

The Sixteen Machine: Generating *Artificially Intelligent* Rap Lyrics

Antonio Tan-Torres, Aaron Brackett
Department of Computer Science, Stanford University

Motivation

Our motivation for this project stems from our mutual appreciation and fascination of rap lyrics.

Problem Definition

- Modeling process of writing rap lyrics
- Learning the model from rap lyrics as data
- Using that model to output different rap lyrics

Challenges

- Modeling aspects of rap lyrics (rhythm, rhyme)
- Extracting features from raw rap lyrics
- Randomizing agent to produce different lyrics

Approaches

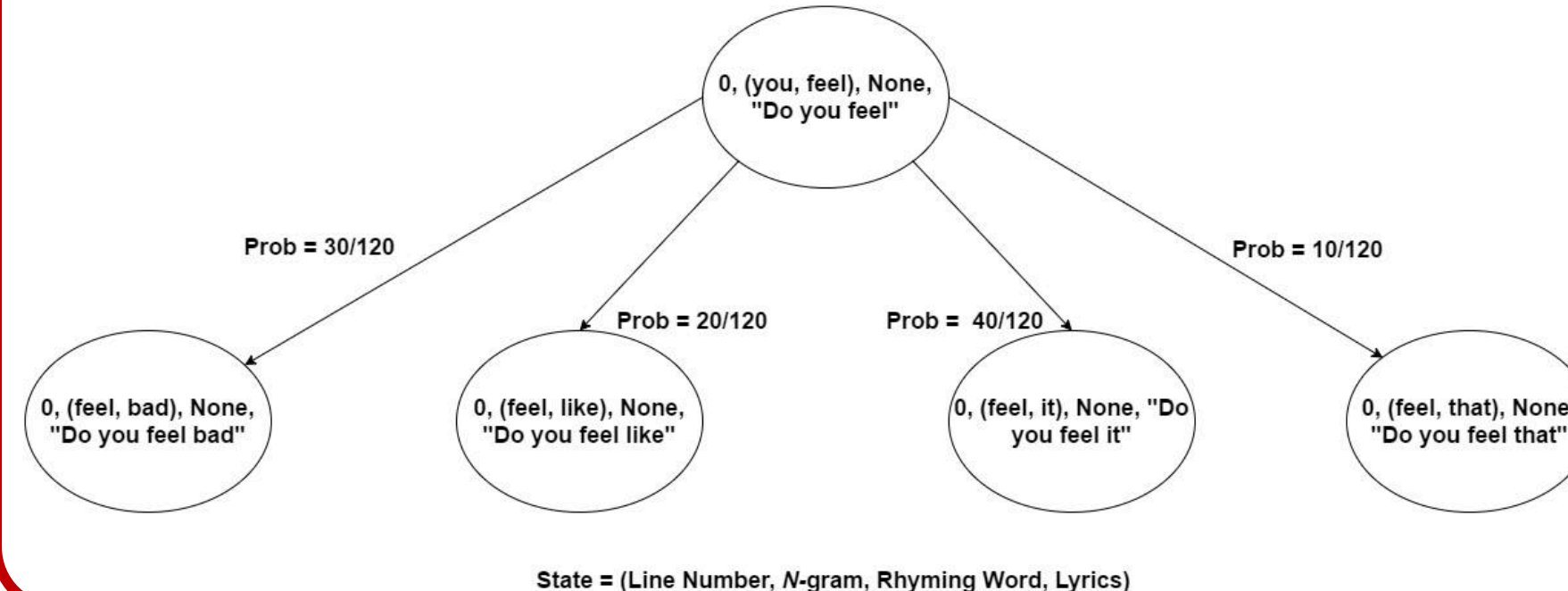
- *N-gram model (baseline)*
 - Create n-gram corpus from dataset of rap lyrics, output each word of lyrics based on most likely next word from n-gram
- *Search Problem (progress)*
 - Model writing process as choosing next word, and cost/states incorporate rhyme and rhythm heuristic. Problem: outputs same verse (minimum cost)
- *MDP Problem (final)*
 - To add randomness to writing the rap verse, we model the writing process using an MDP

Further Steps:

- Incorporate other rap lyric heuristics into reward function (theme of song, intra-line rhymes)
- Implement a way to make whole verse/lines coherent and consistent altogether

Implementation of MDP

- **States:**
 - Each state is represented by a tuple containing (Current line number, N-gram tuple, rhyming word, string of current lyrics)
- **Actions:**
 - In each state, the writer can take one of two actions:
 - **"Keep Going"** : continue to add words to line by choosing word from n-gram set
 - **"Finish the Line"** : choose the word to add from the intersection of n-gram set and set of rhyming words
- **Transition Probabilities:**
 - Probability of choosing the word from its respective set (word count / total number of word possibilities)
 - The number of word possibilities varies depending if we pick a word from just the n-gram set, or the intersection with the rhyming words
- **Rewards:**
 - Rewards for non-terminal states are zero
 - Rewards for terminal states are determined by a rhythm heuristic and rhyme heuristic
 - **Rhythm**: difference in syllable count between output verse and average syllable count from data
 - **Rhyme**: number of rhymes that are recognized by the Natural Language Toolkit library
- **Discount:**
 - We used a discount of factor of 1



Results

Input Data: Kendrick Lamar lyrics from RapGenius

OUTPUT VERSE:

Pans, pots, plates, bowls
One time that I hit him a nigga that's the stove
That don't look so much
All my own crutch
Then close to get this since an individual
At the pinnacle
I'mma let hip-hop die on your chaperone
A demon glued to Al Capone
I'm a bitch
Everybody wanna be one, how she wanna fuck
that bitch
When the goblins
Or racially profiled, I go and violence
Light skinned nigga trapped nigga is all of E&J
will kill you
Vaca'd in the game as my name of turmoil
Said it you
Break the glass of doing that make a house lick,
tell you don't want stripes, and I need you!

Analysis & Conclusion

- 3-gram was too specific and failed to create unique and coherent lines
- Rhymes most of time, but not always
- Verses are usually coherent, but fail Turing test