

Billboard Top 100 Hot Charts Prediction using ANN, CNN, LSTM

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1 Abstract

I constructed several prediction models (ANN, CNN, LSTM) to predict a) How many songs of each genre would be in the Hot 100 Charts in 1 year, and b) how long each song in the latest Hot 100 will last. The dataset I pulled from included Hot 100 charts from the very first instance of the Hot 100 to August 2025.

2 Data Preparation

The Original Dataset did not include genre data, which I felt would be important, A) for how many songs of each genre would be in the Hot 100 Charts in 1 year, and B) how long each song in the Hot 100 would last. I pulled genre data from the Spotify Web API. This method had a $\approx 60\%$ success rate. I also combed through a few of the most recent years and manually put in genre data, and got the amount of missing data to $\approx 20\%$. With more time, I could have reduced this even further to get more accurate predictions.

Included in the repository will be some of the steps I made to clean and add genre data to the Hot 100 charts.

3 Results for Genre Forecasting

I trained ANN, CNN, and LSTM models on genre data from previous weeks to make predictions for 1 year in the future from the latest dataset (August 2026). I tested each model with the parameters of `validation_split = {0.1, 0.2}` and `epochs = {5,20,100}`.

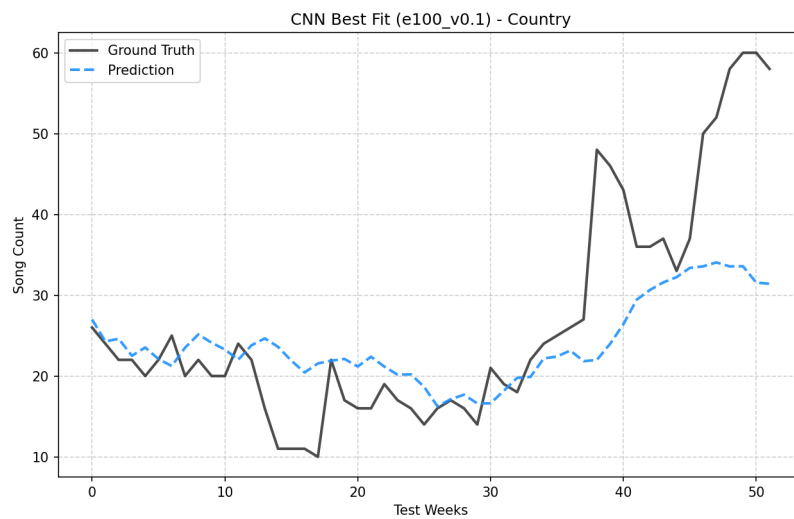
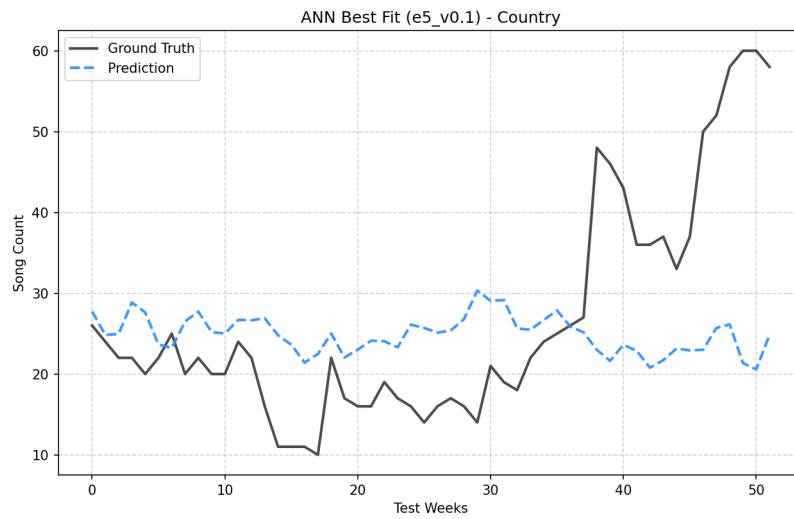
The LSTM model with 100 epochs, with `validation_split` of 0.1 performed the best, with a MSE of 0.01160.

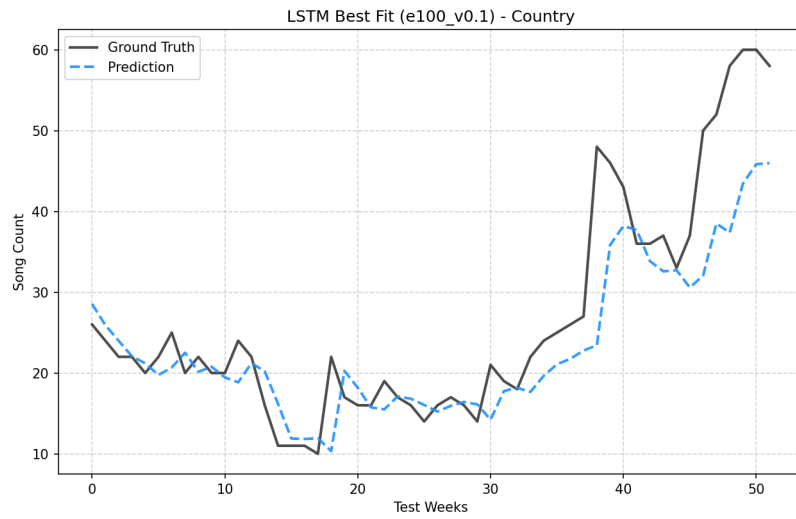
The ANN's best model was on 5 epochs with a `validation_split` of 0.1, with a MSE of 0.02244.

The CNN's best model was on 100 epochs with a `validation_split` of 0.1, with a MSE of 0.02020.

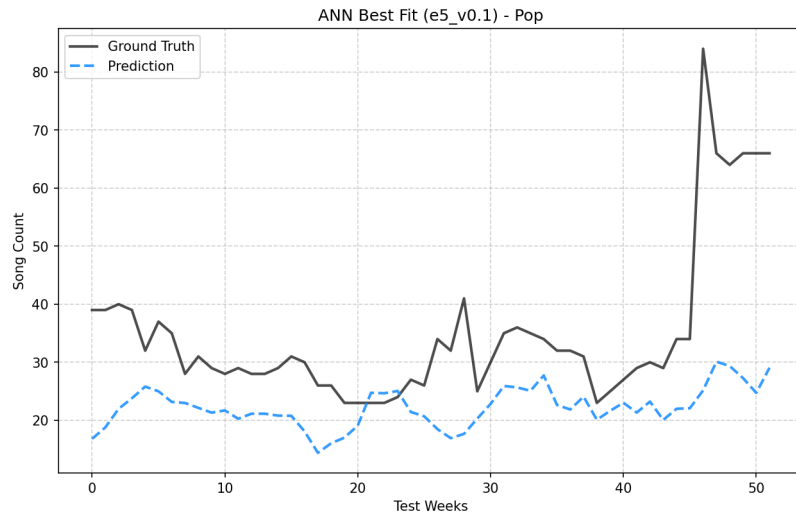
In order, the LSTM model consistently performed the best, followed by the CNN model, and finally the ANN.

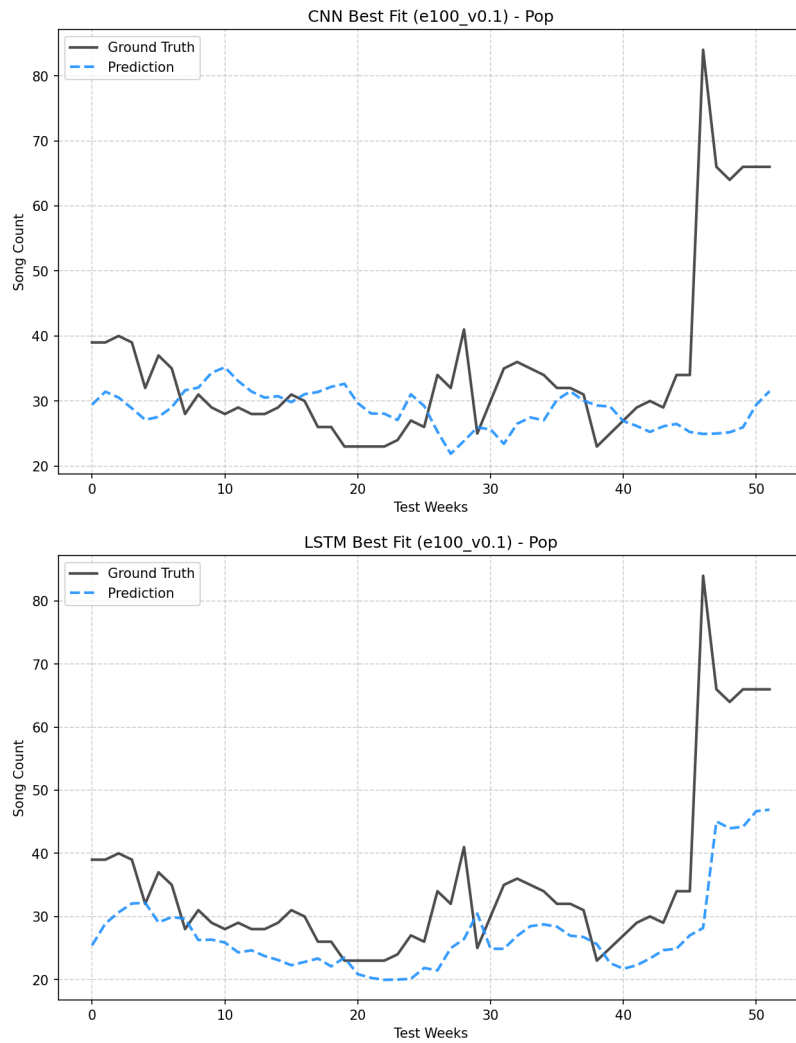
Looking at the Best model for each, let's look at one genre to see how they performed.



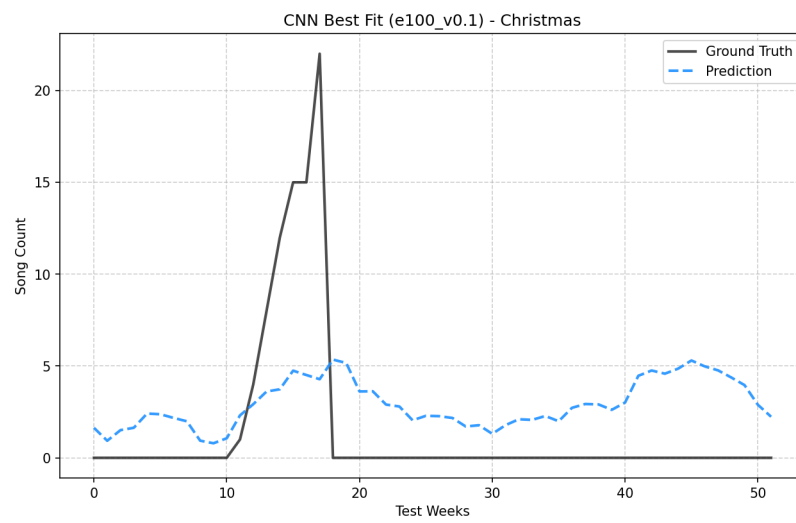
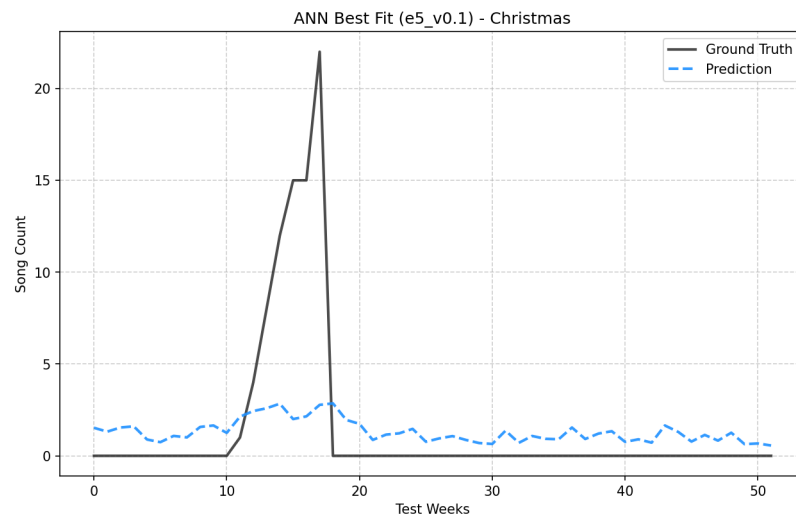


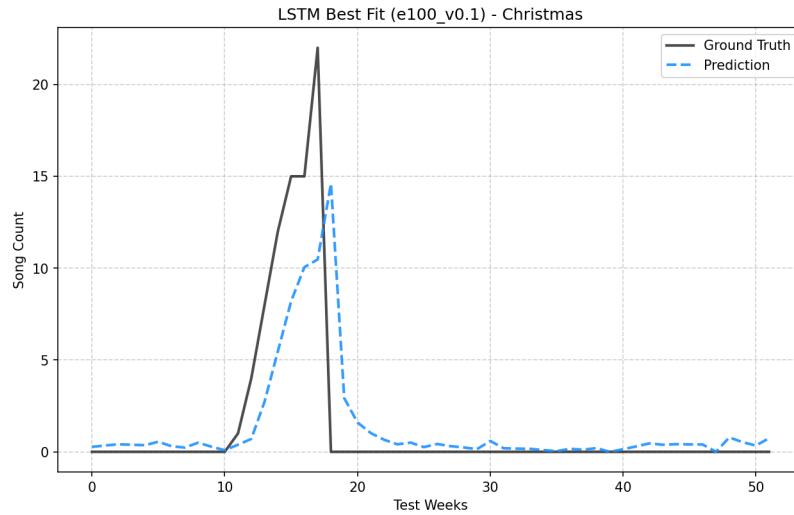
We can see that in the Country Genre, the LSTM performed the closest to the ground truth, then the CNN, then finally the ANN. Looking at another Genre:





We see that clearly the LSTM model performed the best for the Pop Genre, followed by the ANN and CNN, which were close in this genre.





The Best LSTM Model predicted (rounded):

Pop	35
Country	32
Hip Hop	27
Other	2
Latin	2
Electronic	2
Christmas	1

Obviously, we can see some problems with this (1 Christmas song seems incorrect for August). As the number of Epochs increased in my testing, the LSTM model improved dramatically. I believe that testing higher Epochs would improve the model even further.

The Best CNN Model predicted (rounded):

Hip Hop	37
Pop	25
Country	19
Rock	7
Other	4
R&B/Soul	3
Christmas	3
Latin	2
Electronic	1

With CNN's best model, we notice even more problems, Hip Hop is extremely rarely higher than Pop music in the Hot 100. Rock (even though it's one of my favorite genres) rarely has any spots in the Hot 100 in the last few years, and we have even more Christmas songs now.

The Best ANN model predicted (rounded):

Hip Hop	33
Pop	30
Country	28
Other	3
Latin	2
Electronic	2
R&B/Soul	1
Christmas	0.7

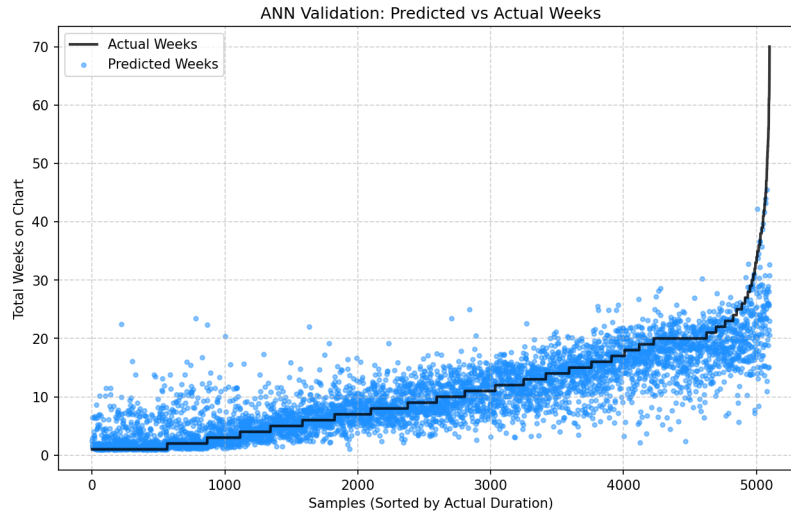
Honestly, I believe the ANN Prediction is slightly better than the CNN prediction, but both are obviously worse than the LSTM model.

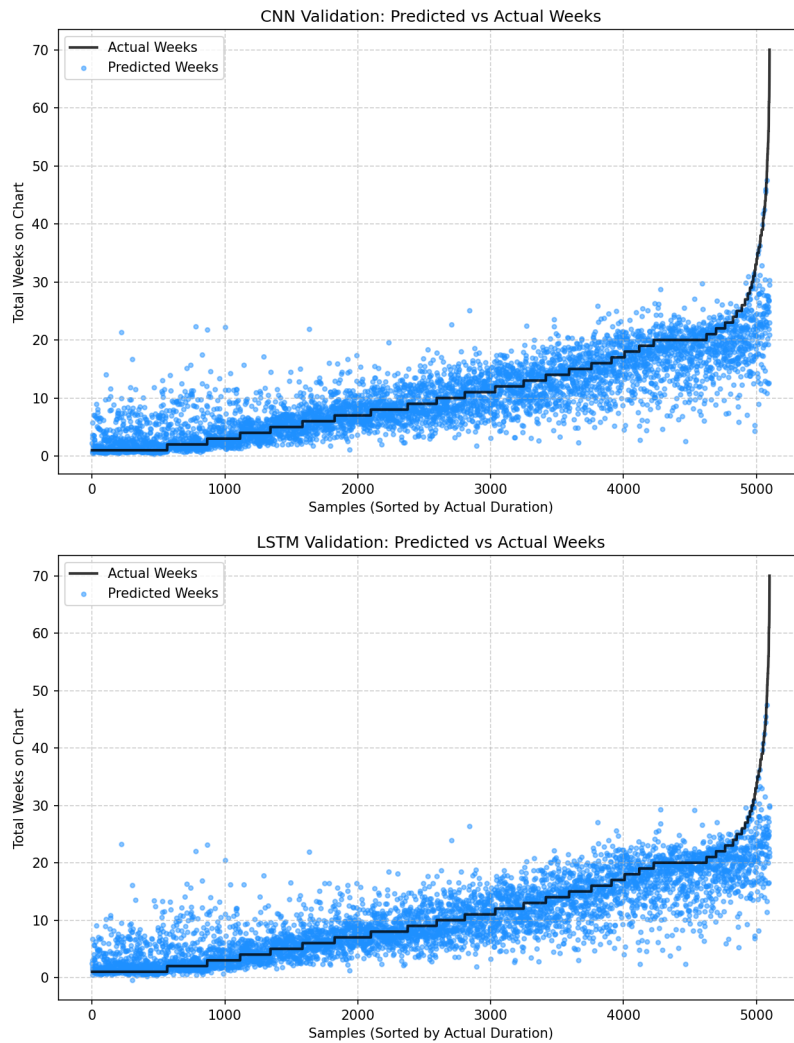
This is in line with my expectation. The Hot 100 charts have a directional over the years and contain a strong seasonal variation. I expected the LSTM to be far and way the best model, and it was.

The Graphs for other genres are available in the GitHub Repository.

4 Current Songs Forecasting

I trained ANN, CNN, and LSTM models on hundreds of thousands of songs to make predictions for how long each song in the latest Hot 100 (in this dataset August 2025) would last.





We see that all three models performed very similarly here.

ANN Validation MAE: ± 2.84 weeks

CNN Validation MAE: ± 2.88 weeks

LSTM Validation MAE: ± 2.81 weeks

This model took considerably longer to train, and I did not have enough time to test for increasing epoch count, validation_split or other variables.

For the latest Hot 100, the Models predicted:

Table 1: Song Data and Model Metrics

Song	Artist	Current	ANN	CNN	LSTM
The Subway	Chappell Roan	3	20.2	19.6	20.3
Back In The Saddle	Luke Combs	4	15.5	15.6	16.1
Nice To Meet You	Myles Smith	11	13.6	30.6	3.1
Bar None	Jordan Davis	7	12.8	11.9	13.3
Heart Of Stone	Jelly Roll	1	12.1	13.2	9.2
6 Months Later	Megan Moroney	9	11.3	12.0	11.5
What I Want	Morgan WallenFeat..	6	10.8	12.4	11.6
Manchild	Sabrina Carpenter	11	10.4	10.7	11.4
Somewhere Over Laredo	Lainey Wilson	7	10.1	9.1	10.0
Miami	Morgan WallenFeat..	4	9.7	10.5	9.9
Luther	Kendrick Lamar&SZ..	6	9.2	7.9	10.7
Imaginary Playerz	Cardi B	1	9.1	7.7	9.2
Which One	Drake& Central Ce..	4	8.8	8.3	8.8
Die With A Smile	Lady Gaga&Bruno M..	6	8.8	9.0	8.8
I Had Some Help	Post MaloneFeatur..	6	8.3	9.4	8.6
Hell At Night	BigXthaPlug & Ell..	2	7.8	8.1	8.0
Soda Pop	Saja Boys: Andrew..	8	7.8	8.1	8.3
Golden	HUNTR/X: EJAE, Au..	9	7.6	8.0	8.5
Eternity	Alex Warren	5	7.5	7.5	7.1
Outside	Cardi B	9	7.4	7.1	8.5
Daisies	Justin Bieber	6	7.1	7.1	7.8
Your Idol	Saja Boys: Andrew..	9	6.9	7.3	7.6
Forever Be Mine	GunnaFeaturingWiz..	2	6.8	5.0	6.6
How Its Done	HUNTR/X: EJAE, Au..	8	6.8	7.0	6.8
What Did I Miss?	Drake	7	6.7	3.4	5.8
It Depends	Chris BrownFeatur..	4	6.6	6.5	5.4
Backup Plan	Bailey Zimmerman&..	6	6.0	6.4	6.6
No Broke Boys	Disco Lines &Tina..	5	5.6	5.6	5.6
Is It A Crime	Mariah the Scient..	2	5.6	5.3	5.5
All The Way	BigXthaPlug Featu..	6	5.5	5.3	4.2
What It Sounds Like	HUNTR/X: EJAE, Au..	8	4.9	4.9	4.4
30 For 30	SZAWithKendrick L..	6	4.9	5.3	4.7
Last One To Know	Gavin Adcock	1	4.9	4.9	5.0
APT.	ROSE &Bruno Mars	6	4.5	4.4	3.9
Bottle Rockets	Scotty McCreery&H..	6	4.5	3.8	4.6
Burning Blue	Mariah the Scient..	6	4.5	4.3	3.3
Free	Rumi, JINU, EJAE ..	8	4.4	4.4	3.8
Yukon	Justin Bieber	6	4.2	4.1	4.7
Takedown	HUNTR/X: EJAE, Au..	8	4.1	4.1	3.4
Bloodline	Alex WarrenWithJe..	5	4.0	2.3	3.8
Amen	Shaboozey&Jelly R..	6	3.7	2.7	3.7

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Table 1 – *Continued from previous page*

Song	Artist	Current	ANN	CNN	LSTM
So Far So Fake	Pierce the Veil	3	3.7	3.6	3.5
Dont Mind If I Do	Riley GreenFeatur..	3	3.5	3.4	3.6
I Aint Coming Back	Morgan WallenFeat..	6	3.5	3.1	3.7
After All The Bars Are Clos..	Thomas Rhett	17	3.0	3.2	3.4
Cliche	MGK	2	2.7	2.2	2.3
Strategy	Twice	5	2.6	2.9	2.5
I Got Better	Morgan Wallen	14	2.2	3.8	2.9
Let Down	Radiohead	1	1.7	1.2	1.7
Takedown	JEONGYEON, JIHYO ..	7	1.2	1.2	1.2
Superman	Morgan Wallen	15	1.1	2.6	1.7
Rather Lie	Playboi Carti&The..	6	0.6	0.0	0.7
Somebody	Latto	2	0.3	1.1	0.5
What Kinda Man	Parker McCollum	1	0.3	3.2	0.0
wgft	GunnaFeaturingBur..	2	0.2	0.8	0.4
Gabriela	KATSEYE	5	0.0	0.0	0.0
Tu Sancho	Fuerza Regida	9	0.0	0.0	0.3
20 Cigarettes	Morgan Wallen	14	0.0	1.0	0.3
Good News	Shaboozey	39	0.0	0.0	0.0
Frecuencia	Dareyes de La Sie..	5	0.0	0.0	0.0
Birds Of A Feather	Billie Eilish	66	0.0	0.0	0.0
Better Me For You (Brown Ey..	Max McNowN	10	0.0	0.0	0.0
Back To Friends	sombr	21	0.0	0.0	0.0
A Bar Song (Topsy)	Shaboozey	70	0.0	0.0	0.0
Folded	Kehlani	10	0.0	0.0	0.0
Country Song Came On	Luke Bryan	3	0.0	1.1	0.0
Beautiful Things	Benson Boone	81	0.0	0.0	0.0
Blue Strips	jessie murph	6	0.0	0.0	0.0
Happen To Me	Russell Dickerson	18	0.0	0.0	0.0
Hard Fought Hallelujah	Brandon LakeX Jel..	6	0.0	0.0	0.0
Pink Pony Club	Chappell Roan	62	0.0	0.0	0.0
Nokia	Drake	27	0.0	0.0	0.0
Napoleon	\$uicideboy\$	3	0.0	0.0	0.0
Marlboro Rojo	Fuerza Regida	14	0.0	0.0	0.0
Mutt	Leon Thomas	29	0.0	0.0	0.0
Mystical Magical	Benson Boone	17	0.0	0.0	0.0
Love Somebody	Morgan Wallen	44	0.0	0.0	0.0
Love Me Not	Ravyn Lenae	21	0.0	0.0	0.0
Im The Problem	Morgan Wallen	29	0.0	0.0	0.0
Jump	BLACKPINK	6	0.0	0.0	0.0
Just Keep Watching	Tate McRae	12	0.0	0.0	0.0
Just In Case	Morgan Wallen	22	0.0	0.0	0.0
Just Say Dat	Gunna	2	0.0	0.2	0.0

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Table 1 – *Continued from previous page*

Song	Artist	Current	ANN	CNN	LSTM
Lose Control	Teddy Swims	104	0.0	0.0	0.0
House Again	Hudson Westbrook	18	0.0	0.0	0.0
Party 4 U	Charli xcx	18	0.0	0.0	0.0
Ordinary	Alex Warren	28	0.0	0.0	0.0
Sparks	Coldplay	6	0.0	0.0	0.0
Revolving Door	Tate McRae	19	0.0	0.0	0.0
Shake It To The Max (Fly)	MOLIY, Silent Add..	14	0.0	3.8	0.0
Ring Ring Ring	Tyler, the Creato..	5	0.0	0.0	0.0
Sugar On My Tongue	Tyler, the Creato..	5	0.0	0.0	0.0
TN	Morgan Wallen	14	0.0	0.0	0.0
Sorry Im Here For Someone E..	Benson Boone	25	0.0	0.0	0.0
Typa	Glorilla	5	0.0	0.0	0.0
Undressed	sombr	20	0.0	0.0	0.0
Went Legit	G Herbo	7	0.0	0.0	0.0
Wildflower	Billie Eilish	62	0.0	0.0	0.0
Worst Way	Riley Green	32	0.0	0.0	0.0
Your Ways Better	Forrest Frank	18	0.0	0.0	0.0