Introduction: Baby Cry Types

It has been claimed that babies cry uniquely for any and every reason, including diaper changes and hunger. However, data and models will confess to anything when under enough pressure. Here, you will investigate whether 5 different baby cry samples are acoustically distinct.

1. Summary Statistics of Demographics. Are babies similar in all 5 groups?
2. Unsupervised learning:
    a. How many cry types/clusters exist in the data based on acoustic features?
    b. When the data is clustered into categories, how well do these categories map to parent labels (confusion matrix)?
    c. Which type of cry is the most separable and unique? Rank categories from most to least unique/separable.
    d. How many dimensions are the cry acoustics?
3. Supervised learning:
    a. Using 5 parent labels, what is the average cross-validated accuracy?
    b. Using cluster labels of N categories, what is the average cross-validated accuracy?
    c. Does adding demographic information to the classifier improve accuracy?

Data:

Demographics_students.xlsx: This contains demographic information

ID: Participant ID

Reason: Parent Label

Age: Baby's Age

Gender: Baby's Gender

Filtered_full_data_odd.csv

ParentFile Parent Label. Remove unnecessary parts - e.g. gemaps_part_diaper.csv = diaper

Filename: Filename/ID. First portion of Filename corresponds to User ID in demographics file.

Remaining columns: Acoustic features

Feature Name	Category	Description
shimmerLocaldB_sma3nz_amean	Voice Quality	Average local amplitude perturbation (shimmer) in dB
shimmerLocaldB_sma3nz_stddevNorm	Voice Quality	Variability (normalized std. dev.) of local shimmer
HNRdBACF_sma3nz_amean	Voice	Harmonics-to-noise ratio in

Feature Name	Category	Description
alphaRatioV_sma3nz_amean	Quality Spectral Balance	dB – reflects voice clarity Ratio of energy <1kHz to 1–5kHz in voiced segments (timbre)
alphaRatioV_sma3nz_stddevNorm	Spectral Balance	Normalized variability of alpha ratio
loudness_sma3_amean	Loudness	Mean perceived loudness
loudness_sma3_stddevNorm	Loudness	Normalized standard deviation of loudness (dynamic range)
loudness_sma3_percentile20.0	Loudness	Loudness value at 20th percentile
loudness_sma3_percentile50.0	Loudness	Loudness value at 50th percentile (median)
loudness_sma3_percentile80.0	Loudness	Loudness value at 80th percentile
loudness_sma3_meanRisingSlope	Loudness Dynamics	Mean slope of increasing loudness – reflects energy bursts
F0semitoneFrom27.5Hz_sma3nz_percentile20.0	Pitch (F0)	20th percentile of pitch in semitones from 27.5 Hz
F0semitoneFrom27.5Hz_sma3nz_percentile50.0	Pitch (F0)	50th percentile (median) of pitch in semitones
F0semitoneFrom27.5Hz_sma3nz_percentile80.0	Pitch (F0)	80th percentile of pitch in semitones
F0semitoneFrom27.5Hz_sma3nz_pctlrange0.2	Pitch (F0)	Pitch range between 90th and 10th percentiles
F0semitoneFrom27.5Hz_sma3nz_stddevNorm	Pitch (F0)	Normalized pitch variability
F1amplitudeLogRelF0_sma3nz_amean	Formant	Mean log-amplitude of F1 relative to F0
F1amplitudeLogRelF0_sma3nz_stddevNorm	Formant	Variability in F1 amplitude relative to F0
F2amplitudeLogRelF0_sma3nz_amean	Formant	Mean log-amplitude of F2 relative to F0
F2amplitudeLogRelF0_sma3nz_stddevNorm	Formant	Variability in F2 amplitude relative to F0
F3amplitudeLogRelF0_sma3nz_amean	Formant	Mean log-amplitude of F3 relative to F0
F3amplitudeLogRelF0_sma3nz_stddevNorm	Formant	Variability in F3 amplitude relative to F0
MeanUnvoicedSegmentLength	Temporal	Average duration of unvoiced (silent or voiceless) segments
StddevUnvoicedSegmentLength	Temporal	Variability in unvoiced segment lengths

Feature Name	Category	Description
slopeV500.1500_sma3nz_amean	Spectral Slope	Average spectral slope between 500–1500 Hz in voiced frames