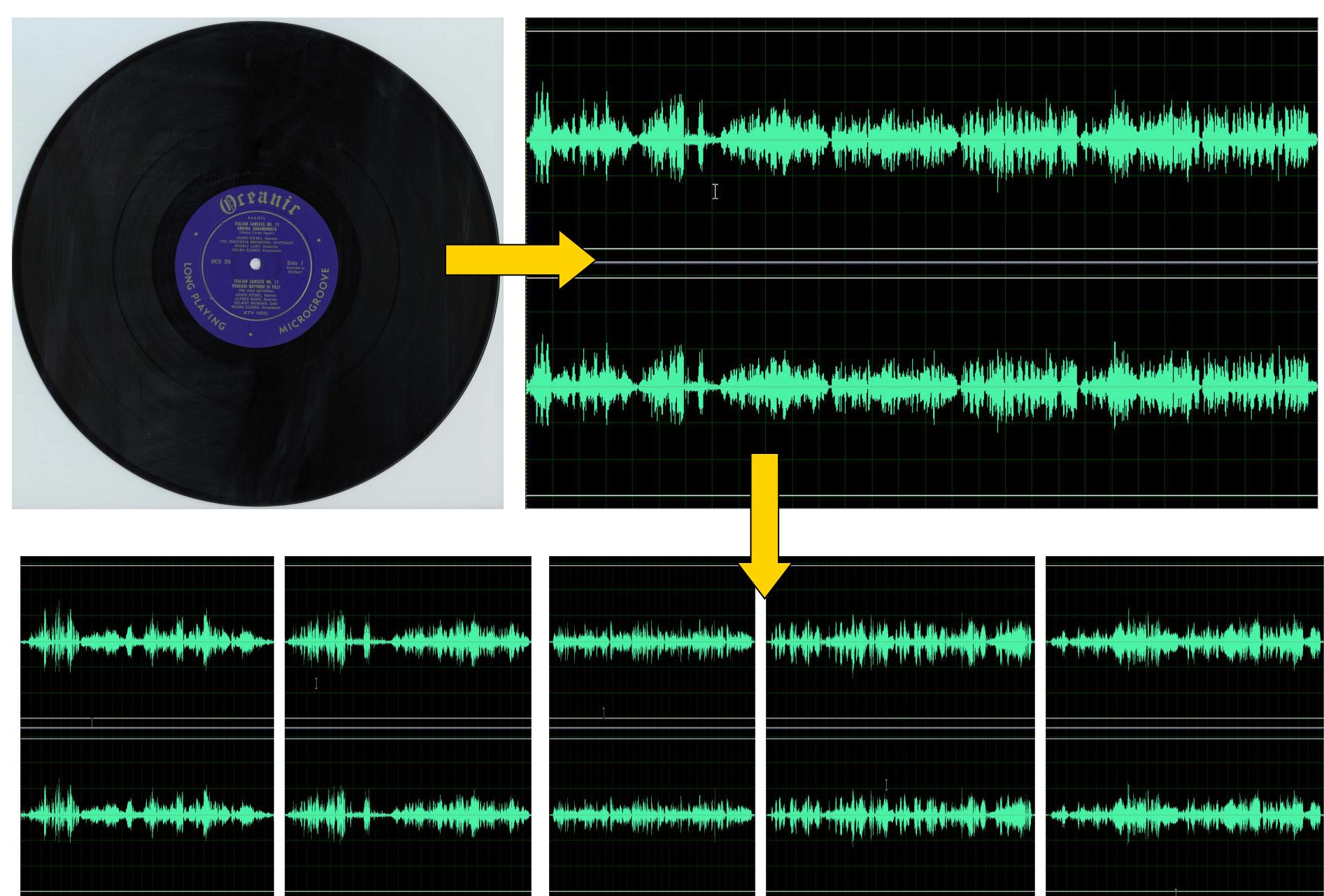


# Technical Issues in Digitization of Large On-Line Collections of Phonograph Records (1)

Beinan Li, Catherine Lai, Ichiro Fujinaga

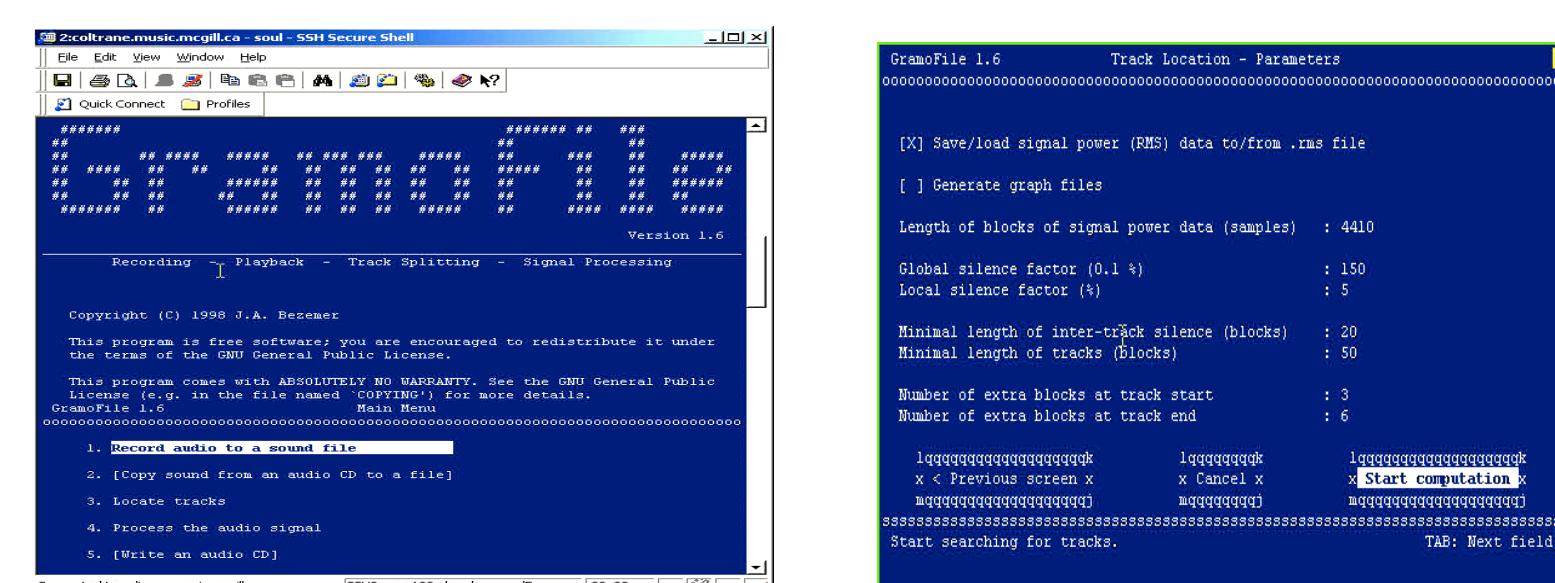
Music Technology Area, Schulich School of Music, McGill University, and CIRMMT, Montreal, Canada

## Track Segmentation for LPs



Automatic track segmentation is desirable in massive digitization for LPs.

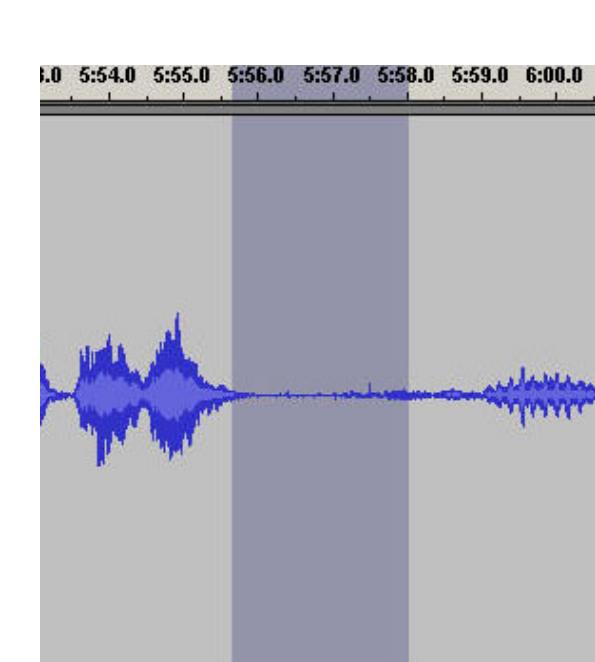
## Existing Efforts (partial)



Gramofile:  
(Open-source)

### To locate inter-track silences:

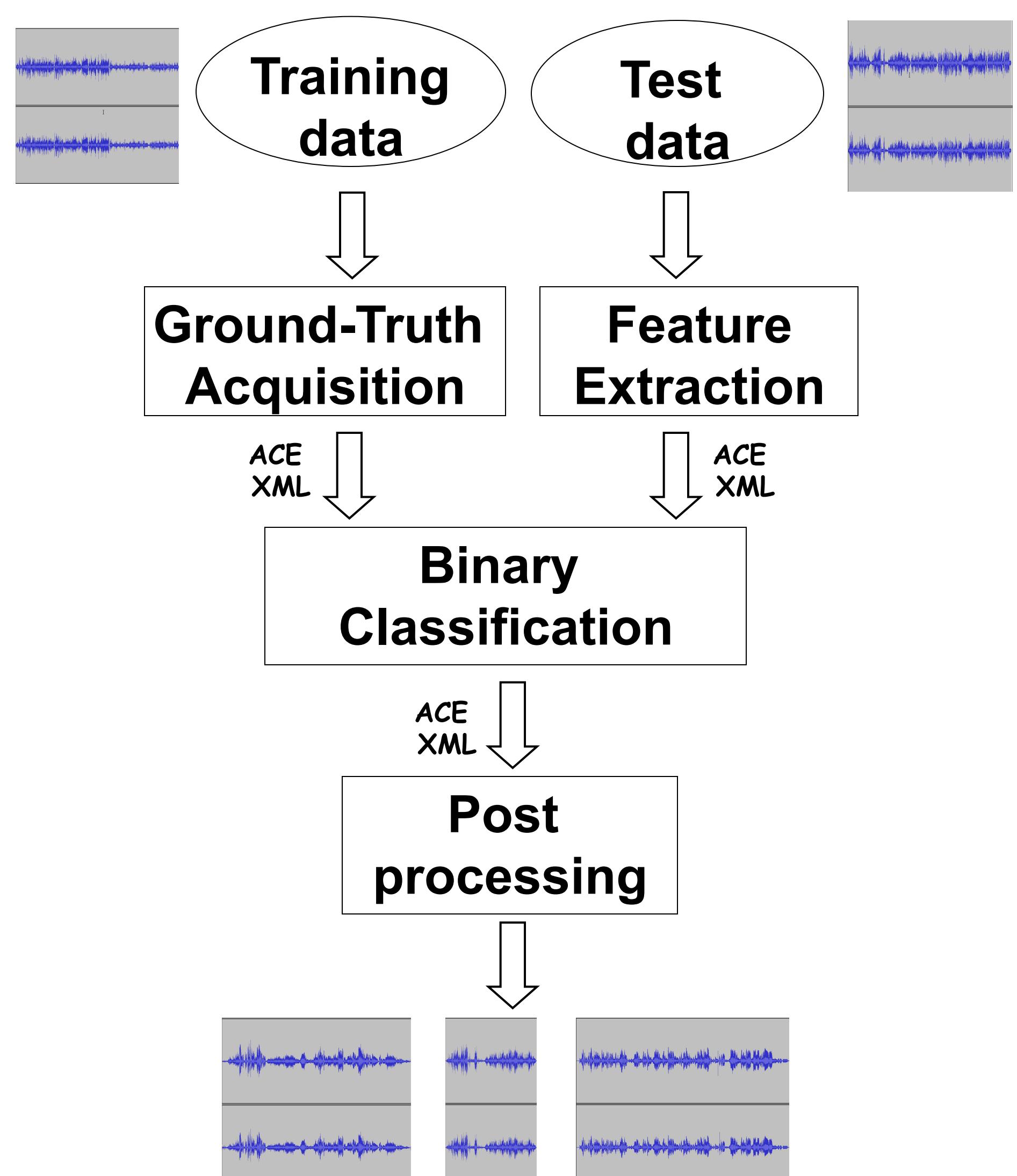
Rule-based;  
Parameter tweaking;  
Quiet area and pauses;



## Our Approach

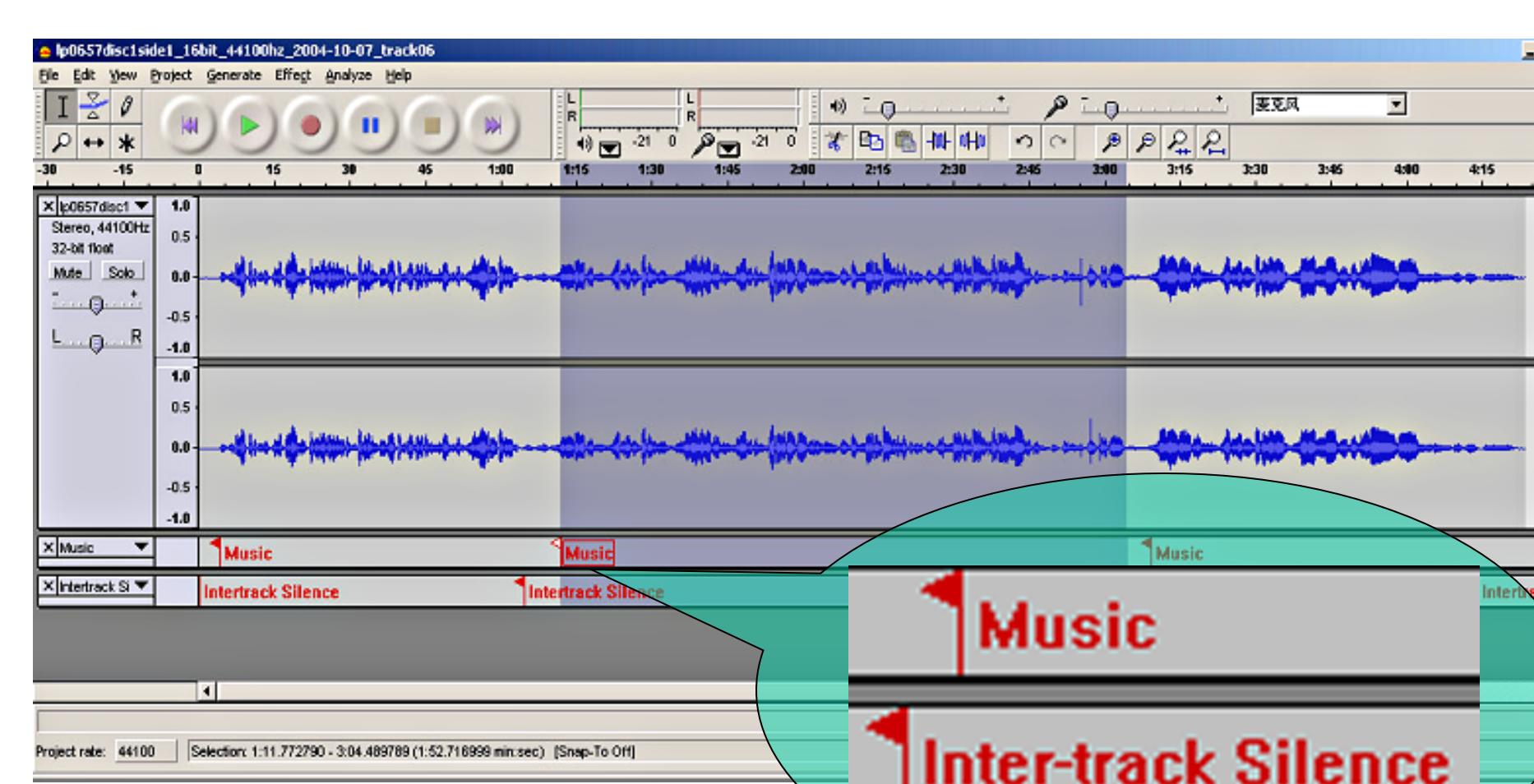
### Supervised Classification:

Music vs. Inter-track Silence



## Ground-Truth Acquisition

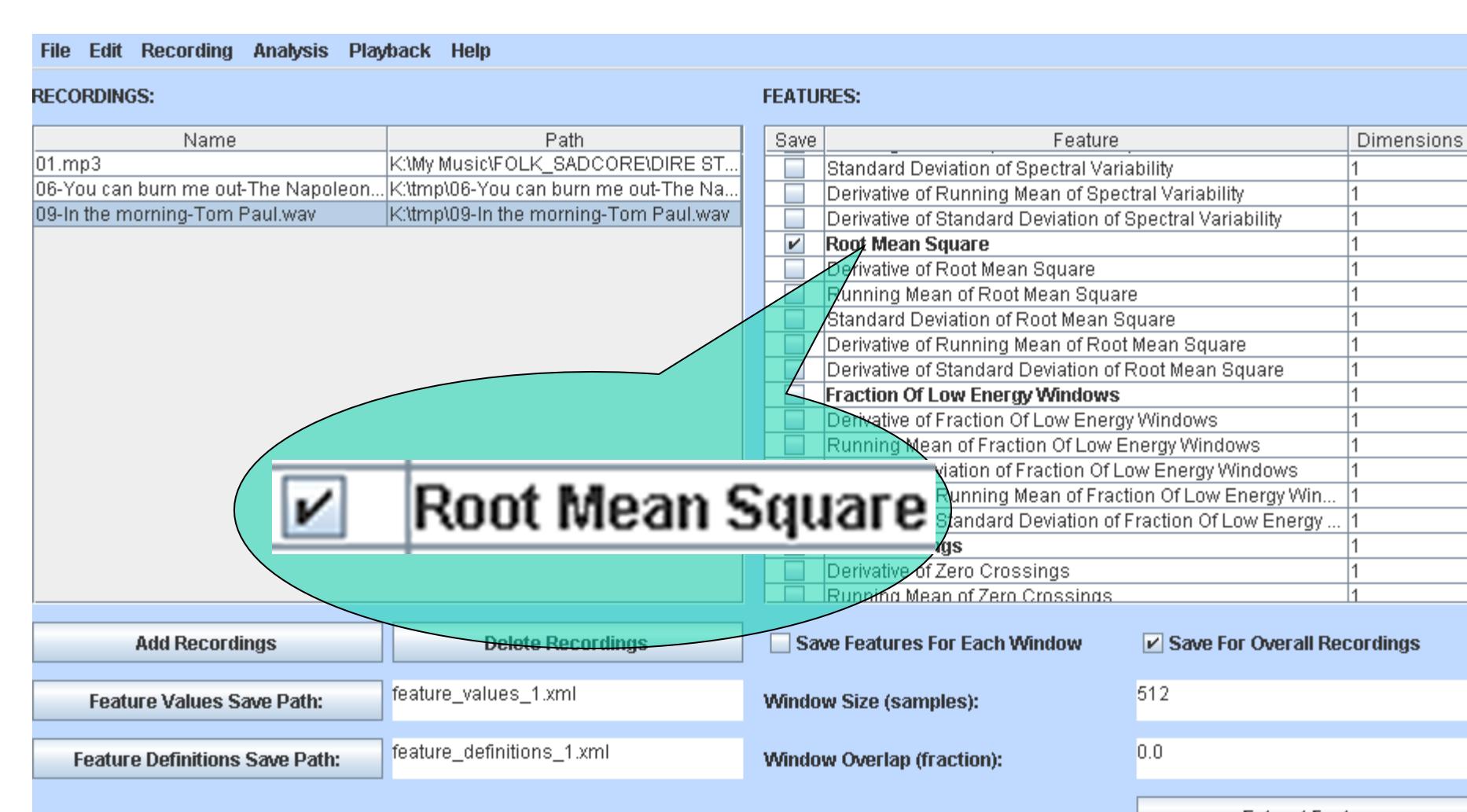
A cross-platform audio annotation tool based on Audacity



In a binary case, label only one category and the complementary category will be automatically filled in.

## Feature Extraction

### jAudio: a Java-based audio feature extractor

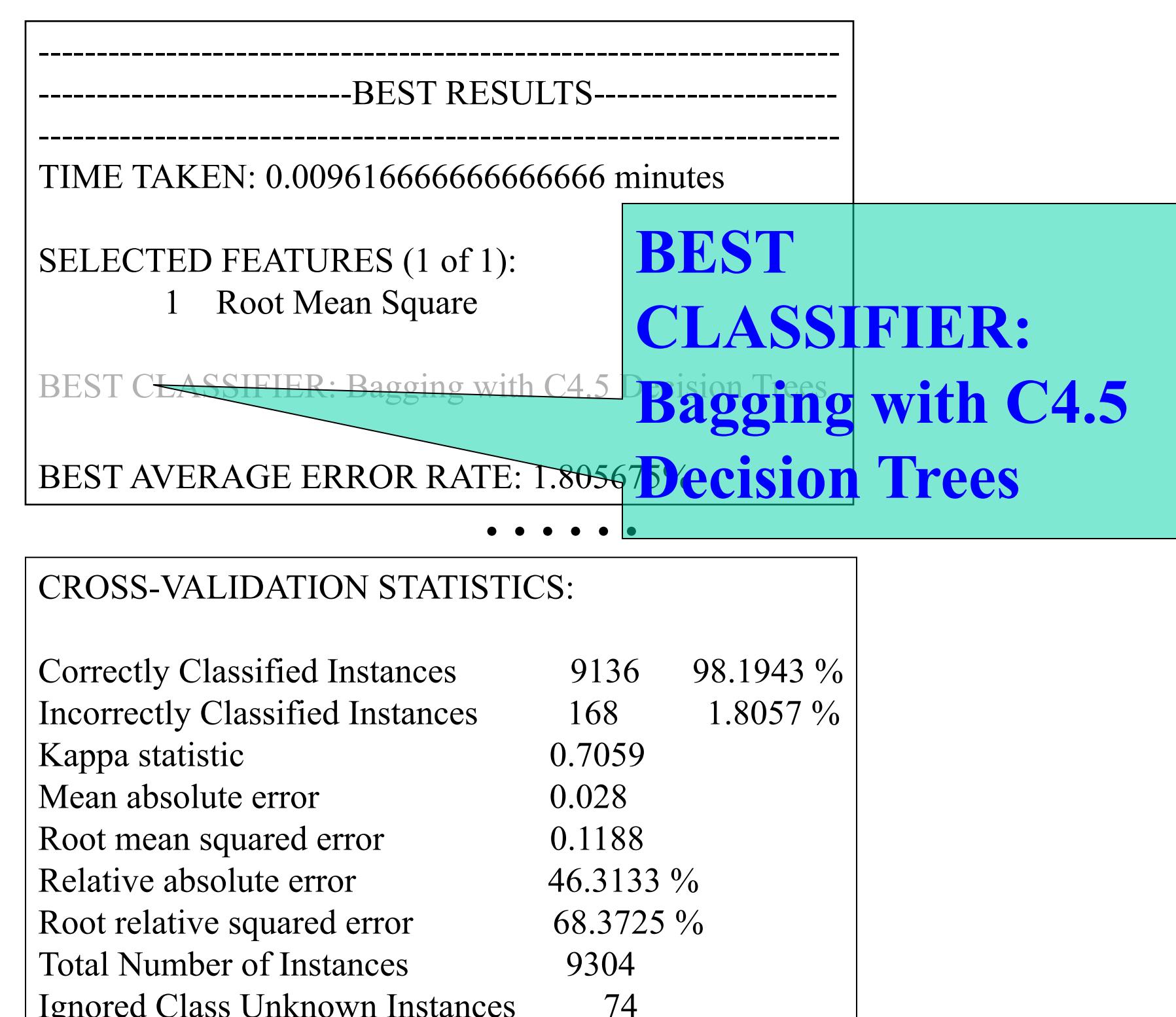


In our experiment, only RMS was extracted for objective comparison with Gramofile.

## Binary Classification

### ACE: Autonomous Classification Engine

Based on WEKA, Ace selects the most suitable classifier through experiments.

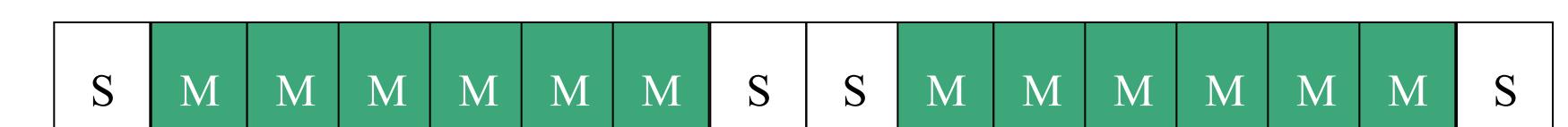


## Post Processing

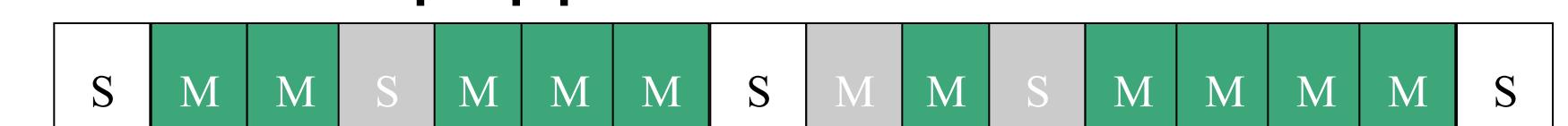
### The Output of ACE:

M = Music, S = Inter-track Silence

Ideal Case:  
Minor S vs. Continuous M

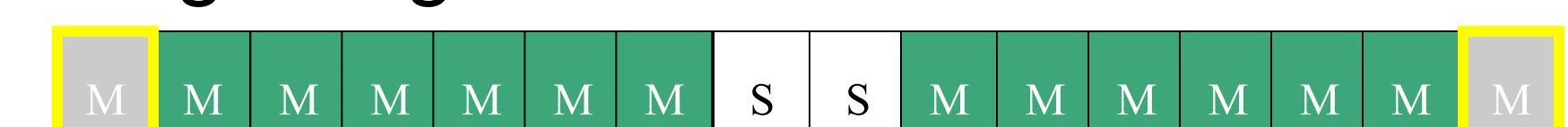


Reality:  
Salt and pepper noises



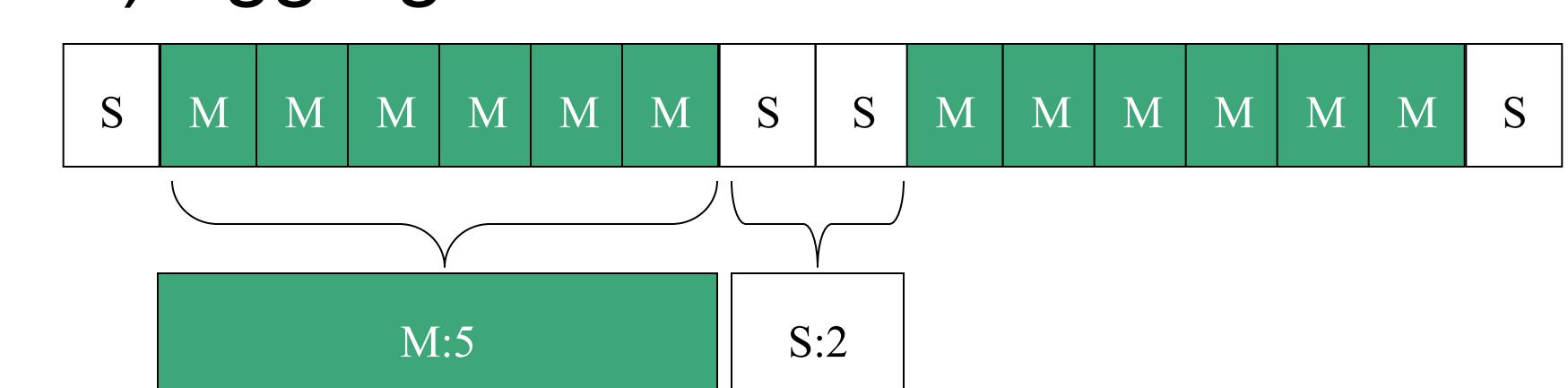
### Solutions:

Beginning and end:



Non-uniform-window smoothing:

1) Aggregation



2) Find window boundaries (long S' s)



3) Weighted smoothing

$$S:M = 3 \times (4+70+1) : 2 \times (1+2) = 75 : 2$$



## Evaluation and Results

### Error Types:

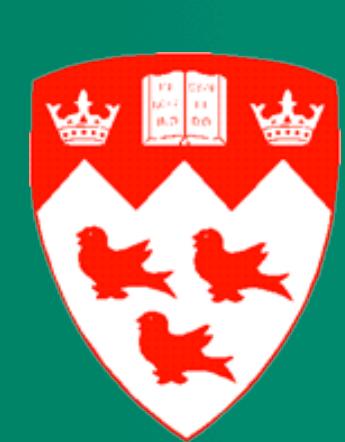


$$e = w_I e_I + w_{II} e_{II} + w_{III} e_{III}$$

$$w_I > w_{II} > w_{III}, \sum_i w_i = 1$$

### Resulting Accuracy:

	Before post-proc (%)	After post-proc (%)	Gramofile (%)
Album 1	82.33	99.99	99.84
Album 2	72.71	99.99	99.77
Album 3	89.97	99.98	99.93
Album 4	69.98	99.98	35.71
Album 5	64.82	99.99	92.20
Album 6	76.87	99.97	99.89



McGill

Schulich School of Music  
École de musique Schulich

CIR  
MMT

Centre for Interdisciplinary Research  
in Music Media and Technology