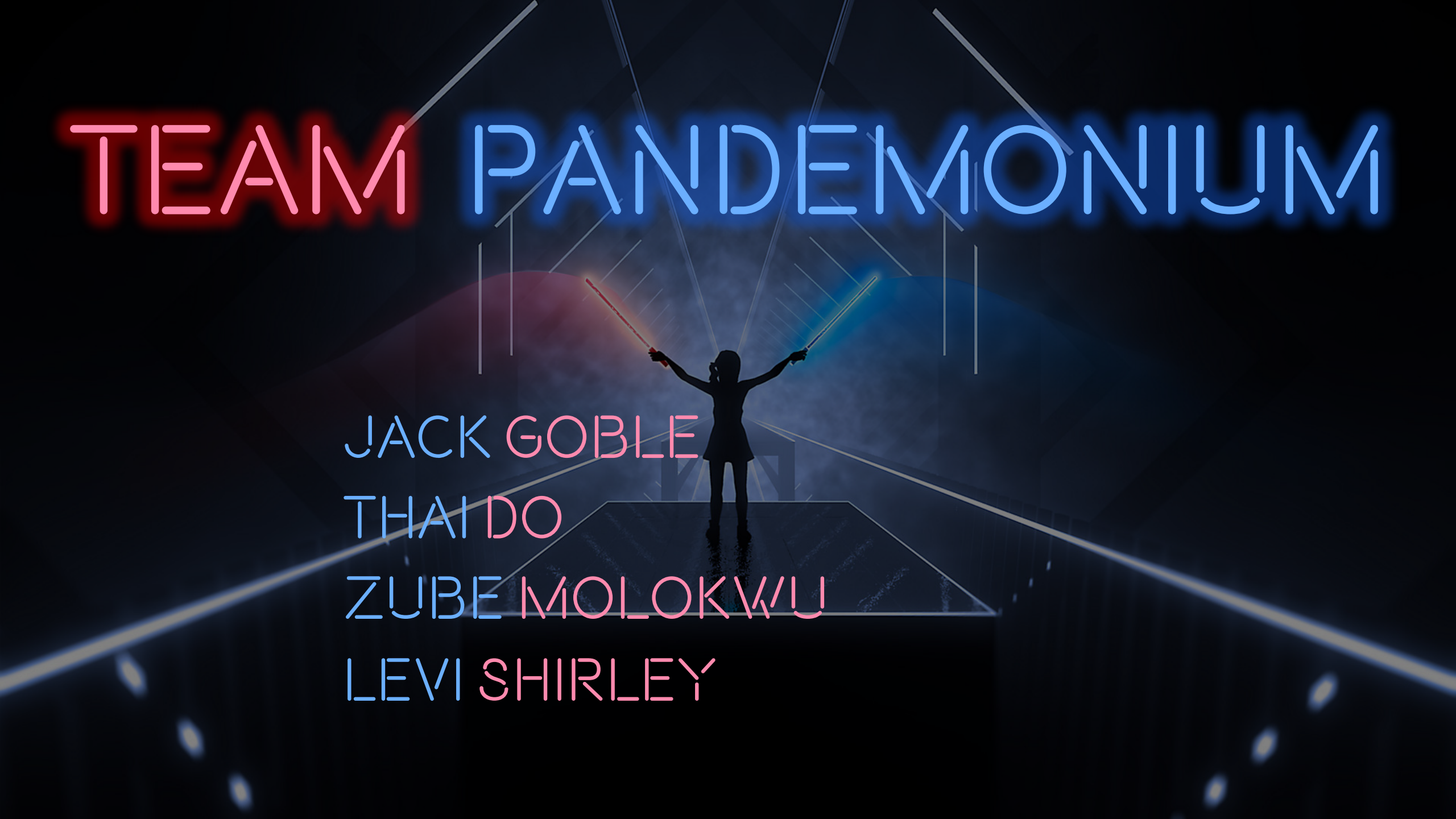

TEAM PANDEMONIUM
JACK GOBLE
THAI DO
ZUBE MOLOKWU
LEVI SHIRLEY

BEAT SABER

- BEAT SABER IS A VIRTUAL REALITY RHYTHM GAME.
- THE GOAL OF THE PLAYERS IS TO SLASH THE INCOMING NOTES, AVOID SLASHING BOMBS, AND DODGE WALLS.
- WHEN YOU SLASH A NOTE, YOU HAVE TO SLASH IT WITH THE SABER OF THE SAME COLOR, AND THE DIRECTION OF THE SLASH HAS TO BE IN THE DIRECTION THAT THE NOTE SPECIFIES.

BEAT-MAPS

- A BEAT-MAP IS THE LEVEL FOR A SONG THAT A PLAYER CAN PLAY
- A BEAT-MAP CAN HAVE DIFFERENT DIFFICULTIES: EASY, NORMAL, HARD, EXPERT, EXPERT+
- ANYONE CAN MAKE A BEAT-MAP FOR ANY SONG, AND SHARE THAT BEAT-MAP WITH OTHER PLAYERS
- A BEAT-MAP IS A 3X4 GRID, SO A NOTE, BOMB, OR WALL CAN BE PLACED WITHIN ANY OF THESE 12 SPOTS AT ANY MOMENT IN TIME.

GOAL OF THE PROJECT

- BECAUSE ANYONE CAN MAKE A BEAT-MAP, THERE IS AN INCONSISTENCY AMONG THE SHARED MAPS
- SOME MAPS THAT ARE SHARED ONLINE ARE IMPOSSIBLE TO PLAY
- BECAUSE OF THIS, WE WANTED TO BUILD A NEURAL NETWORK THAT IS CAPABLE OF AUTOMATICALLY GENERATING BEAT-MAPS GIVEN A SONG

AUDIO FILE PROCESSING

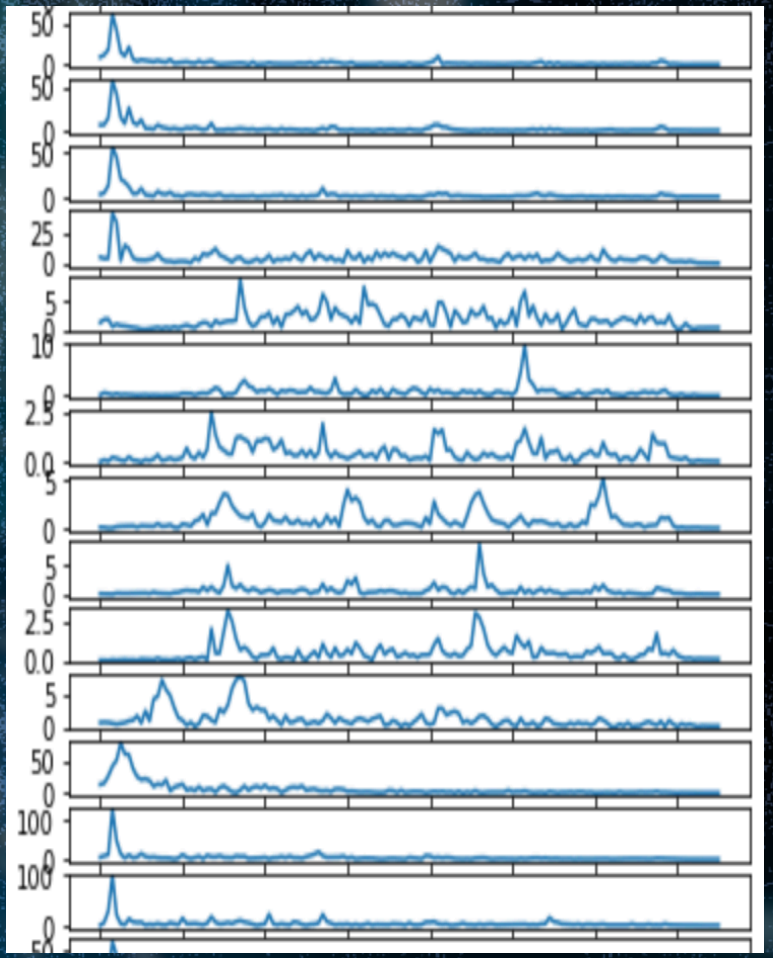
- WE USED THE LIBROSA LIBRARY WHICH ALLOWED US TO DO THE FOLLOWING:
  - LOAD THE AUDIO FILE (.OGG FILE)
  - FIND THE DURATION OF THE FILE IN SECONDS
  - RESAMPLE THE SONG AND DETERMINE THE TEMPO

- AFTER RESAMPLING THE SONG TO A SPECIFIC NUMBER OF SAMPLES PER BEAT, THE AUDIO FILE IS DIVIDED INTO 1/8TH NOTES

- WE PERFORM A FOURIER TRANSFORMATION ON EACH OF THESE NOTES WHICH BREAKS DOWN THE AUDIO INTO SIMPLER CONSTITUENT FREQUENCIES

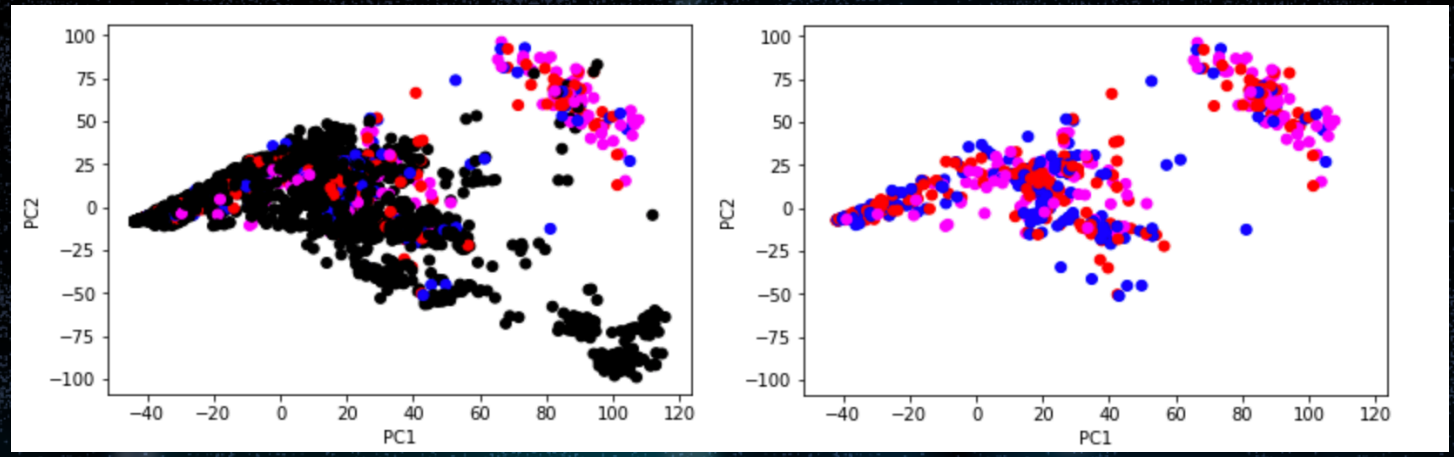
PRINCIPLE COMPONENT ANALYSIS

- DATA SEPARATED INTO 150 FREQUENCY BANDS AT EACH TIME-STEP.
- GOAL IS TO ISOLATE WHICH FREQUENCIES PROVIDE THE GREATEST INDICATION THAT SOMETHING “IMPORTANT” IS HAPPENING

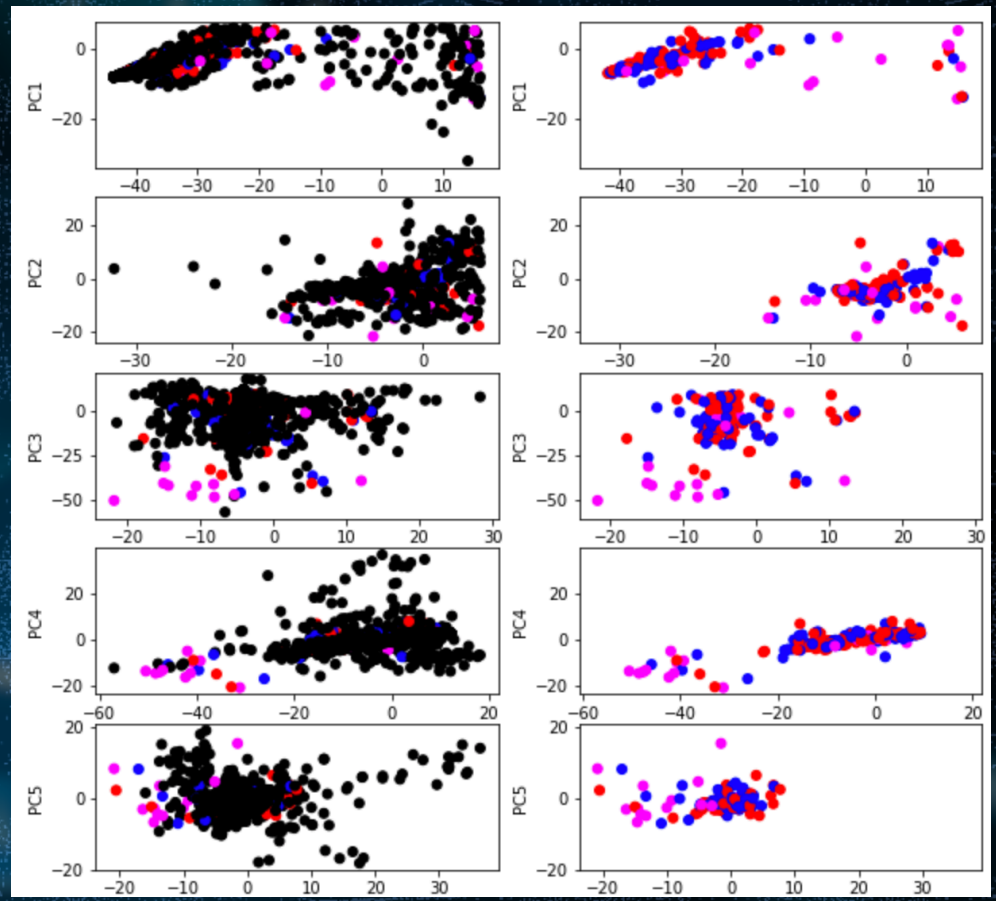


FFT DATA OVER TIME

P.C.A. (PART 2)



- DUE TO THE NATURE OF THE DATA, THERE IS ABOUT A 4:1 RATIO OF "NO-NOTE" VS ANYTHING ELSE.
- THE FIRST PRINCIPLE COMPONENT SEPARATED SEVERAL POINTS
- SUBSEQUENT COMPONENTS EACH ONLY PROVIDED A FEW OUTLIERS
- WE KEPT ALL 150 COMPONENTS




FIRST NETWORK

CONVOLUTION LAYER

- THIS LAYER TAKES IN THE INPUT DATA, AND PERFORMS A CONVOLUTION ON IT GIVING US ACCESS TO A LARGER TIME INTERVAL
- THE ACTIVATION FUNCTION WE USED IS THE RECTIFIED LINEAR UNIT (RELU) FUNCTION.
- THE OUTPUT OF THIS LAYER WILL GO INTO AN LSTM LAYER.

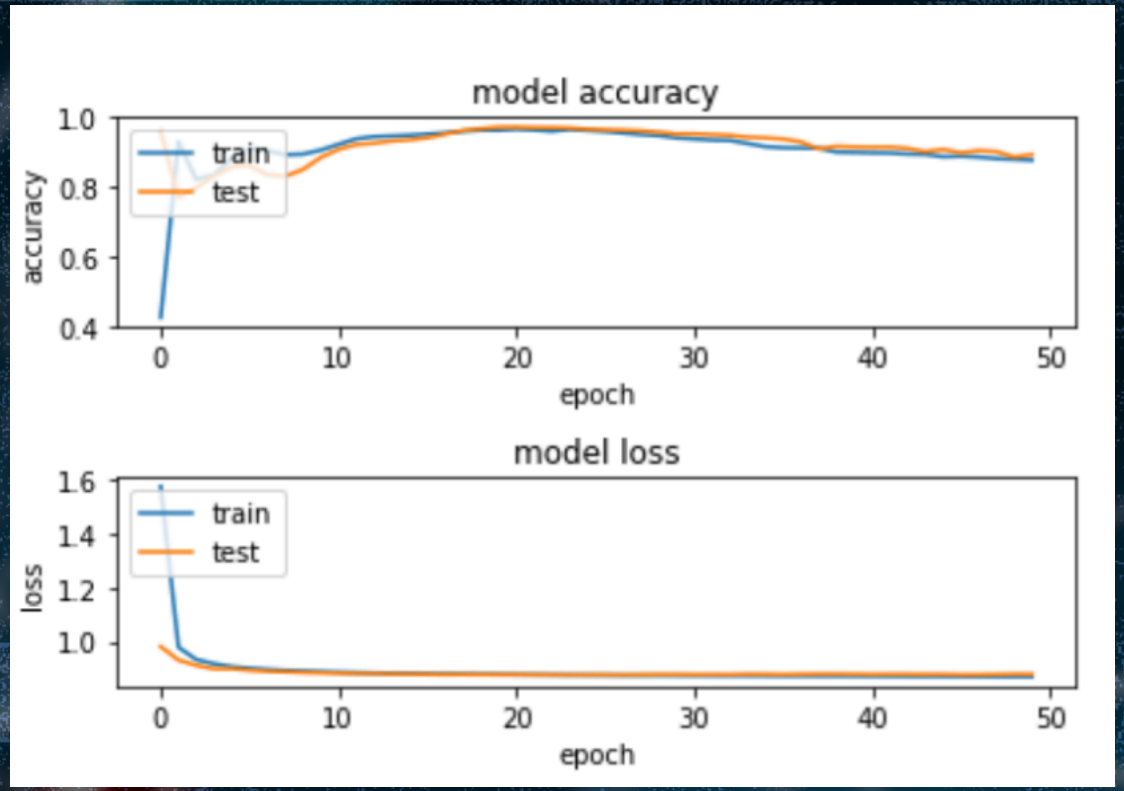
LSTM LAYER

- THIS LAYER LOOKS AT EACH PARTICULAR PIECE OF THE SONG WHILE KEEPING IN MIND THE PREVIOUS PIECE AND THE UPCOMING PIECE IN ORDER TO UPDATE THE WEIGHTS APPROPRIATELY
- THIS LAYER GENERATES TWO OUTPUTS : ONE FOR DIRECTION AND THE OTHER FOR THE COLOR OF THE NOTE
- THESE TWO OUTPUTS ARE THEN FED INTO TWO SEPARATE DENSE LAYERS
- INFORMATION IS PASSED TO A DECONVOLUTION LAYER

TRAINING AND TESTING

- AVERAGE TRAINING ACCURACY – 88%

- AVERAGE TESTING ACCURACY – 92%




REVISED NETWORK

REVISED NETWORK

THE PREVIOUS NETWORK WASN'T GENERALIZING WELL ENOUGH.

SO, WE MADE THE FOLLOWING CHANGES:

- BRANCHED EARLIER (RIGHT AFTER LSTM LAYER)
- USED A LINEAR ACTIVATION FUNCTION FOR THE DENSE LAYERS
- RESHAPED THE DENSE LAYERS
- PERFORMED A SOFTMAX
- REMOVED THE CONCATENATION LAYER

- THIS YIELDED A MODEL WITH ONE INPUT AND TWO OUTPUTS
  - BOTH OUTPUTS WERE SOFTMAX
  - THIS ALLOWED US TO USE TWO LOSS FUNCTIONS
  - AND MINIMIZE THE LOSS FOR BOTH COLOR AND DIRECTION

TRAINING AND TESTING

- SHOWS EVIDENCE OF TRAINING
- USES A BATCH SIZE SCHEDULE
- TRAIN AND TEST HAVE SHARED INFORMATION