

Finding Repetition Patterns in Songs

BRIDGES Team

SIGCSE 2019

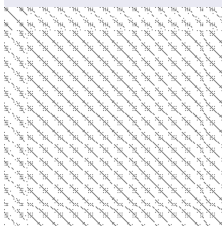
- 1 Presentation of the Problem and Overview
- 2 A CS 1 problem
- 3 Variants and Reflection

Visualizing Repetition Patterns in Songs

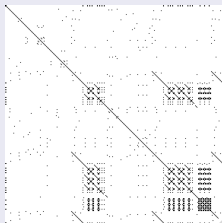
Algorithm

- Pick a song of n words
- If the i -th word is the same as the j -th
 - Paint pixel (i, j) black.

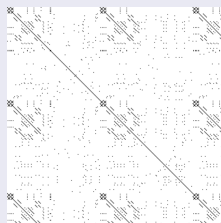
Some cases



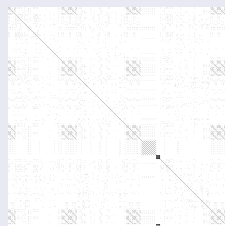
Daft Punk
Harder Faster
Better Stronger



Queen
Radio Gaga



Cardi B
What a Girl Likes



Lin-Manuel
Miranda
My Shot

What does BRIDGES do for you?

Engagement

Students can plug whatever song they want to look for repetition patterns. Something you can show your roommate.

Accessing a Song through BRIDGES (access Genius)

```
DataSource ds;  
Song s = ds.getSong(title, author);
```

ColorGrid usage

```
ColorGrid grid (10, 10);  
grid.set(0,0, Color(255,0,0));
```

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Bird's eye view of the Song Lyrics assignment

Getting the data

Get data from an API into the program.

Topics: API Usage.

Song to Words

Transforming the song into a list of words.

Topics: String processing, Tokenization.

Image Basic

Show a basic image.

Topics: Understand images as a 2D set of pixels.

Building Repetition

Build a complete image based on word repetition.

Topics: String comparison, for loops, if statement.

Getting the data (Topics: API Usage.)

Get a Song from an API into the program and print it.

In C++

```
DataSource ds;  
Song s = ds.getSong(title, author);
```

In Java

```
public static String[] [] splitLines(String lyrics) {
```

In Python

```
so = get_song("Delicate", "Taylor Swift")
```

Song to Words (Topics: Tokenization, String Processing)

Transform the Song into a array of Words. (Here scaffolded, but a good exercise in class)

In C++

```
auto words = lyrics_tokenize(s.getLyrics());
```

In Java

```
lyrics = lyrics.trim();
```

In Python

```
lyrics = split_lyrics(song)
```


Basic Color Grid (Topics: Image Representation)

Create a ColorGrid and draw anything.

In C++

```
ColorGrid grid (10, 10);  
grid.set(0,0, Color(255,0,0));  
bridges.setDataStructure(&grid);  
bridges.visualize();
```

In Java

```
ColorGrid grid = new ColorGrid(20, 30);  
grid.set(12, 12, new Color(0, 0, 0));  
bridges.setDataStructure(grid);  
bridges.visualize();
```

In Python

```
grid = ColorGrid(2, 25)  
grid.set(1,2, Color(255,255,255))  
bridges.set_data_structure(grid)  
bridges.visualize()
```

Build a Repetition Matrix (Topics: String Test, Loops)

Make a ColorGrid of $nbword \times nbword$. If word i and word j are the same strings, color pixel i, j black.

In C++

```
std::string str1 ("green apple");
std::string str2 ("red apple");
if (str1.compare(str2) == 0) std::cout << "Identical";
```

In Java

```
String str1 = "green apple";
String str2 = "red apple";
if (str1.equals(str2))
    System.out.println("Identical");
```

In Python

```
str1 = "green apple"
str2 = "red apple"
if (str1 == str2) :
    print ("Identical")
```

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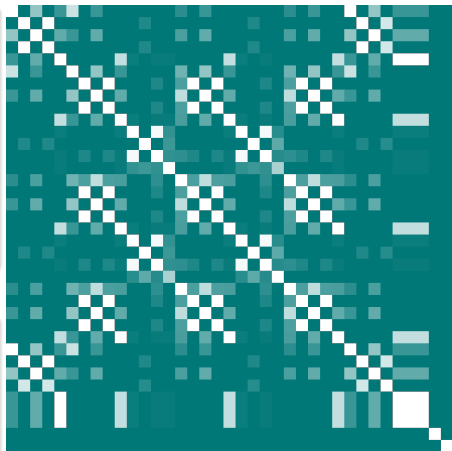
Term Frequency-Inverse Document Frequency

Idea

- Treat each line of the lyrics as a bag of word
- Treat a bag of word as a high dimensional vectors
- Compute distance between vectors

Topics

- Basic NLP
- Data structure: Dictionaries (associative arrays)
- Basic Data Mining



James Brown - I Feel Good

Other Image Based Assignments

Artist distance graph

- Collate a few songs of an artist, get a bag-of-words representation of artists
- Compute distance between artists
- Build a graph of artists based on similarity
- Islanding analysis

Image based problems

Dropping the lyrics idea and reading ColorGrid's back from BRIDGES:

- Flipping an image
- Blurring
- Edge Detection
- Histogram Equalization

Questions from the room?