# Tracking the Evolution of a Band's Live Performances over Decades

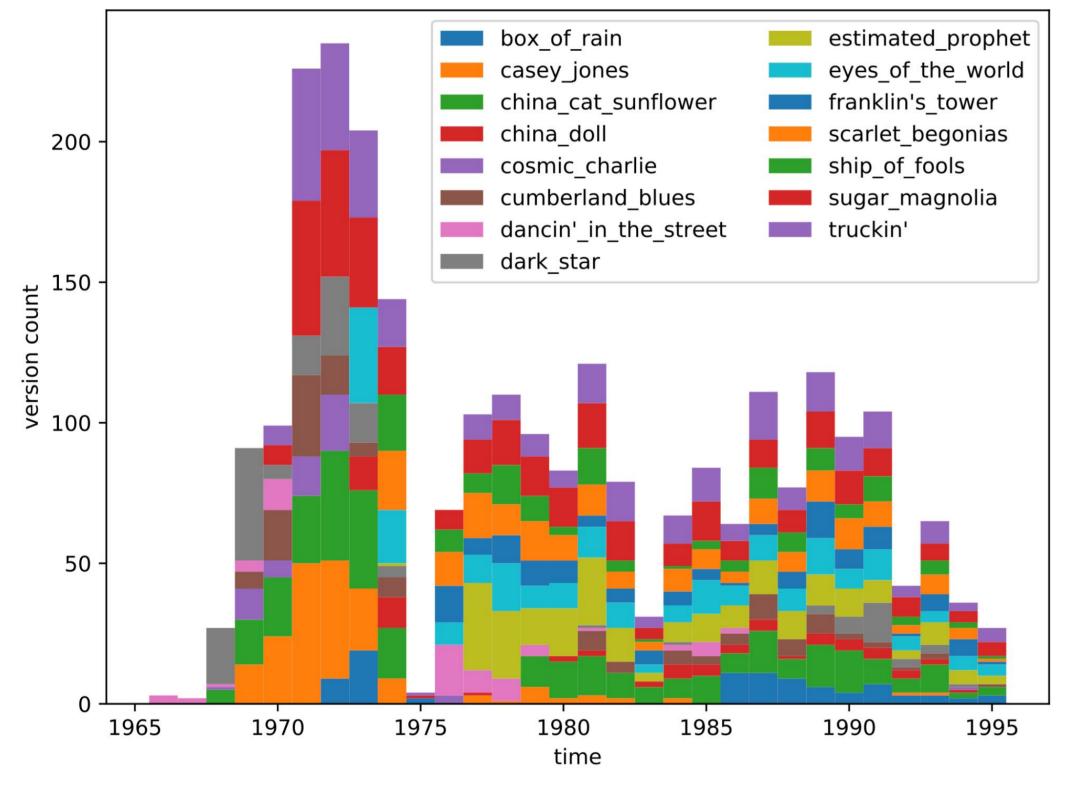
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Many recent studies use MIR methods on large music collections to determine the evolution of music over time. Most of these studies look at relatively diverse musical datasets and they are able to infer general trends in music composition or production techniques. However, no study to date has focused on the music of a single band.



The Grateful Dead are well suited for such a study with one of the longest and richest recording histories of any group. Although the Dead's music changed significantly over time due to their love of improvisation and experimentation, they kept playing many of their songs throughout their career.

### **The Dataset**



2617 versions of 15 Grateful Dead songs over 30 years, selected from the Live Music Archive of the Internet Archive. We extracted a number of temporal, dynamic and harmonic audio features on this set.

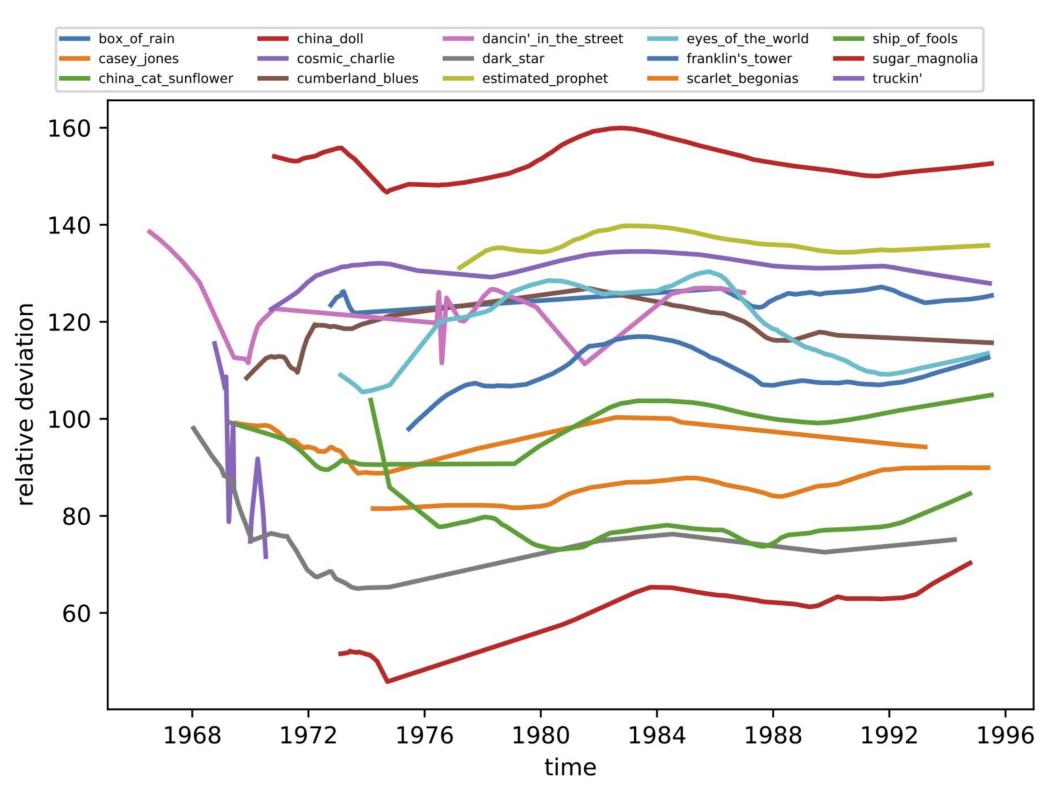
## **Feature Quality Improvement**

An advantage when working with a single band is that we have many versions of individual songs, which we can leverage to improve the quality of extracted features.

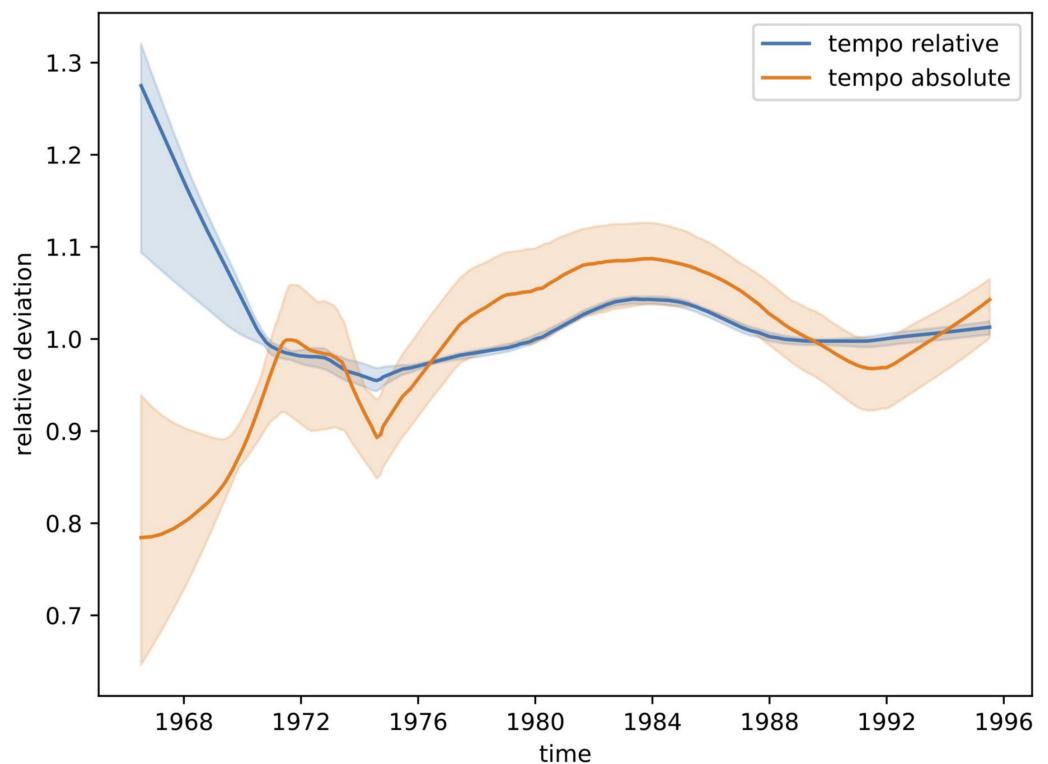
To correct detected beat times we calculated double-time and half-time feature vectors and picked for each song the combination of versions yielding the shortest overall distance in chord sequence distributions (chord ngrams), onset distributions, and tempo. Using a similar method we identified outliers such as mislabeled songs.

### The Method

For every feature we calculated moving averages and LOWESS plots with leave-one-song-out confidence intervals. There is a large variation in feature values between songs. For example, tempo varies by almost a factor of 3:

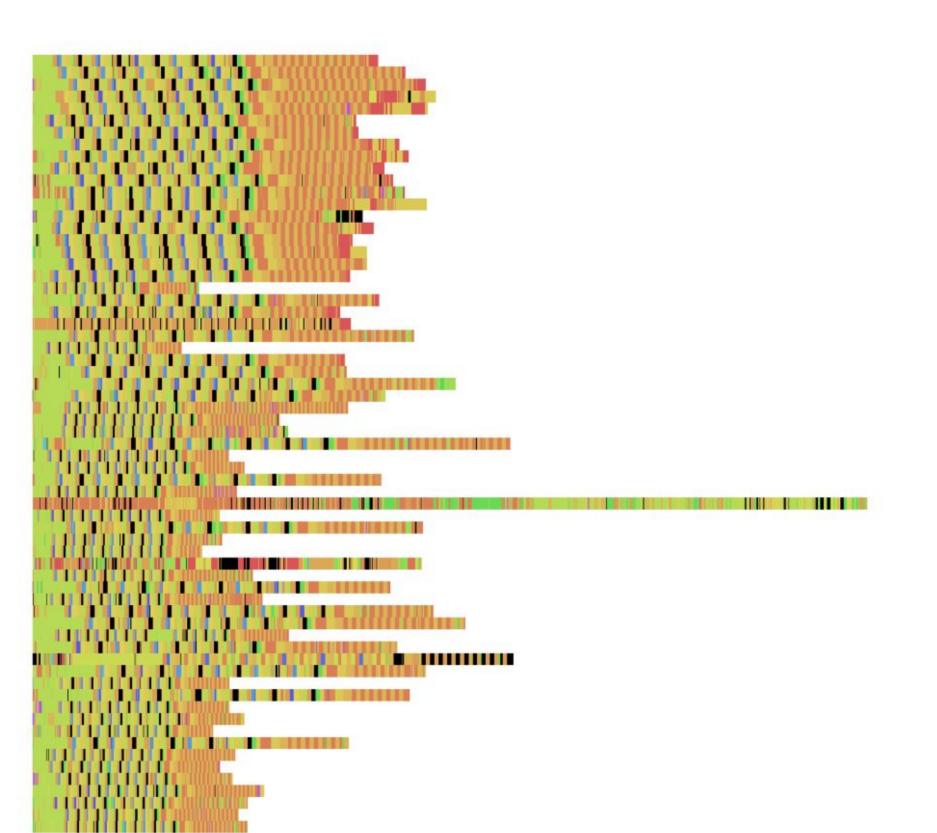


However, we can take advantage of the fact that we are working with a limited number of songs. By considering feature values relative to each song, we were able to significantly narrow the LOWESS confidence interval:



The blue LOWESS curve allows us to confidently infer that relative tempo over all 15 songs increased by more than 10% in the 1980s.

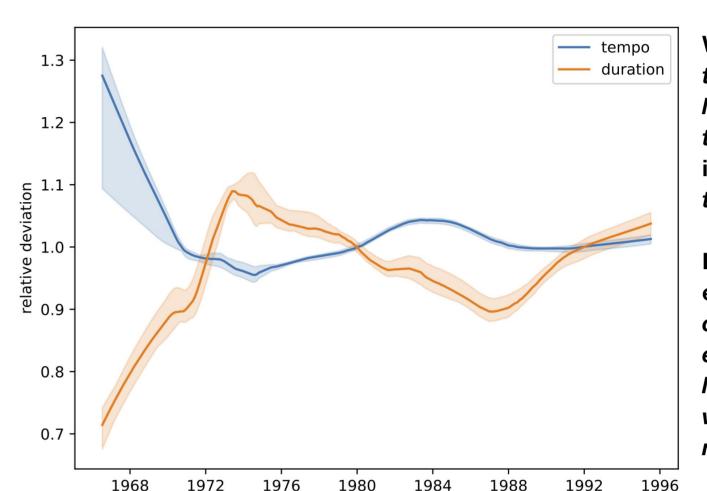




### The Results

We evaluated our results by referring to the people most knowledgeable about this music, the deadheads. We searched the two largest subreddits, with almost 200'000 members, and collected all statements where users refer to specific years when speaking about the evolution of the dead's music overall, or about individual songs. Here are a few examples:

## The Strangest of Places. r/grateful\_dead



Wolfman92097: in 1980 "the tempo [starts] to speed up a little", in 1984 "musically the tempo has really sped up", and in 1985 "the band slows the tempo a little."

Leedye similarly highlights that exact time period: "79-84 stands out to me as the disco/cocaine era ... post 84 just seems to be a little more of the slow churned vanilla as opposed to that sweet mint chocolate chip."

MrCompletely about duration: "82 through 85 is a long uneven slide down ... 87 is the comeback, shows are very different, most are tightly executed, very light on jams ... 88 starting to stretch back out a little."

Wolfman92097: in late 1986 "the setlists get much longer and way more experimental than they had been all year" and that in 1988 "jazz and extreme psychedelia gets added in."

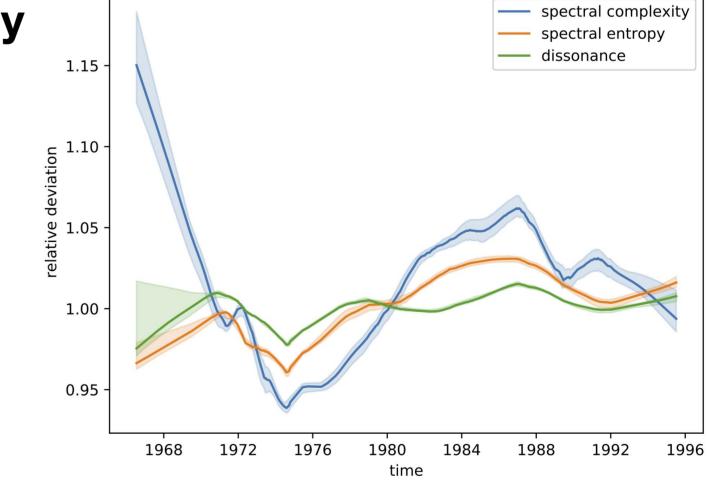
Many deadheads' favorite years are 73/74, "the peak of their spacey, jazzy, psychedelic extended jams" according to devlinontheweb.

EvilLinux admits that "If I am alone in the car, I usually will choose the 80's. There is just more energy, more off the rails."

An anonymous deleted user also says that "the Dead did play some incredible shows in the early to mid-80s. They had a "fatter" sound, especially Jerry"

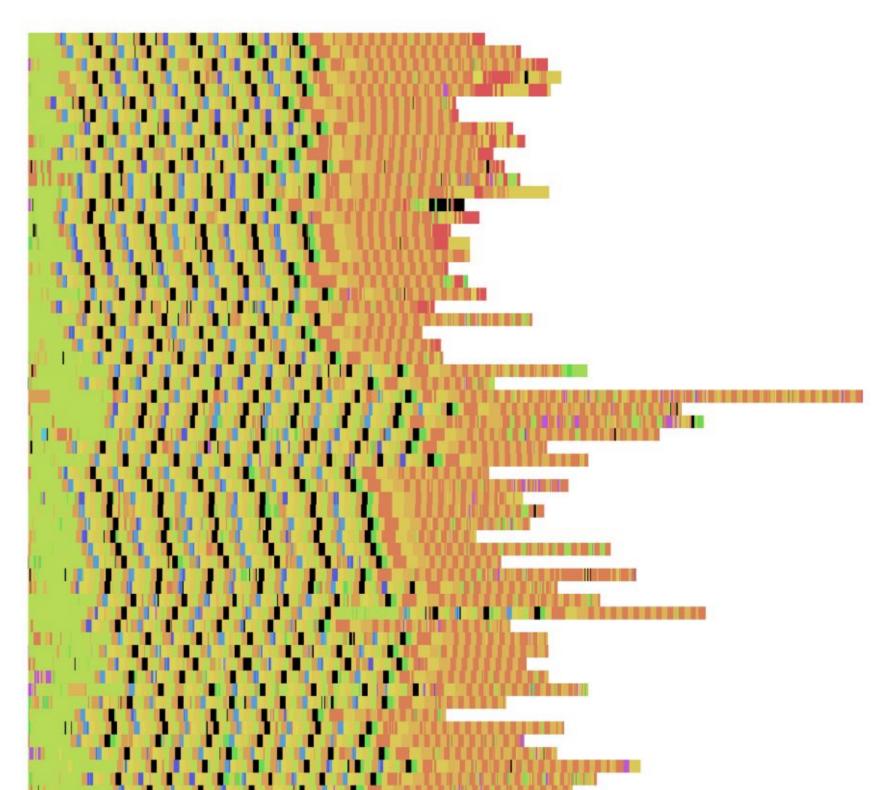
BeaverMartin about Brent Mydland who played with the band from 1979 to 1990 and who used a greater variety of keyboards and many synthesizers: Brent *"really adds a whole different texture to the vocals and keys,"* 

1972



WesternEstatesHOA: "In 1983 the band truly takes off. The physical change of Brent's new keyboard is enough to change the band's sound alone. It has deep watery effects and adds so much depth to some of the more simple tunes."

Wolfman92097: "83 Garcia [guitar] is a little more distorted and Brent is using more fake keyboard sounds Phil [bass] is loud."



The rows in these two graphs represent chord sequences of different versions of a song, original on the left, corrected on the right. One can observe the beat corrections and a few omitted versions on the right.