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

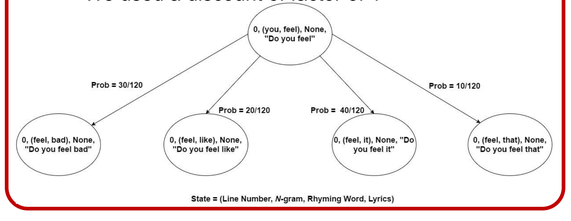
- *N-gram model (baseline)*
  - Create n-gram corpus from dataset of rap lyrics, output each word of lyrics based on most likely next word from n-gram
- *Search Problem (progress)*
  - Model writing process as choosing next word, and cost/states incorporate rhyme and rhythm heuristic. Problem: outputs 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 on 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
- Lines are somewhat coherent but fail Turing test