

How can Artistic partnership with AI and ML generate Emotion driven lyrics for the song-writers?

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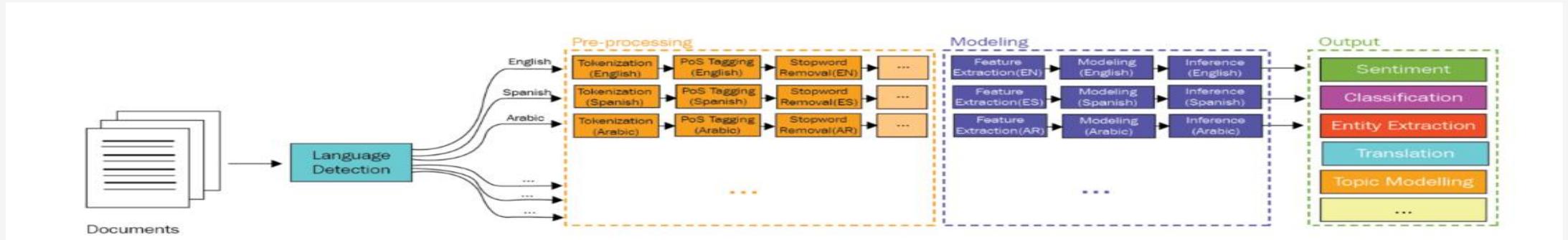
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Background

- Emotion is one of the main reasons why people engage and interact with music – songs can express our feelings, produce goosebumps, bring us to tears, share an emotional state with a composer or performer, or trigger specific memories.
- Music Information Retrieval (MIR) is one most researched areas and extracted features for emotion include timbre key, chords, harmonies, melody, main pitch, beats per minute or rhythm in the piece. There are a number of available audio feature extraction. But not much researched in the area of Lyrics.
- Several scholars are trying to understand the music lyrics auto generation by machine learning models, but very few have successfully been able to achieve the target of generating new music lyrics that have a good sync within the words itself and have an appropriate Emotion.
- An algorithm that could “predict” the emotions that a listener perceives in a lyric or one that could dynamically generate music adapting to the mood. The research aims at critically evaluating on whether the AI and ML is successful in emulating the human creativity and inspiration while generating emotional lyrics.
- Evaluation by analyzing about the quality of generated lyrics in top web based lyrics generator and whether they are satisfactory to the target users.

Literature study- Natural Language Processing

- Literature on AI development in music have reviewed to understand the progress made in this field from machine that could generate simple melodies, genre based music to music that could interact with social environment and generate music which can touch people sentiment and emotion.



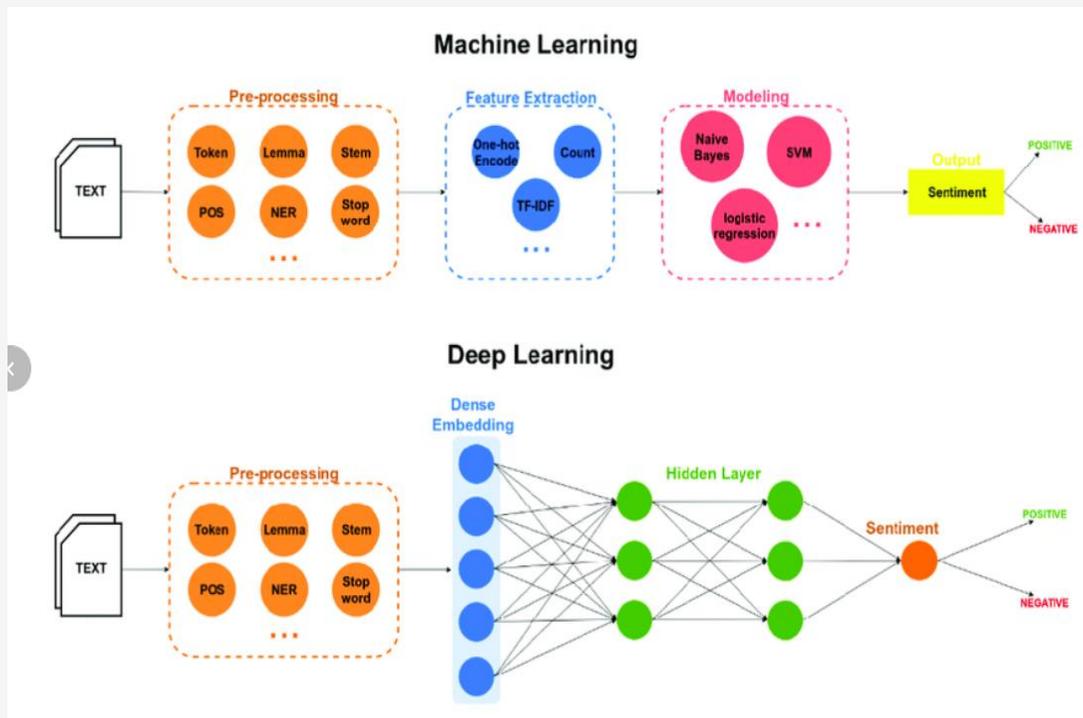
- Natural Language processing methodology and various pre-trained NLP Models are studied which are used by Google, Facebook, Microsoft . The pre-trained model solves a specific problem and requires fine-tuning, which saves a lot of time and computational resources to build a new language model. There are several pre-trained NLP models available that are categorized based on the purpose that they serve such as speech recognition, text to speech transformation, sentiment analysis etc.

BERT 2018 Bidirectional encoder representations from transformers that scan text in a bidirectional way.	XLNet 2019 A model that adopts a newly proposed modeling method called "permutation language modeling".	ALBERT 2019 A model developed on BERT that brings a significant parameter reduction but maintains the same level of performance.	T5 2019 A text-to-text transfer transformer that categorizes all NLP tasks as "text-to-text" tasks.
StructBERT 2019 A model that extends BERT by incorporating language structure into the training procedure.	RoBERTa 2019 A model developed on BERT that removes the next sentence prediction (NSP) objective and replaces static masking with dynamic masking.	ELECTRA 2020 A new framework for pre-training which combines generator and discriminator.	



Literature study- Machine Learning and Deep Learning

- Nine Researches were studied to understand Machine Learning and Deep Learning algorithms to lyrics generation.
- Further various Machine Learning, Deep Learning Algorithm are studied and it is found that Convolutional neural network (CNN) Recurrent neural network (RNN), De-noising- auto-encoder (DAE), deep belief networks (DBNs), Long Short-Term Memory (LSTM) are the most popular deep learning methods have been widely used. Moreover few Machine Learning algorithm are used for better lyrics generation like HMM, SVM, CRF.



Accuracy Results

1. Hidden Markov Model
2. Support Vector Machines
3. Conditional Random Fields
4. Naïve Bayes

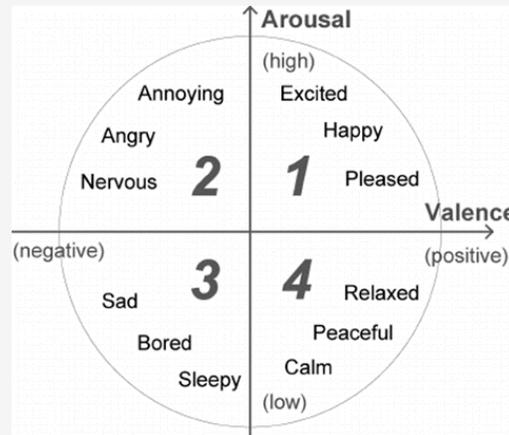
Accuracy Results

1. Recurrent Neural Network (RNN)
2. Long short term memory (LSTM)
3. Conditional Random Fields
4. De-noising Auto-encoders (DAE)
5. Deep Belief Networks (DBN)

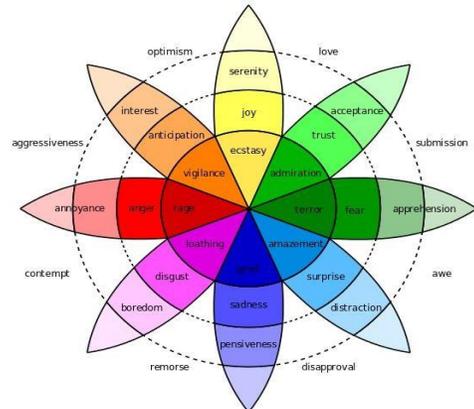
	Algorithms	Accuracy
Machine learning (ML)	SVM	78%
	Logistic Regression	78%
	Random Forest	76%
	Naïve Bayes	52%
Deep Learning (DL)	LSTM	89%
	CNN	81%

Literature study – Emotional Models

- Emotional Model are studied to understand how they are used in appropriate emotion driven lyrics are generated. Out of two Categorical and Dimensional model, the later is used widely for complex emotional attributes.
- For Big data resources- Corpora (linguistic data) and Lexicon (emotion data) are used for large data sets.



Russel's 2D Model



Plutchik's 2D Wheel of Emotions

Dimensional Emotional Model

Complex and Mixed Emotions are addressed well

Wide Range of emotion classes

Highly recommended in application involved in emotion similarities

Survey – Auto generated Lyrics

- Survey is conducted on web based auto lyrics generator to check the quality of lyrics and associated challenges- 10 observers

	These Lyrics Do Not Exist	boredhumans.com	Lyrics.com	Wash your Lyrics	Song Lyrics Generator
Pros	Customize song topic Choose lyric genre Download generated lyrics Free to use Easy to use	Easy to use Free to use Unique generated lyrics Random lyrics generator	Fast speed Choose music genres Generate random lyrics	Fun to use Free to use Generate a poster of your favorite song lyrics	Variety of genres and artists options available
Cons	Shows ads	does not support choosing lyric themes	Interface is not user-friendly	Not support generating random lyrics	The website is cluttered with ads

Feedback on Machine and Human generated lyrics

	Lyrics	Human	Machine	Correct Observation
1	you don't have to worry about anything at all, Cause now I'm here for the very last time and as i'm saying goodbye i hope that you will remember all the good times	7	3	Machine Generated These lyrics do not exist
2	you don't have to show much to show how much care Caring takes no demeanor it doesn't have to show.	6	4	Machine Generated Masterpiece Song Lyrics
3	I can still feel you hold my hand, little man And even the moment I knew You fought it hard like an army guy Remember I leaned in and whispered to you? Come on, baby, with me We're gonna fly away from here	7	3	Human Generated Taylor Swift
4	There's still a little bit of hope in my mind It's still a little hard to say if I have enough	4	6	Machine Generated Song Ly generator
5	Walking on the beach, feeling the breeze	7	3	Machine Generated

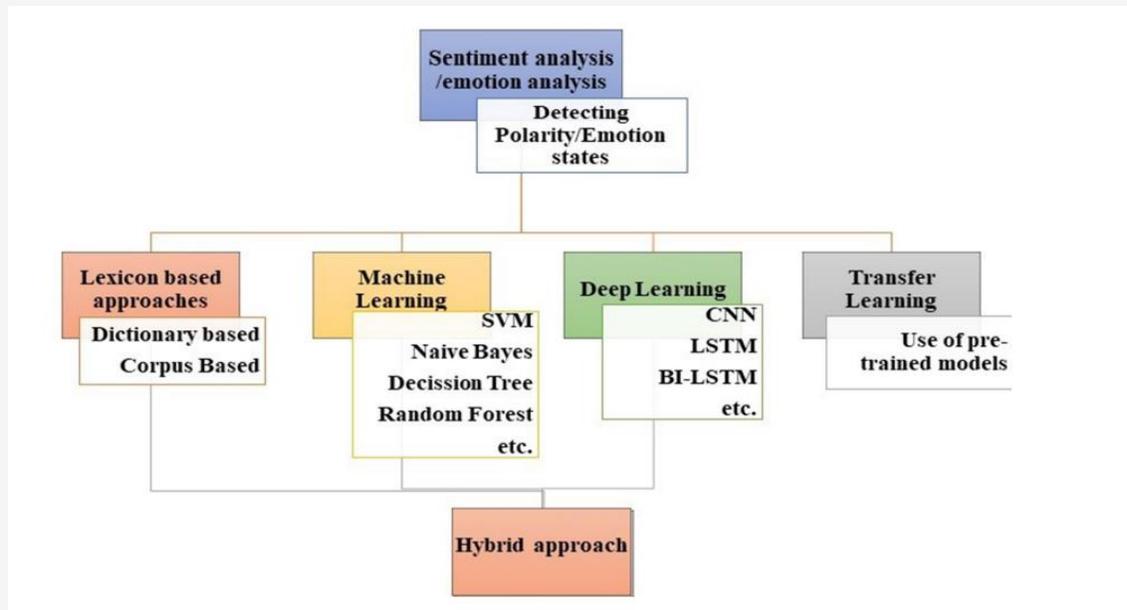
Observations

- Difficult to capture the meaning and related emotion
- Challenges in expressing the feeling
- Very good sentences
- Some words get repeated
- Inspired by musicians

S. No.	Questions	Obs1	Obs2	Obs3	Obs4	Obs5	Obs6	Obs7	Obs8	Obs9	Obs10	% Yes Total
1	Are the lyrics sound original /authentic and not copied from any famous song? Yes, or No	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	70
2	Do you think the lyrics are meaningful and conveys the right message? Yes, or No	No	No	Yes	Yes	No	Yes	Yes	No	No	No	40
3	Do the lyrics inspired by any famous song writer? Yes or No ...guess the name	Yes	No	No	No	70						
4	Do the lyrics are having the rhyming feature – AABB, ABAB or any other? Yes, or No	Yes	No	No	Yes	80						
5	Are the lyrics verses connected and meaningful and explains the right emotion? Yes, or No	Yes	Yes	Yes	No	Yes	No	Yes	Yes	No	No	60
6	Do the lyrics contain emotional word, sentences or feeling? Yes, or No	No	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	60
7	Can the lyrics be further explored to make a complete song? Yes, or No	Yes	100									
8	Do the lyrics contain any irrelevant word, sentence ? Yes, or No	Yes	No	No	Yes	80						
9	Do the lyrics contain words which are too repetitive? Yes or No	Yes	No	No	No	70						
10	Overall do you found the quality of lyrics good to be taken for song creation ? Yes, or No	Yes	No	No	80							

Findings

- 10 Researches (year 2020) are studied for Identification of Emotion from the Text. We have identified researchers have used Machine Learning, Deep learning, Rules based, Corpus based, lexical affinity based approaches.
- Most accurate results were found while researches have used Hybrid approach which is typically a combination of two or more approaches
- This approach has a higher likelihood of transcending the other approaches individually, leveraging the strength of the approaches used while trying to conceal their corresponding limitations



9	Hasan et al, 2019	Hybrid	Developed Emotex for online stream data and obtained accuracy of 90%	Semantic featured extraction should be improved.
10	Ramalingam et al.2018	Hybrid	Developed model combined with keyword-based and learning-based and obtained satisfactory results	Better classification techniques should be applied to improve performance.