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Automatic Recognition of Beatboxing Sounds

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# Introduction

Beatboxing can be defined as the art of vocal percussion, or mimicking real drum machines with the human mouth and voice. Beatboxing performances can be done solo or with a group of singers, like in a cappella music. Due to their dependence on physical features (how the human mouth is shaped) and subjective interpretation (how a drum sound is translated to a vocal sound by each beatboxer), beatboxing sounds tend to vary significantly across individual performers. Despite this, most beatboxing sounds across performers can be loosely recognized as standard drum sounds (e.g. kicks, snares, hi-hats, among others). This is especially true for individuals that are familiar with these standard sounds.

# System Design

## A. Hidden Markov Model

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## B. Percussion Dictionary

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## C. Obtaining Observations

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## D. Training Model

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## E. Estimating States

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# Data Collection

## A. Recording Procedure

## B. Status

# Results

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## A. Evaluation Metric

Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract.

## B. Results

* Use either SI (MKS) or CGS as primary units. (SI units are encouraged.) English units may be used as secondary units (in parentheses). An exception would be the use of English units as identifiers in trade, such as “3.5-inch disk drive”.
* Avoid combining SI and CGS units, such as current in amperes and magnetic field in oersteds. This often leads to confusion because equations do not balance dimensionally. If you must use mixed units, clearly state the units for each quantity that you use in an equation.

# Discussion

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## A. Plots (if we need them for further analysis

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## B. Limitations

Headings, or heads, are organizational devices that guide the reader through your paper.

## C. Future work

Figure Labels: Use 8 point Times New Roman for Figure labels.

# Conclusion

A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

Appendix

Appendixes should appear before the acknowledgment.

Acknowledgment

The team thanks Professor TJ Tsai for his guidance throughout the semester and during the project. The team also acknowledges the time and effort put in by the six beatboxers from the Claremont Colleges a cappella groups to record the test data.

References

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2. W.-K. Chen, *Linear Networks and Systems* (Book style)*.* Belmont, CA: Wadsworth, 1993, pp. 123–135.

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