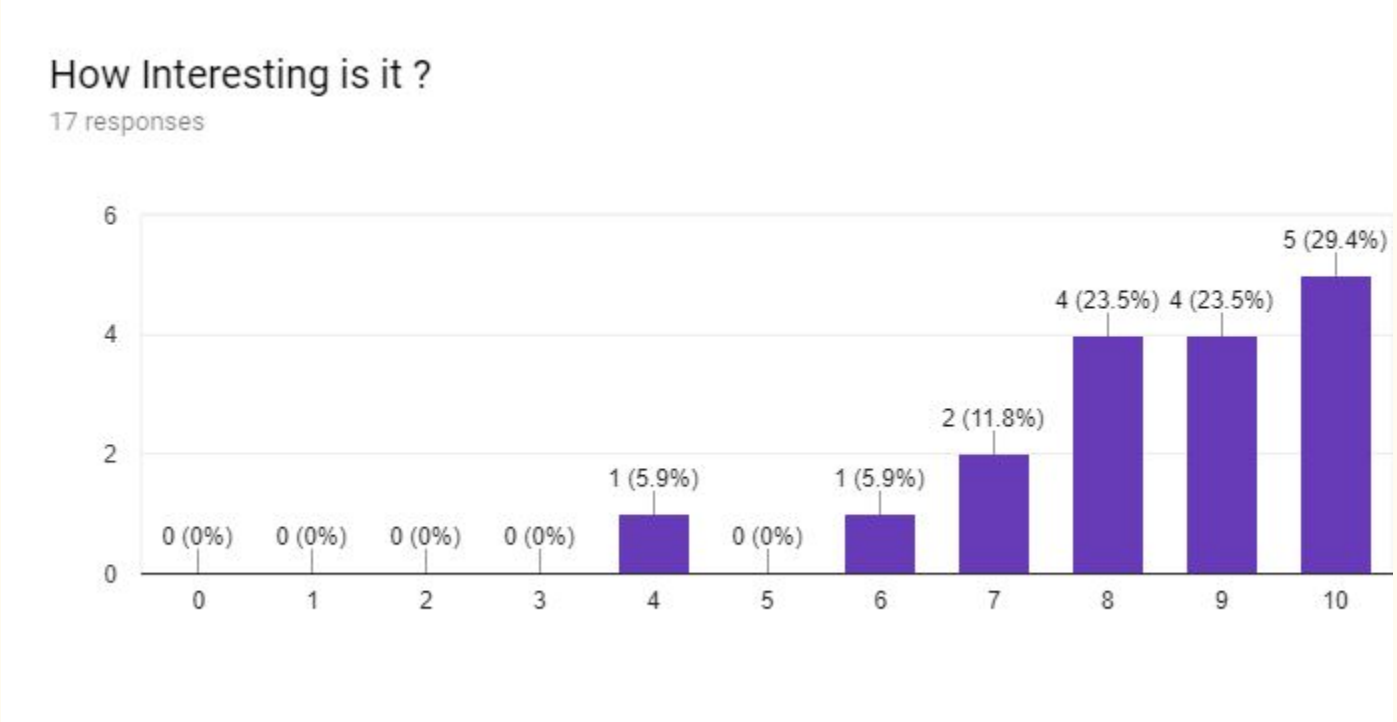
1. How Creative was the sample ?
2. How interesting did you find it ?
3. Did you like the song ?
4. Would you listen to it in your free time ?



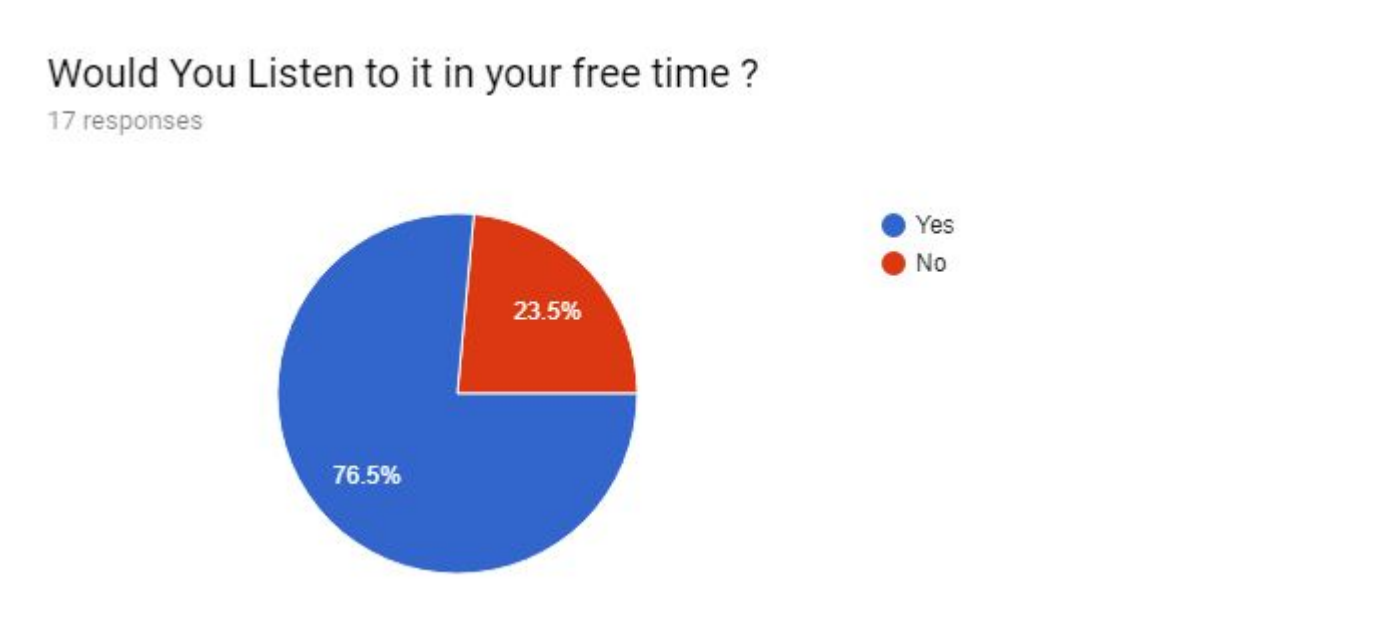
Survey Results



Survey Results



Survey Results



Going Forward

- AI for Music has opened up a flood gate of Opportunities. Drew Silverstein one of the founders of Amper (AI Music Composer for Content Creators) said in a recent interview that the future of music is going to be a collaboration between AI and Human Beings.
- Humtap a IOS Application has implemented something similar to this
- Scientists at Austria's Graz University are working on technology to optimise this algorithm to work with Brain waves .