

**The Application of Cochlear
Audio Analysis Techniques to
Percussion in Electroacoustic Music**

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Introduction

- Objective
- Background
 - Electroacoustic Music
 - Auditory Image Model (A. I. M.)
- Definition of Single, Damped, Percussive Event (S. D. P. E.)
- S. D. P. E. Profile
- S. D. P. E. Onset Detection
- Human Data Collection
- Conclusion and Future Work

Objective

The Greater Goal

provide detailed, informative images corresponding to pieces of electroacoustic music (lack a standard visual representation)

My Goal

create algorithms which use models of human hearing to extract audio properties from recorded electroacoustic music

Today's Goal

show progress that I've made toward an S. D. P. E. profile

Background

Electroacoustic Music

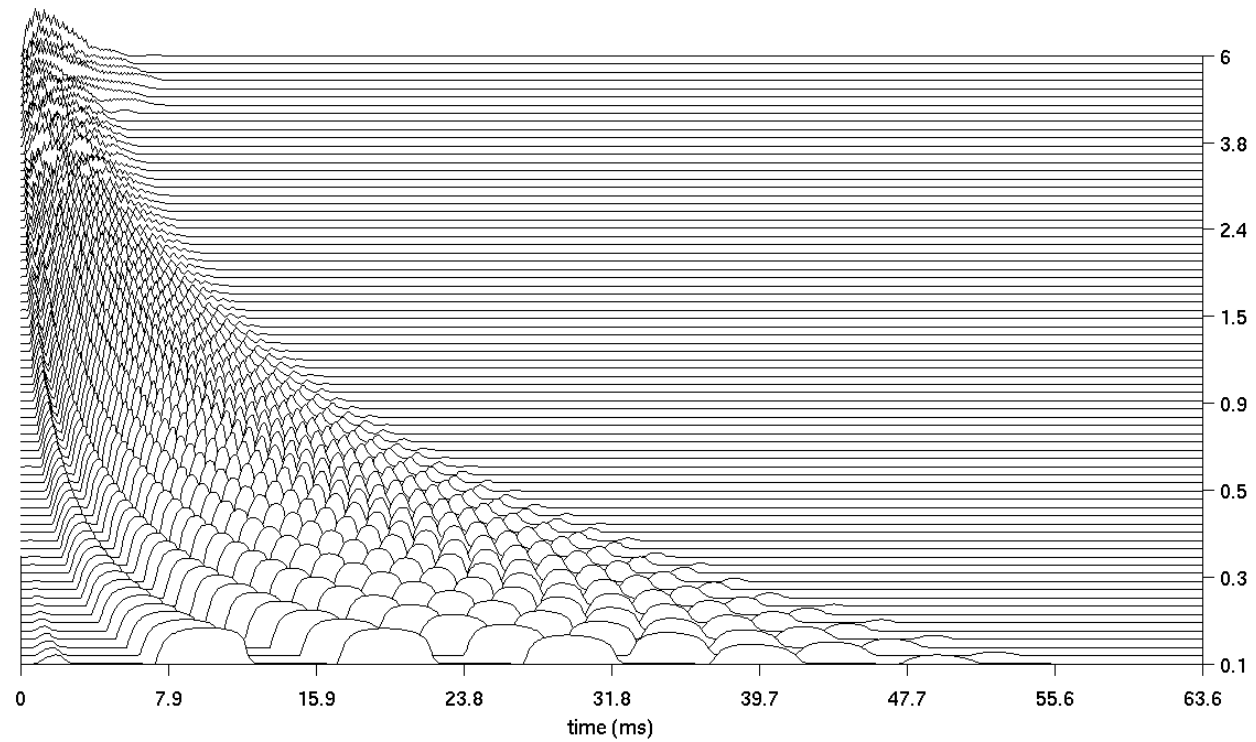
- definition — involves electronic technology for the compositional manipulation of sound
- requires that music is treated as sound

A. I. M. — The Auditory Image Model

- time-domain model of auditory processing
- attempts to simulate “auditory images” humans hear
- Now using
 - P. C. P. — Pre-Cochlear Processing
 - B. M. M. — Basilar Membrane Motion
 - N. A. P. — Neural Activity Pattern

Background

A. I. M. — N. A. P. — Neural Activity Pattern



Single Damped Percussive Event

Definition

a single sound created by the impact of one object with another without either breaking

- Ex. strike of drum, hand clap, dropping a book onto a desk

or by the direct introduction of a extremely sudden pressure change in the air

- Ex. popping a balloon, firing a pistol, vocal plosive

or any synthetic or electronically manipulated sound which is reminiscent of these

S. D. P. E. Profile

Definition

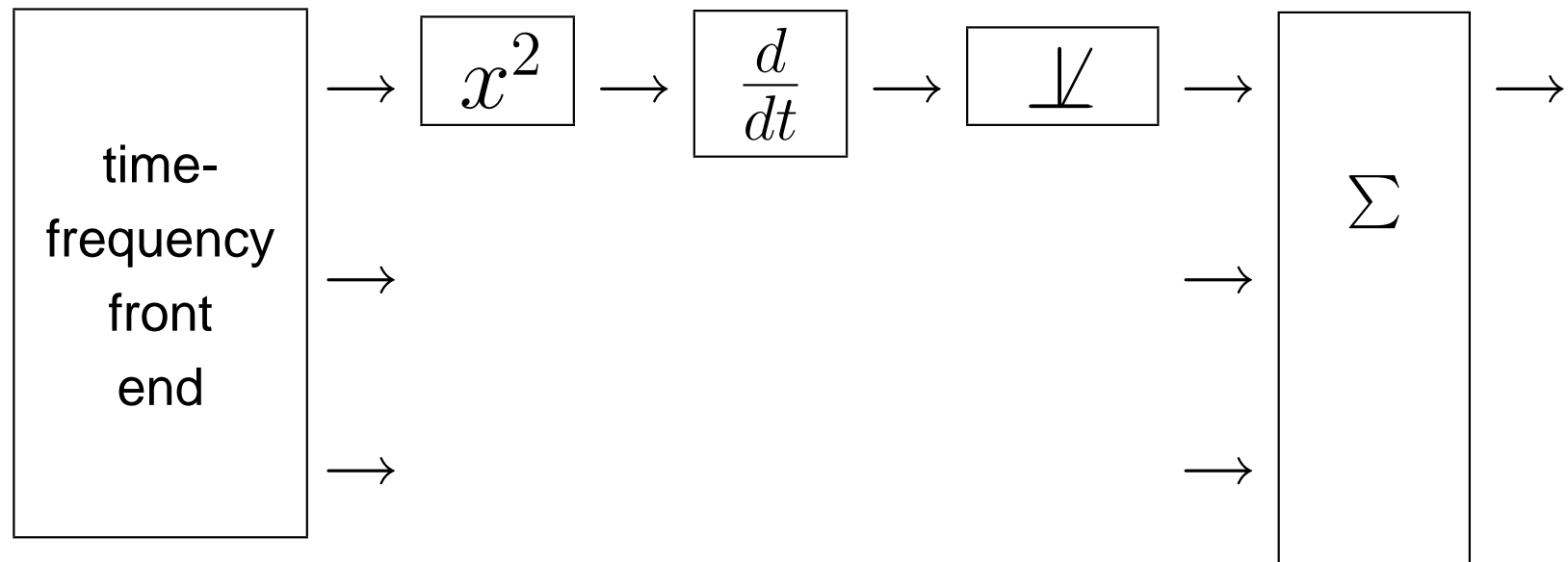
measure of the presence of an S. D. P. E. at each instant in a piece of music

- ignore for now the phenomenon of continual, repetitive percussion events (drum rolls, buzzing, etc)
- ignore for now sustained tone portion

Onset detection provides the best S. D. P. E. profile of the several algorithms tested.

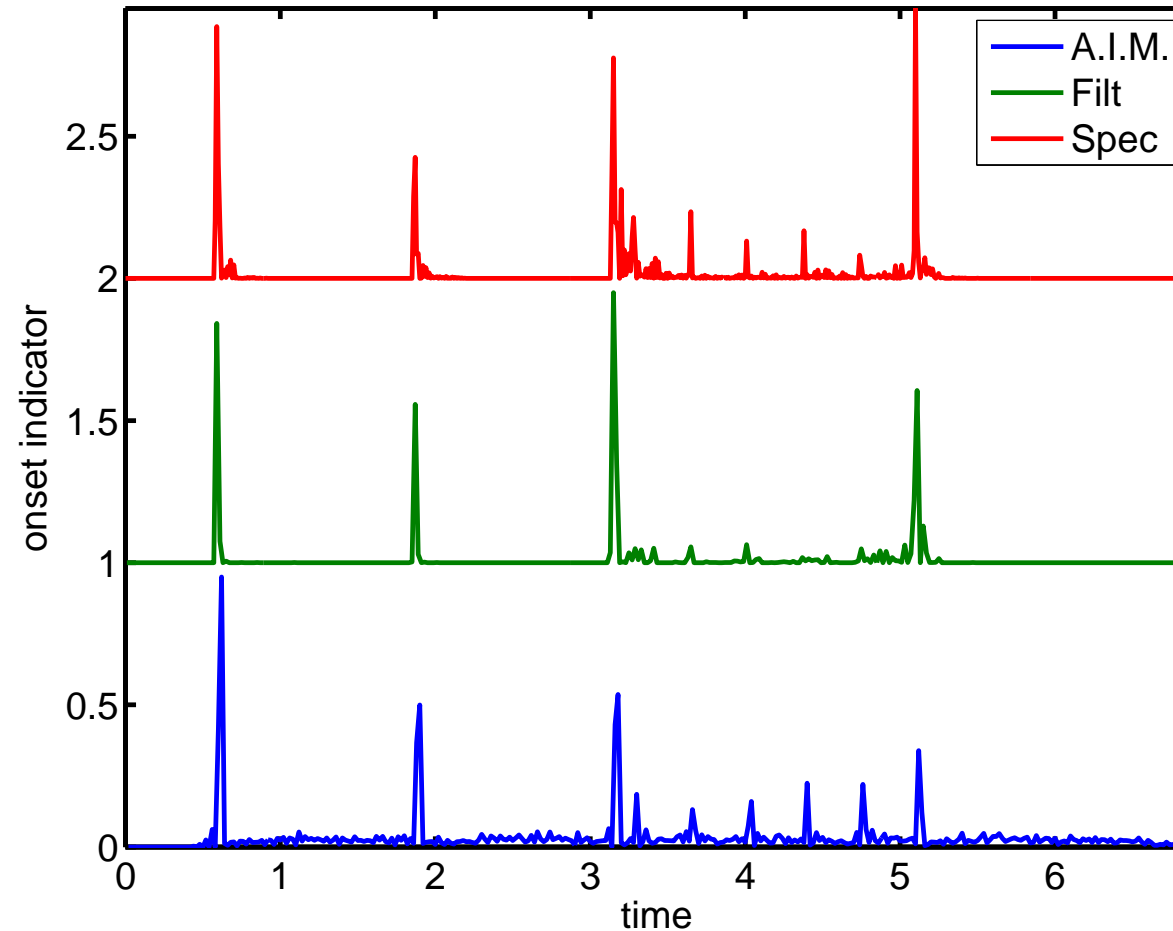
S. D. P. E. Profile

S. D. P. E. Onset Detection Algorithm



S. D. P. E. Profile

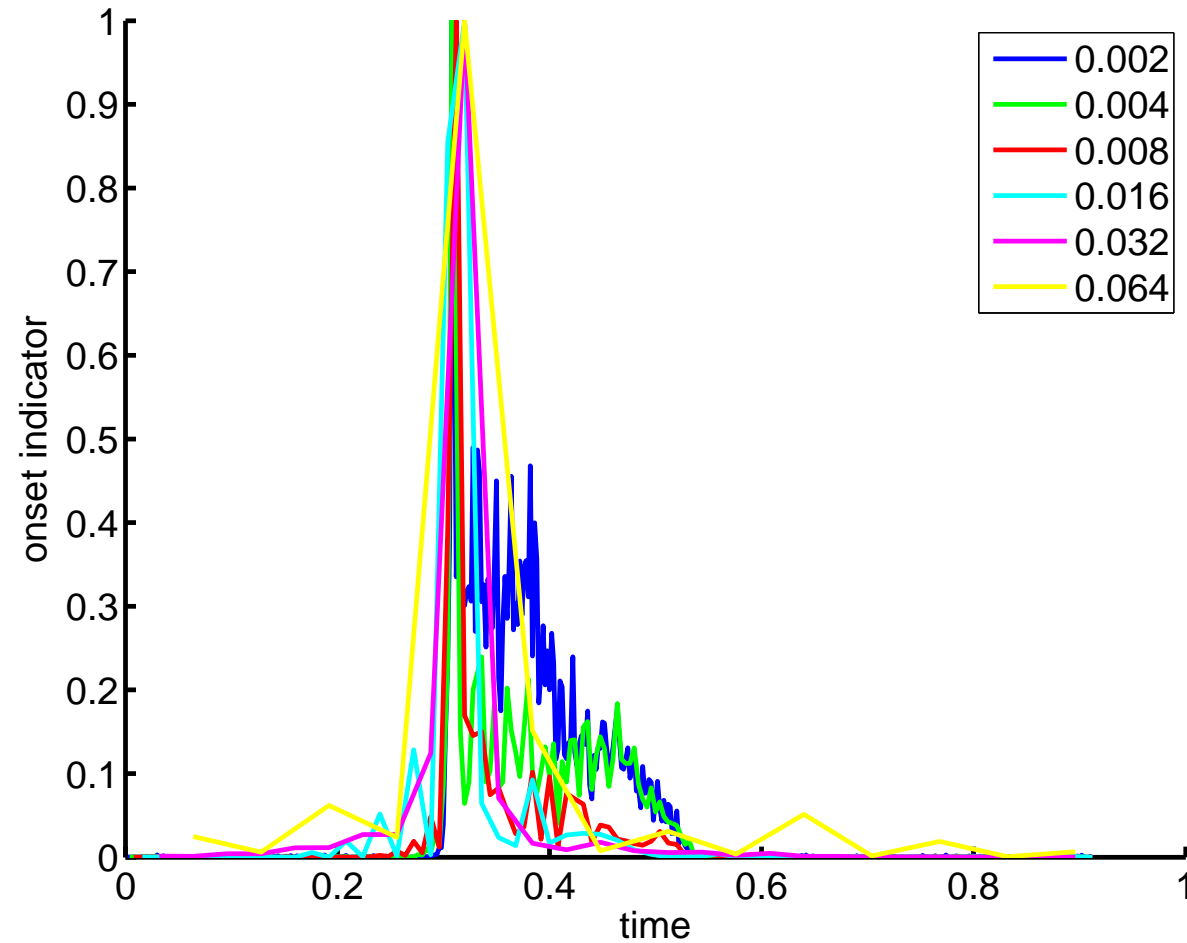
Algorithms — S. D. P. E. Onset Detection — percussive series



0:07 of "Jeux Imaginaires" by Ake Parmerud

S. D. P. E. Profile

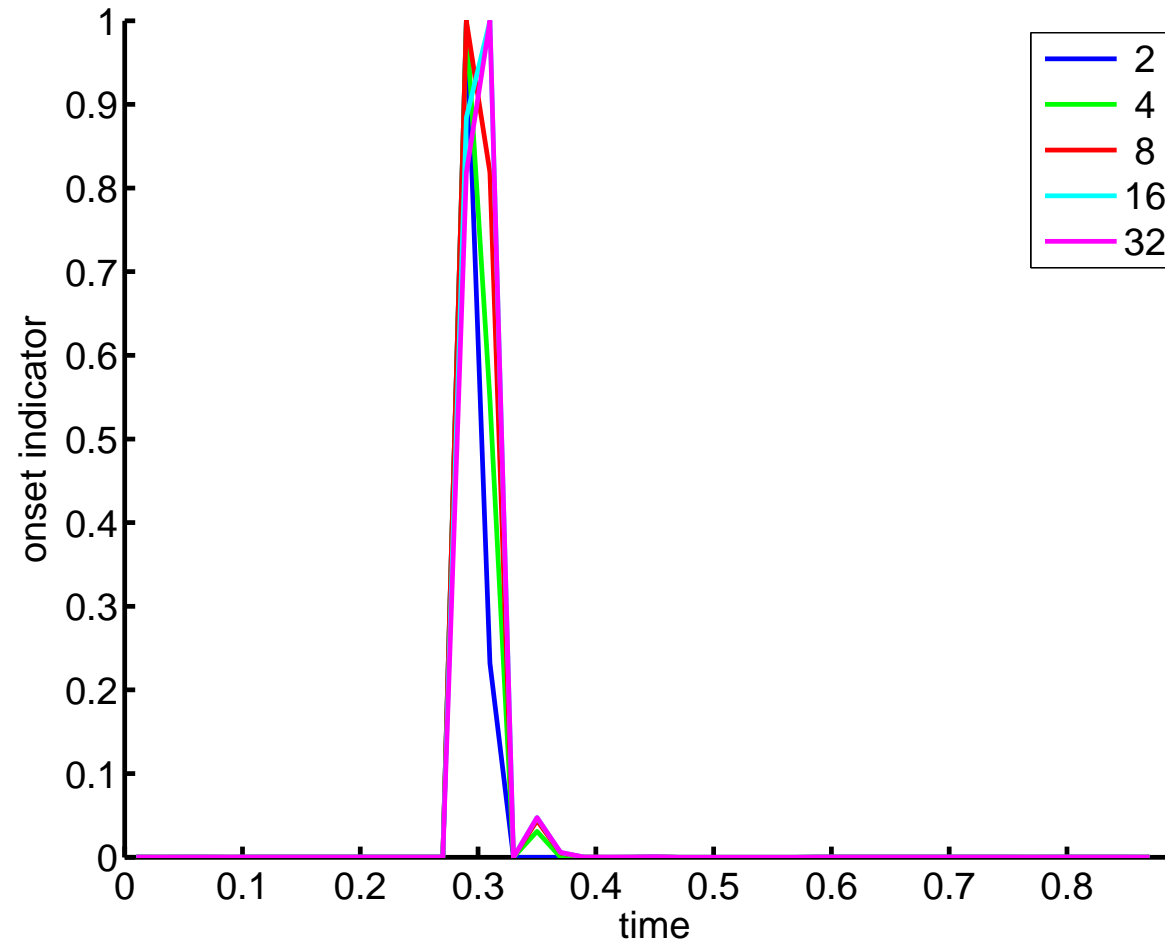
Algorithms — S. D. P. E. Onset Detection — time window comparison



single S. D. P. E.

S. D. P. E. Profile

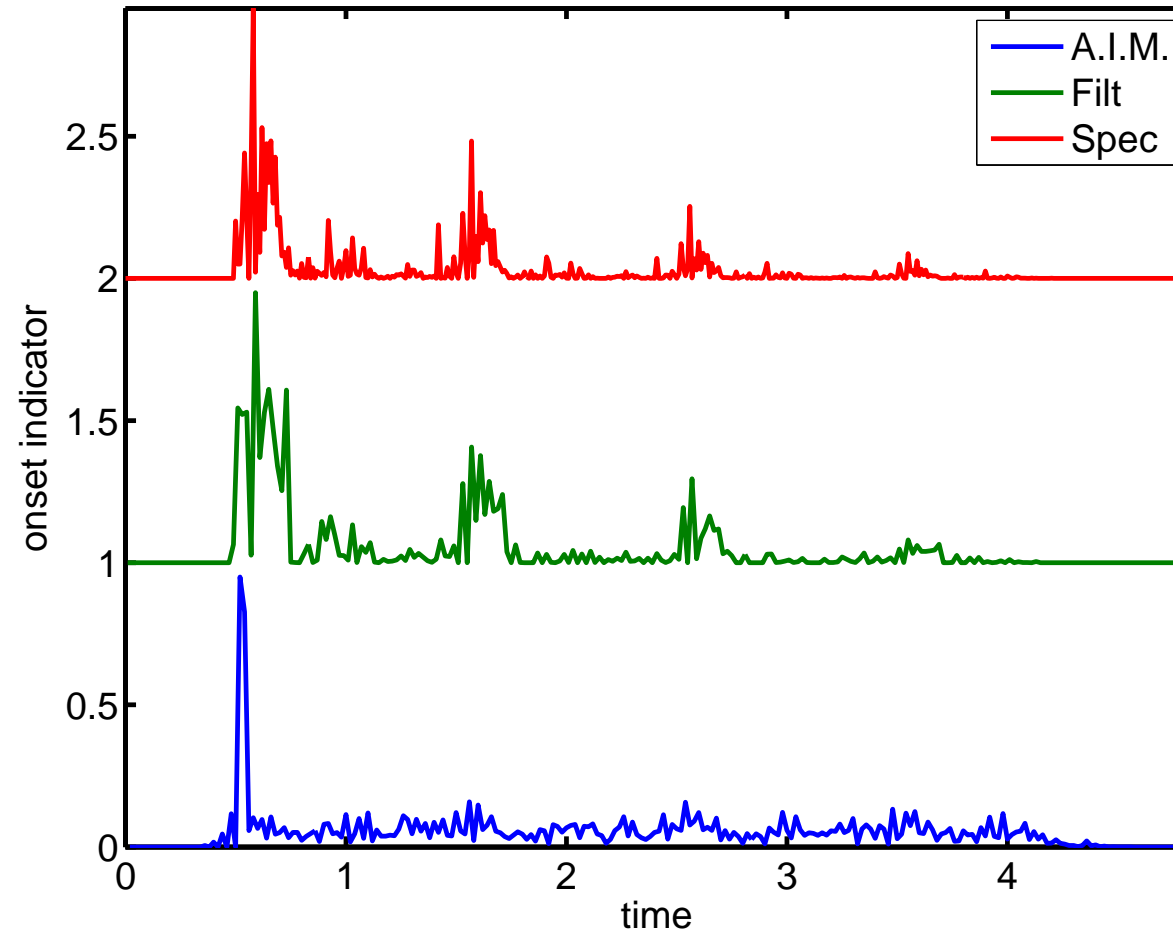
Algorithms — S. D. P. E. Onset Detection — number of bands comparison



single S. D. P. E.

S. D. P. E. Profile

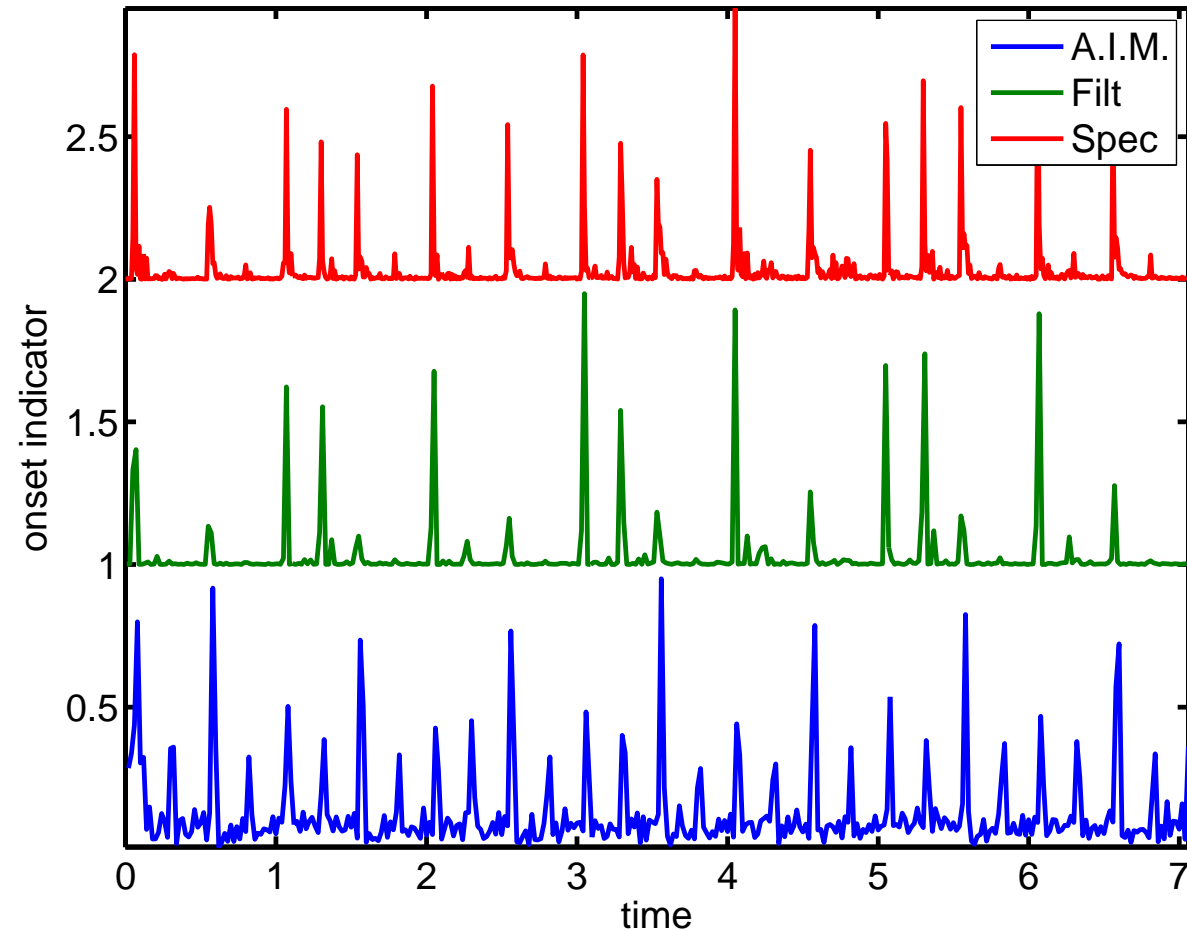
Algorithms — S. D. P. E. Onset Detection — non-percussive series



0:04 of "Le Vertige Inconnu" by Gilles Gobeil

S. D. P. E. Profile

Algorithms — S. D. P. E. Onset Detection — ecological non-electroacoustic



0:07 of "Sgt. Pepper's Lonely Hearts Club Band" by The Beatles

Human Data Collection

Algorithms should match human performance, but **what is human performance?**

Design of Human Data Collection

- Start with 16 S. D. P. E. 's varying along two parameters (two of rise time, spectral filtering, noise-likeness, decay time).
- Ask 10 human listeners to judge “most like an S. D. P. E.” from all possible pairings and “how difficult is it to judge?” each pair.

This procedure will provide a ranked list of S. D. P. E. 's.

The algorithm must then be adjusted to rank the S. D. P. E. 's similarly.

Conclusion and Future Work

Conclusion

- from a larger scope, currently working on **S. D. P. E. profile**
- shown best algorithm — Onset Detection

Future Work

- **human data collection** — guides future work
- self-similarity according to S. D. P. E. profile