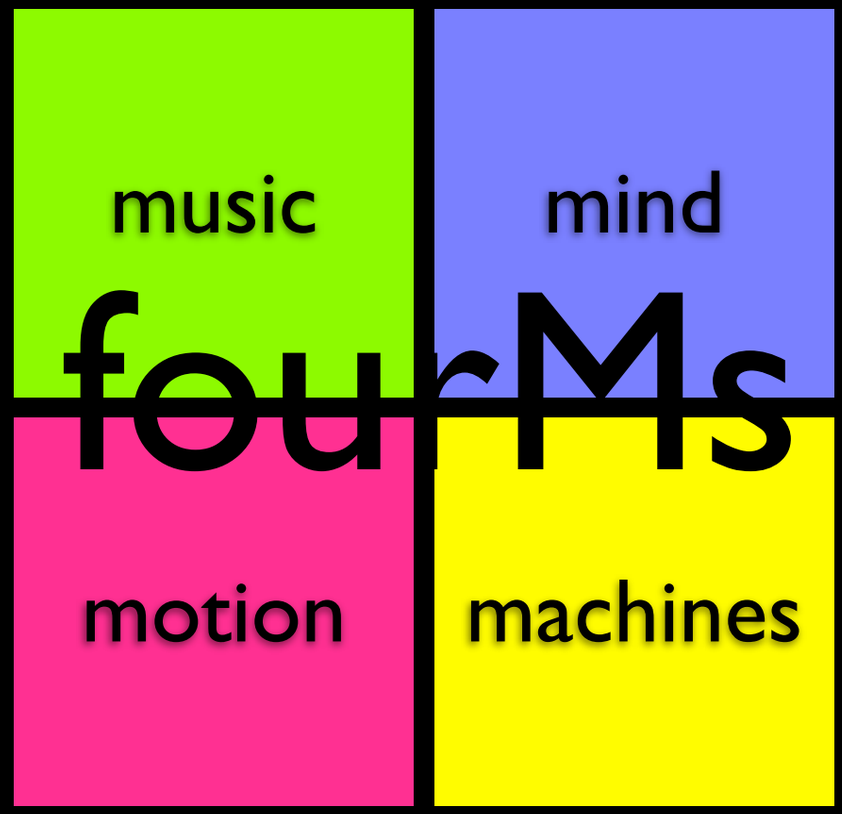
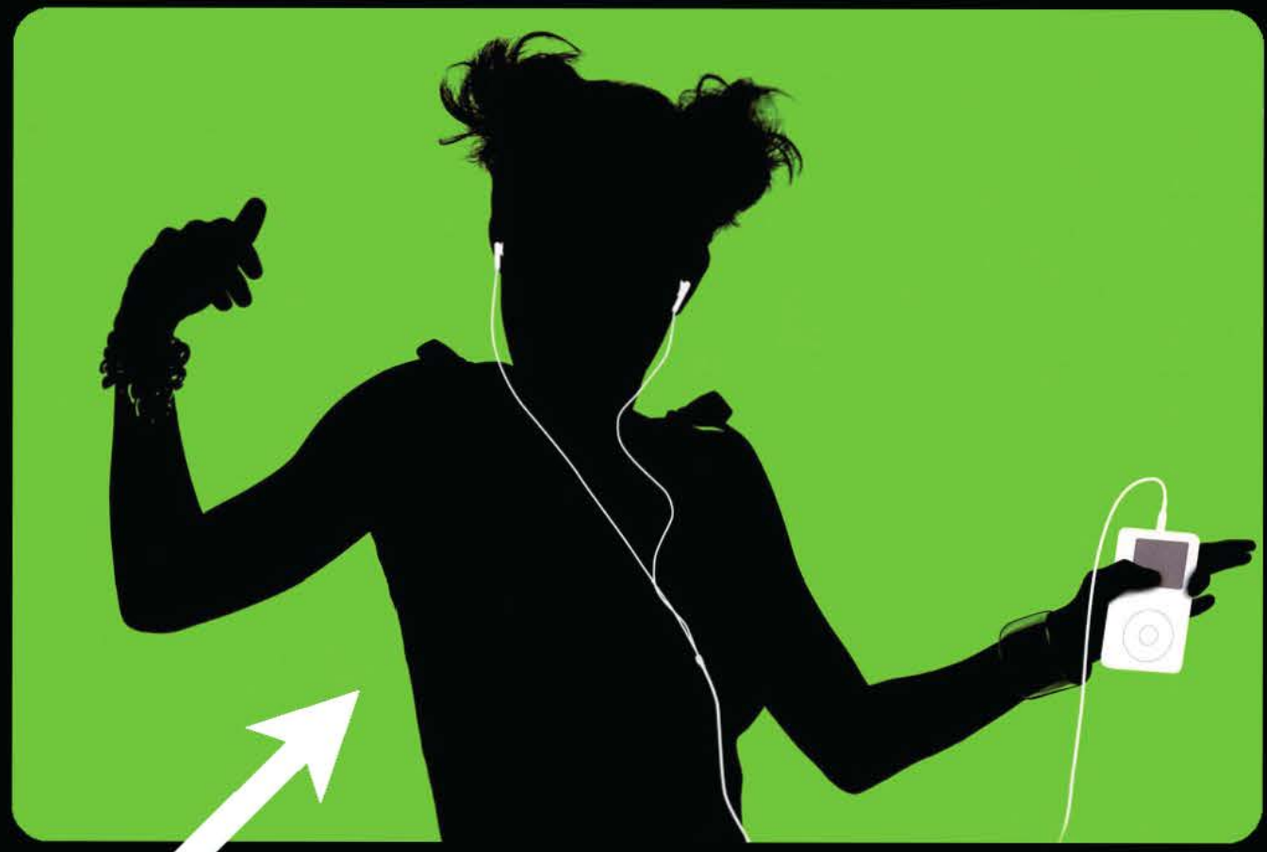
Reduced displays of multidimensional motion capture data sets of musical performance

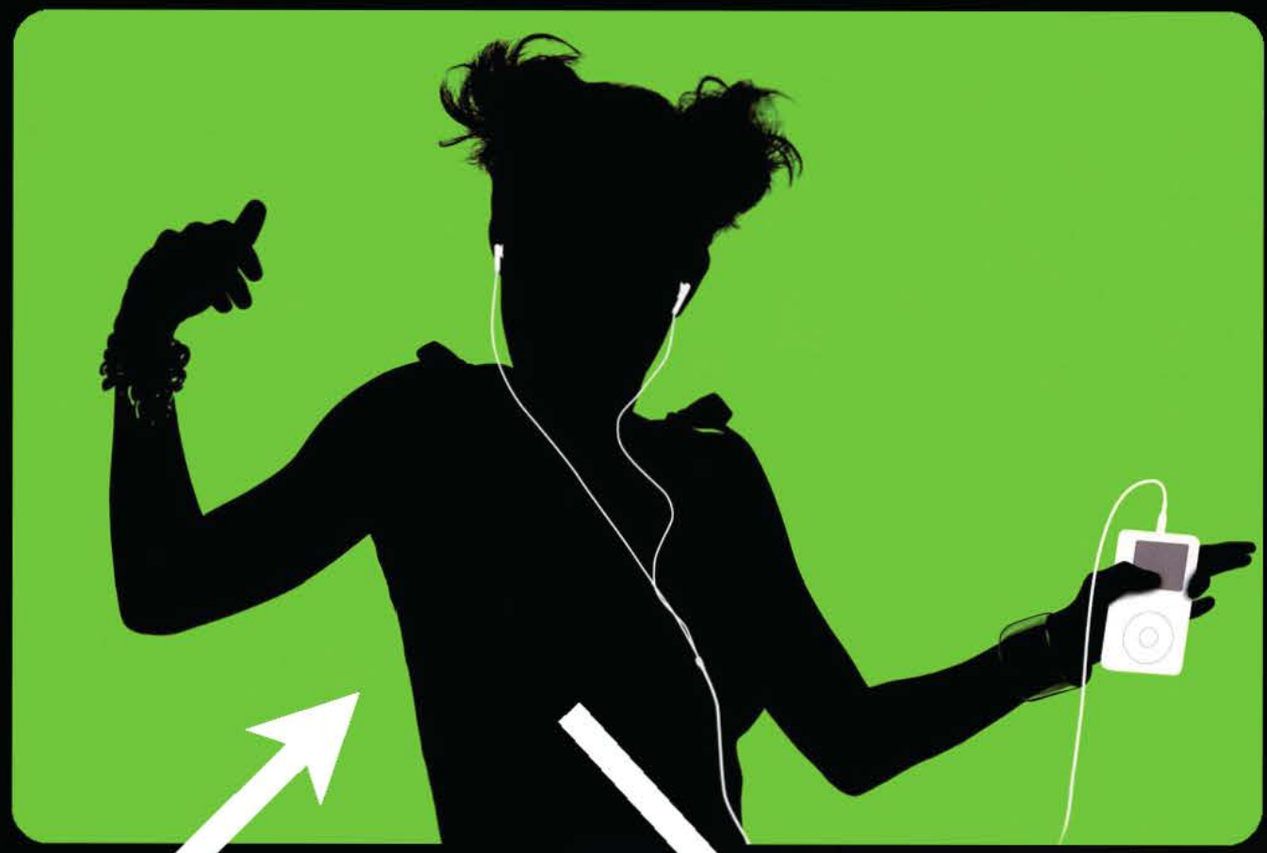
Alexander Refsum Jensenius
Ståle Skogstad, Kristian Nymoen,
Rolf Inge Godøy, Jim Tørresen,
Mats Høvin



University of Oslo

Music & Movement





Motion capture?

Optical (infrared)

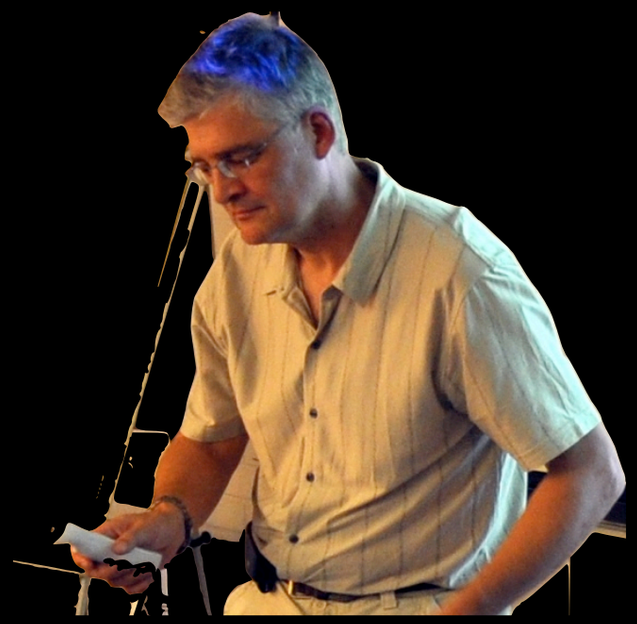
Optical (infrared)

Optical (visual)

Optical (infrared)

Optical (visual)

Electromagnetic

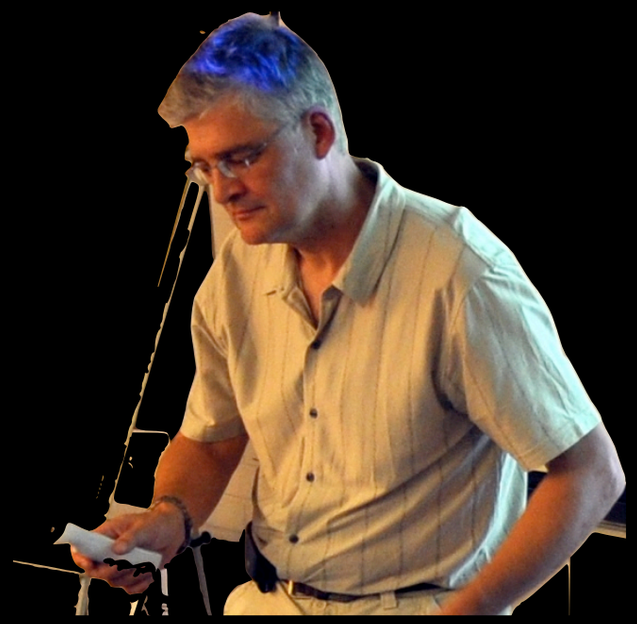


Inertial/magnetic

Optical (infrared)

Optical (visual)

Electromagnetic



Inertial/magnetic

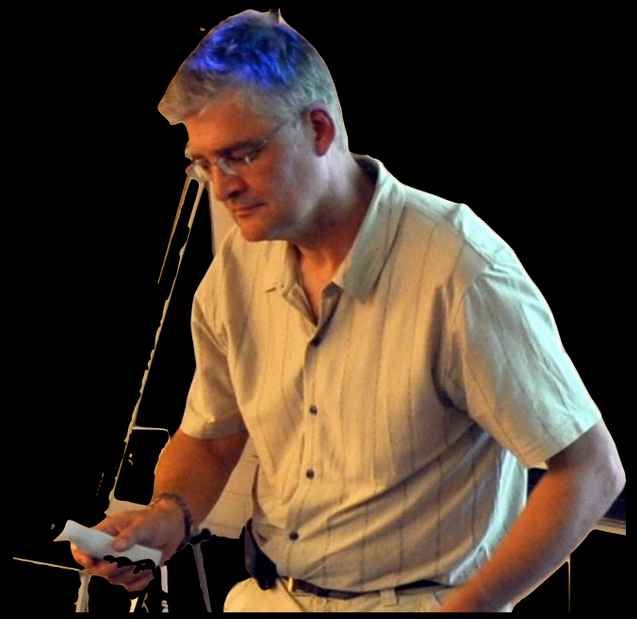
Physiological

Optical (infrared)

Optical (visual)

Electromagnetic

2D (wacom, mouse, joystick)



Inertial/magnetic

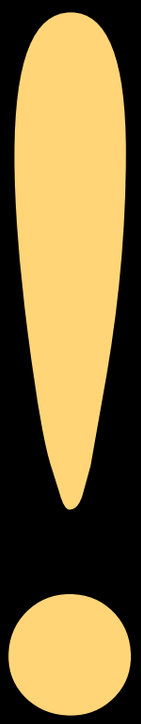
Physiological

Optical (infrared)

Optical (visual)

Electromagnetic

!

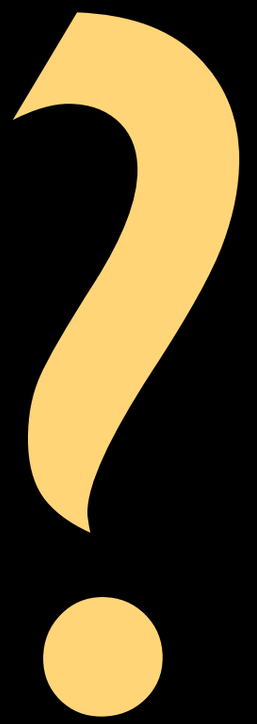


Input	SR	Ch	Bit
Infrared	100	1-50	12
Accelerometers	60	3	32
Electromagnetic	60	6	32
EMG	100	2	7
Video	86	1	8
Audio	44k	2	16
MIDI	1k	1	7
…			

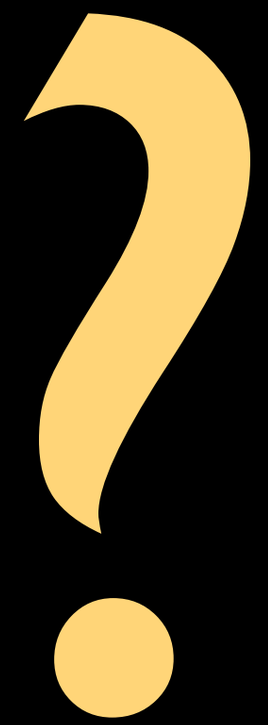
?

How to **record** all data?

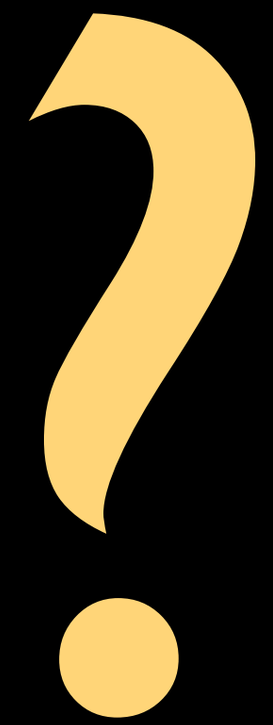
How to **record** all data?
How to **synchronize** all data?



How to **record** all data?
How to **synchronize** all data?
How to **visualize** all data?



How to **record** all data?
How to **synchronize** all data?
How to **visualize** all data?
How to **analyze** all data?

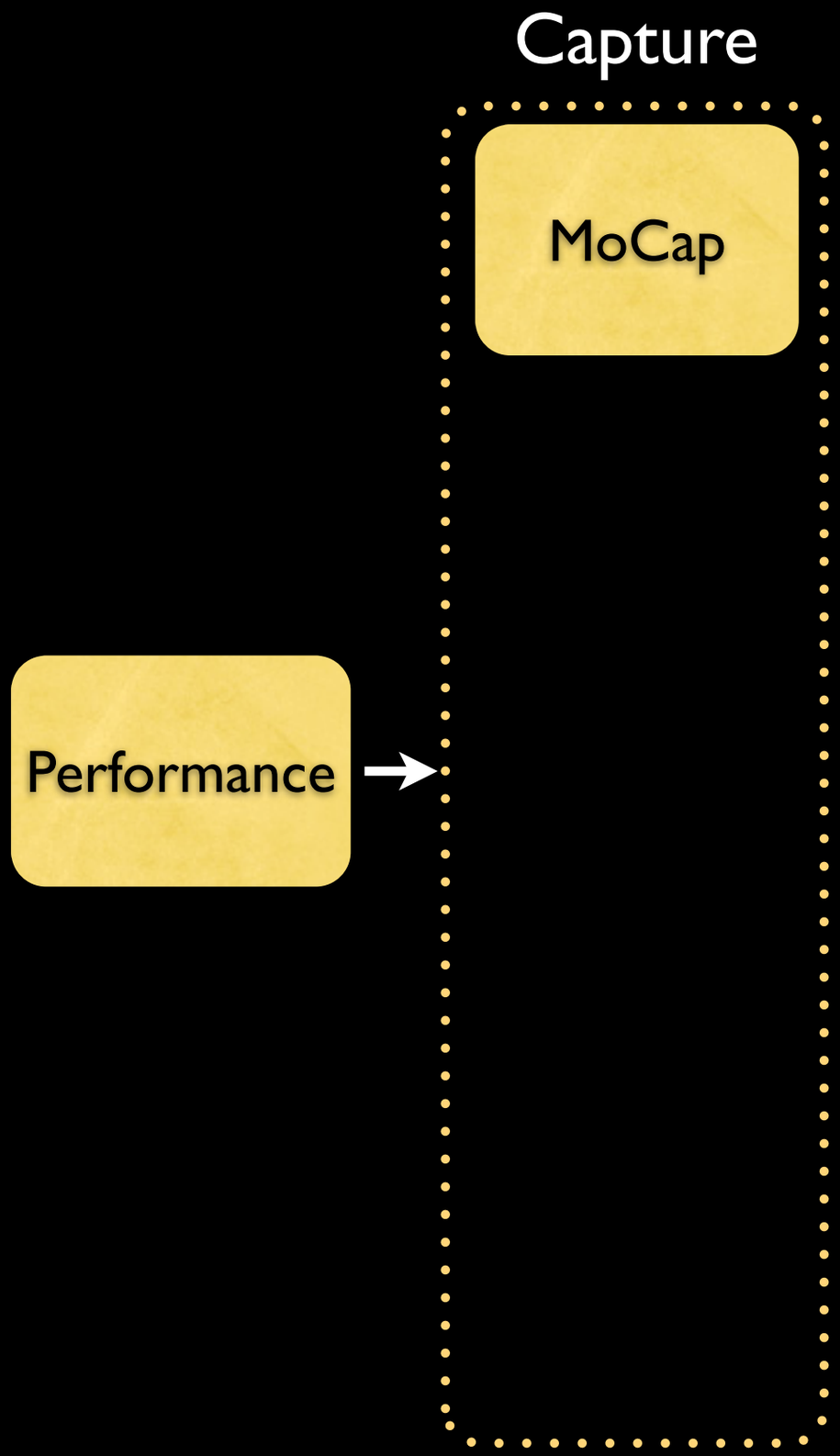


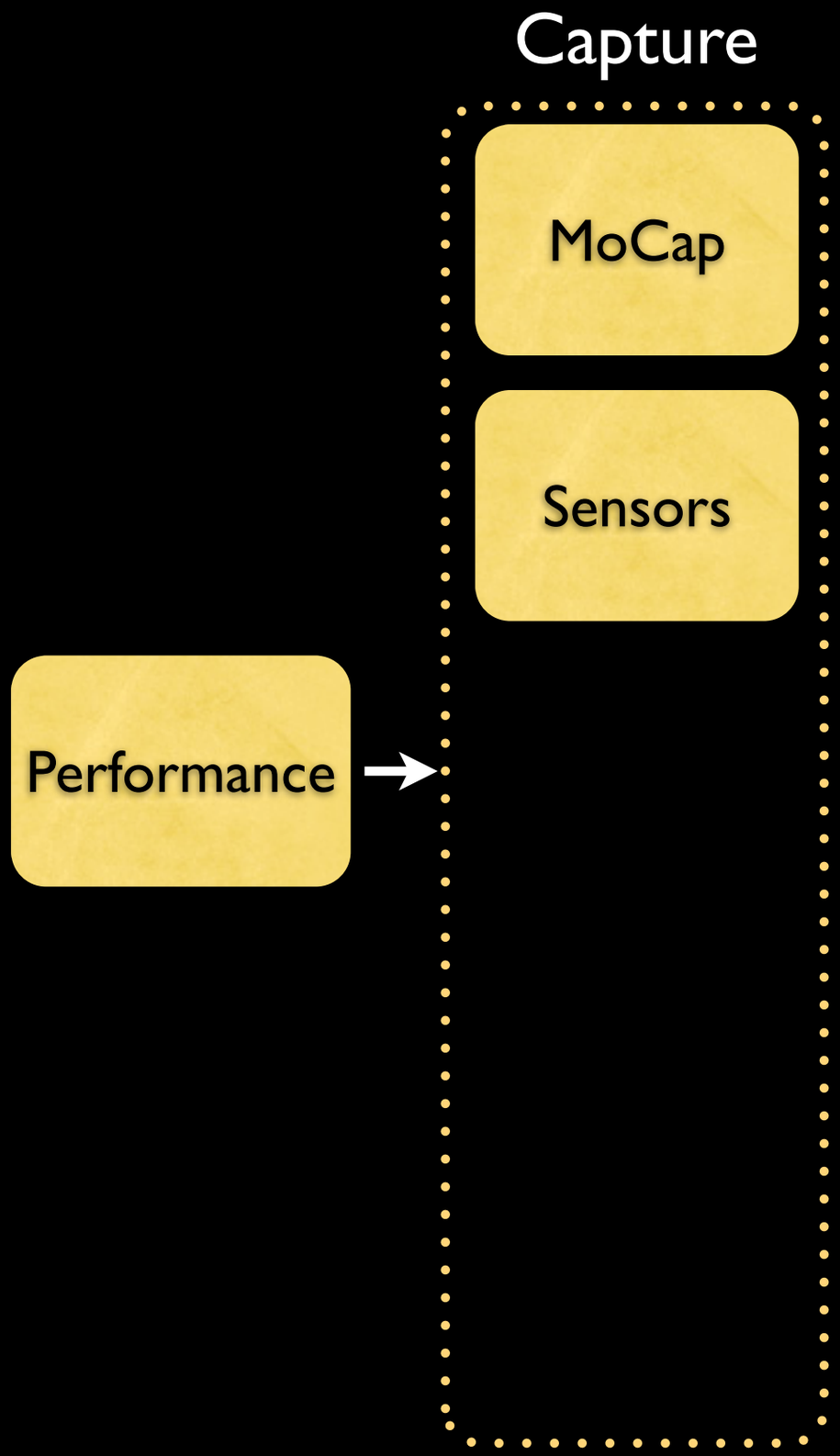
Recording & Synchronization

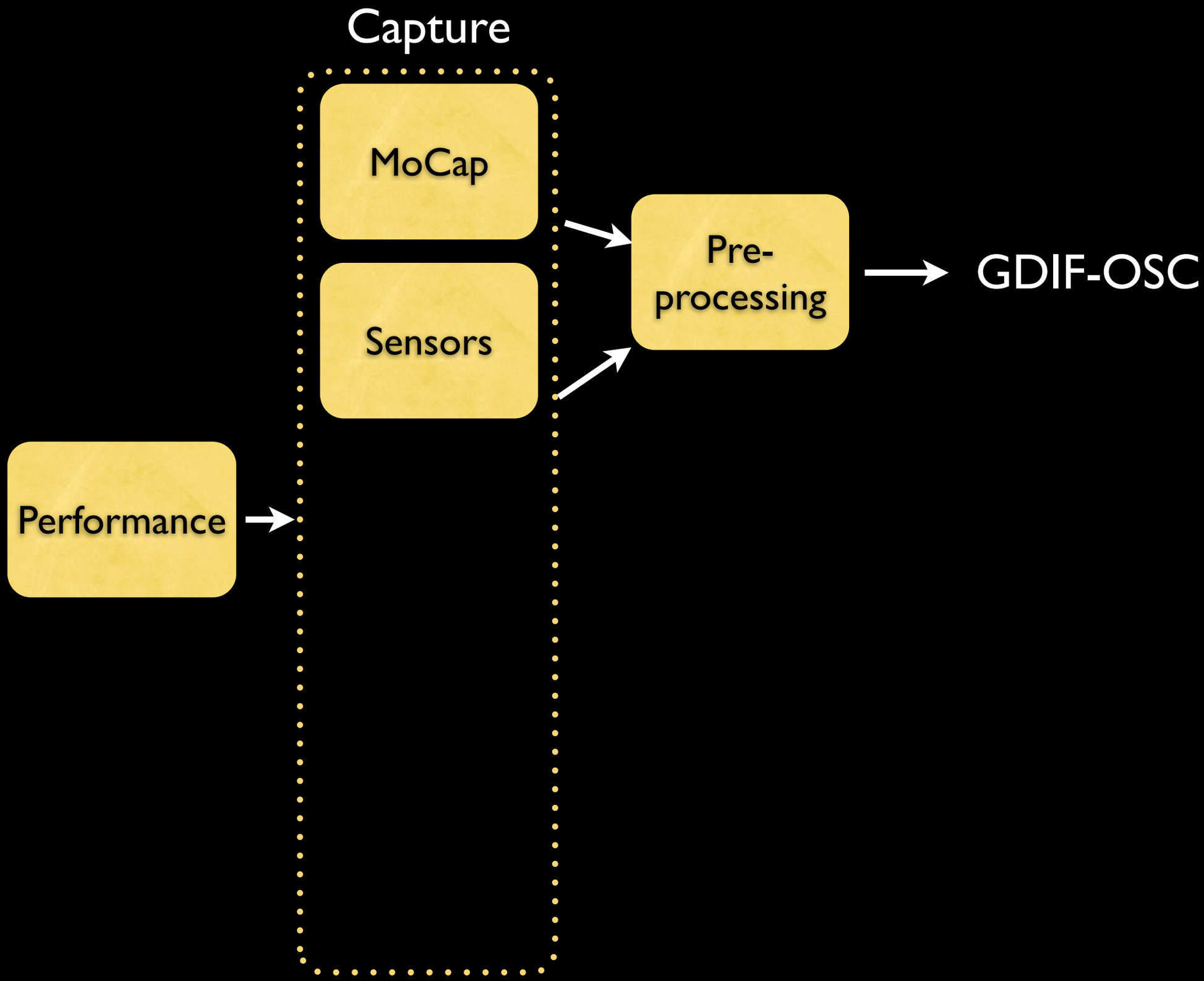
Performance

Capture

Performance


Capture
MoCap
Performance


Capture
MoCap
Sensors
Performance


Capture
MoCap
Sensors
Performance
Pre-
processing
GDIF-OSC

Gesture Description Interchange Format

Capture

MoCap

Sensors

Performance

Pre-processing

GDIF-OSC

Gesture Description Interchange Format

Open Sound Control

Capture

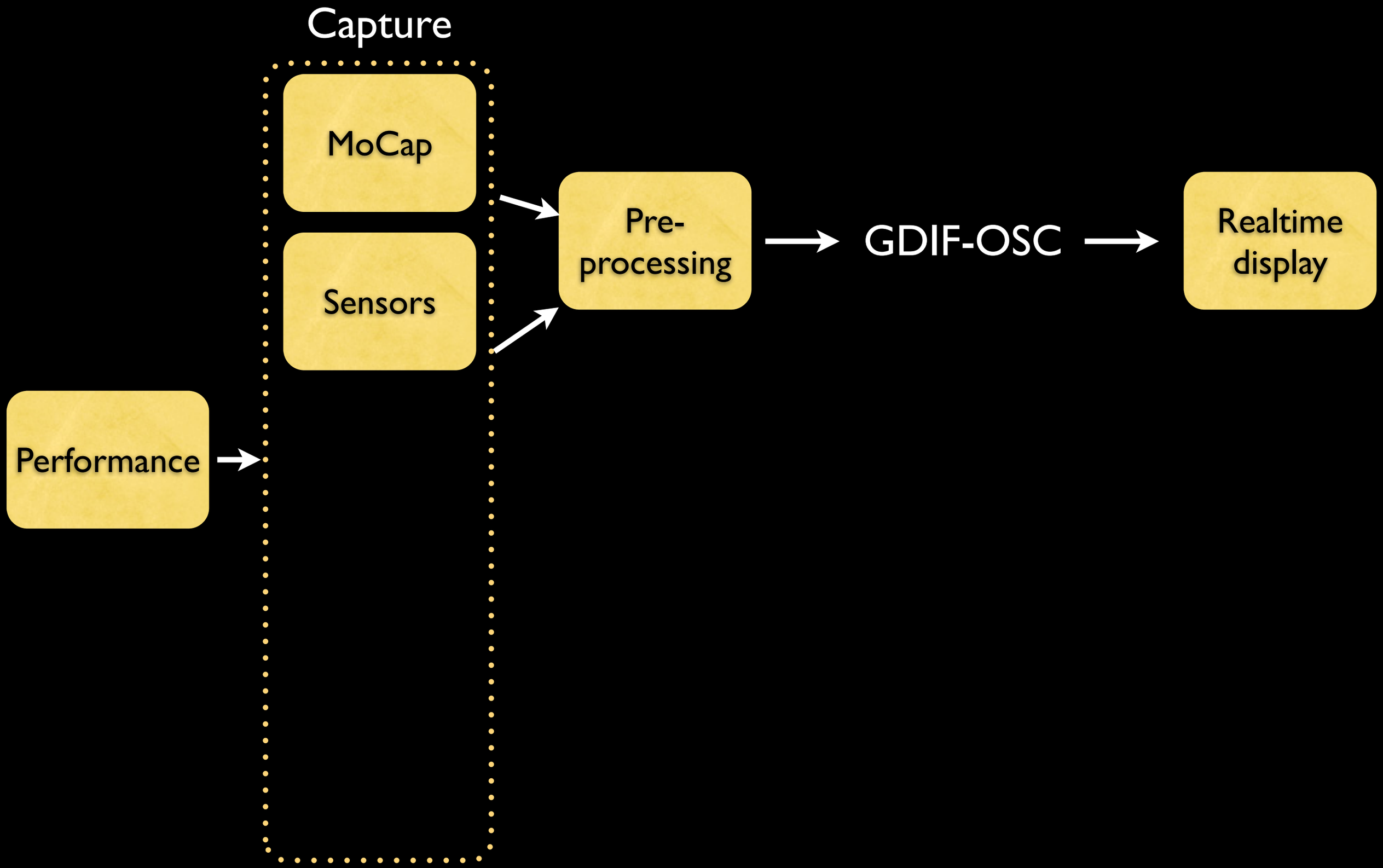
MoCap

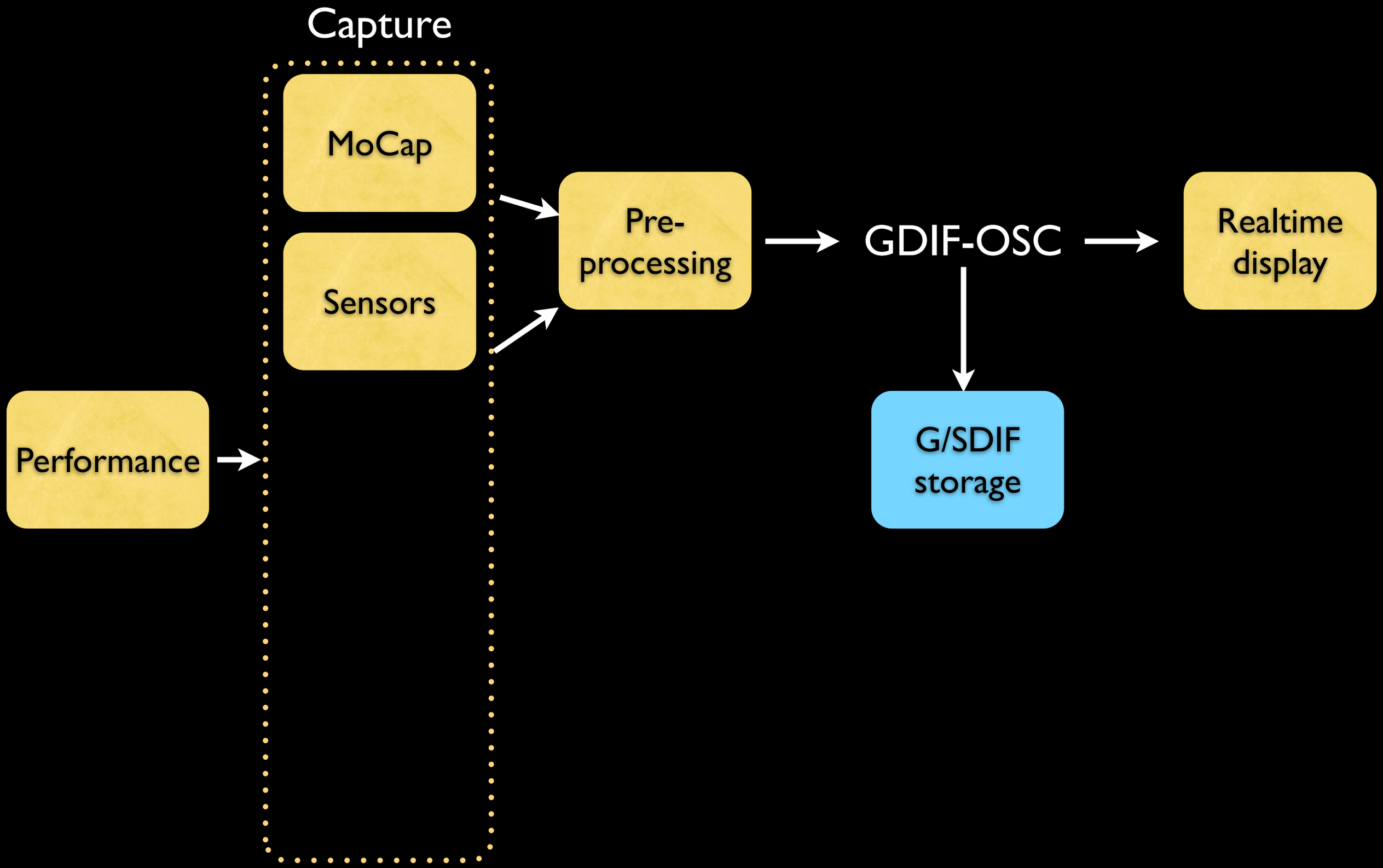
Sensors

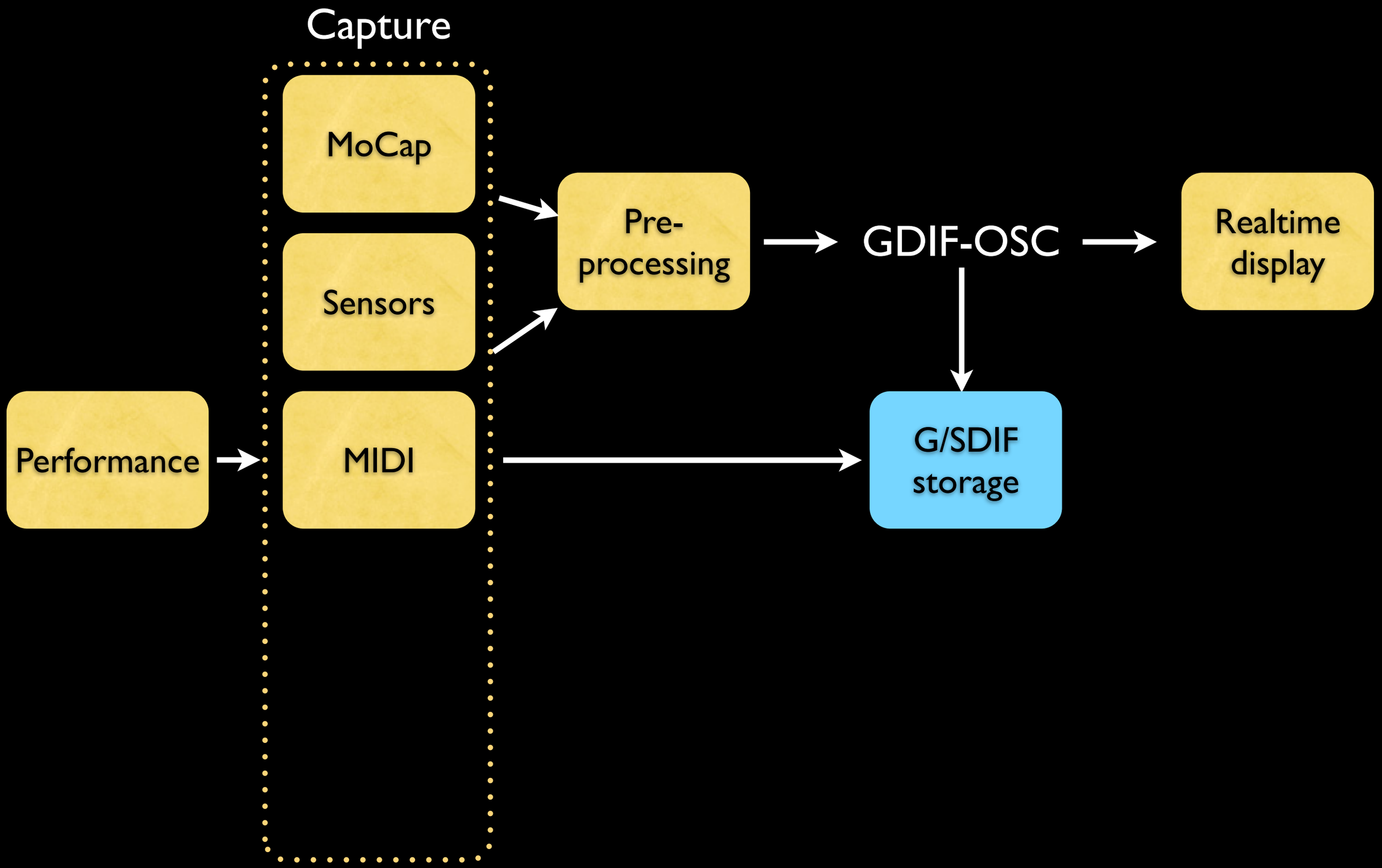
Pre-processing

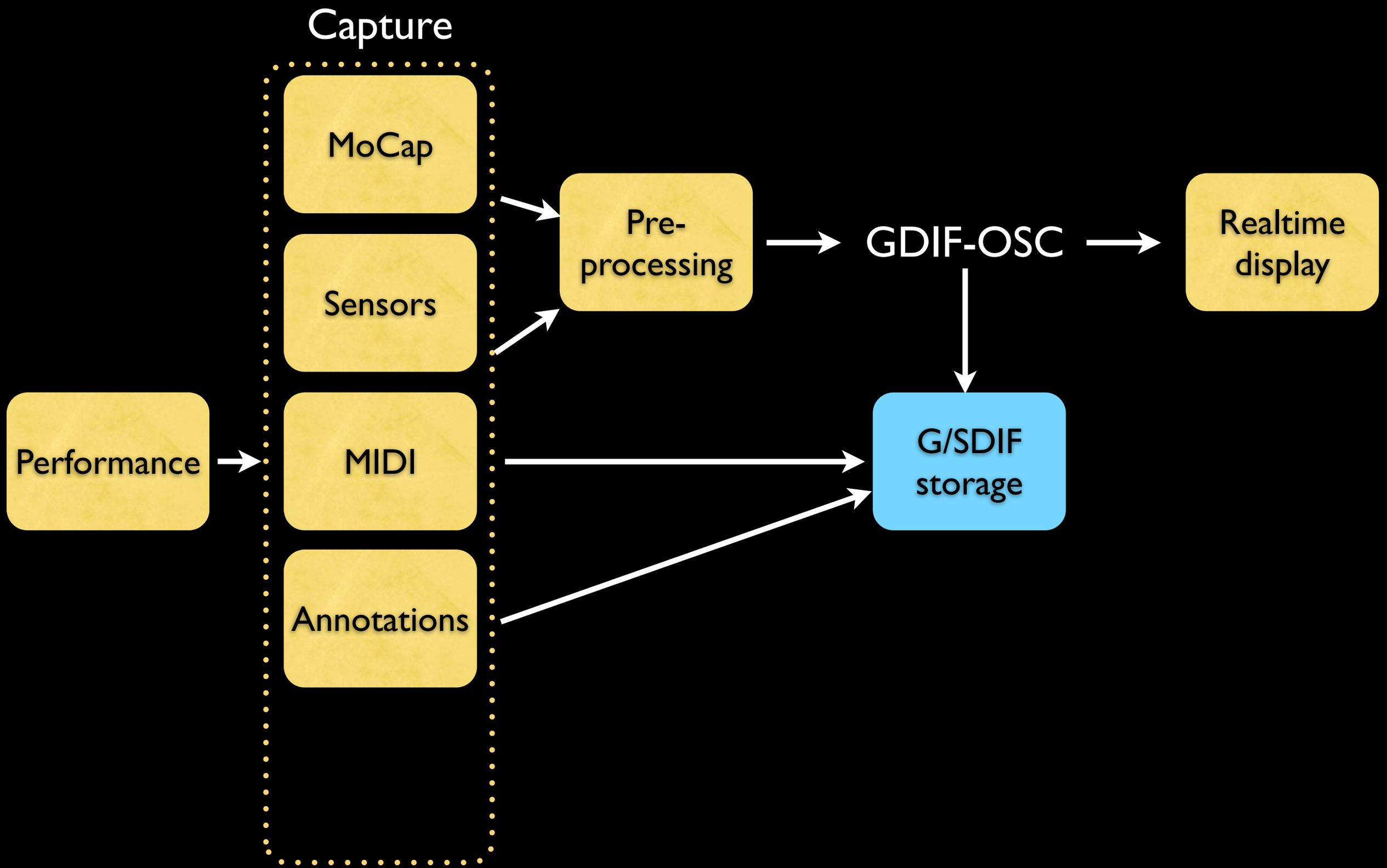
GDIF-OSC

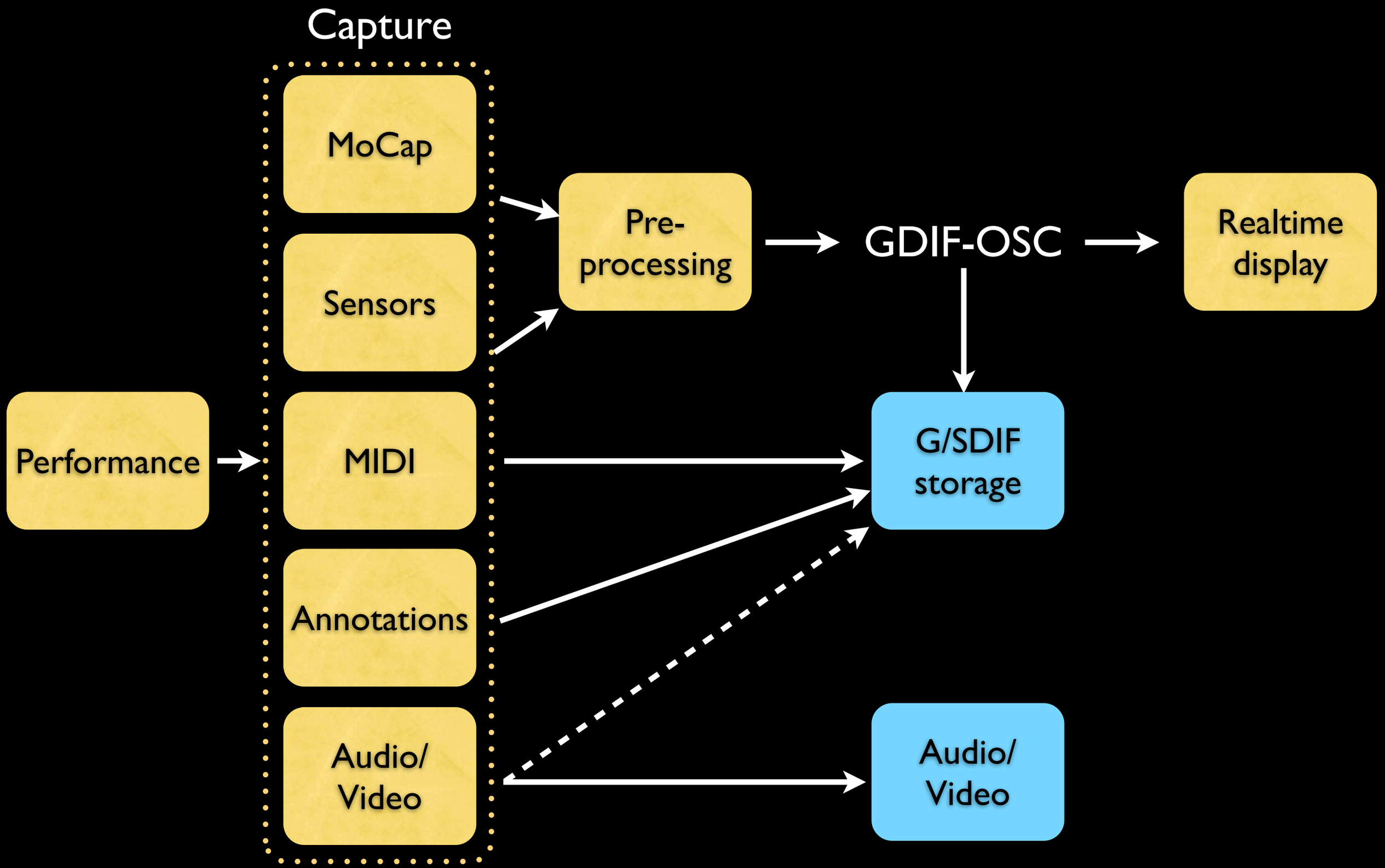
Performance

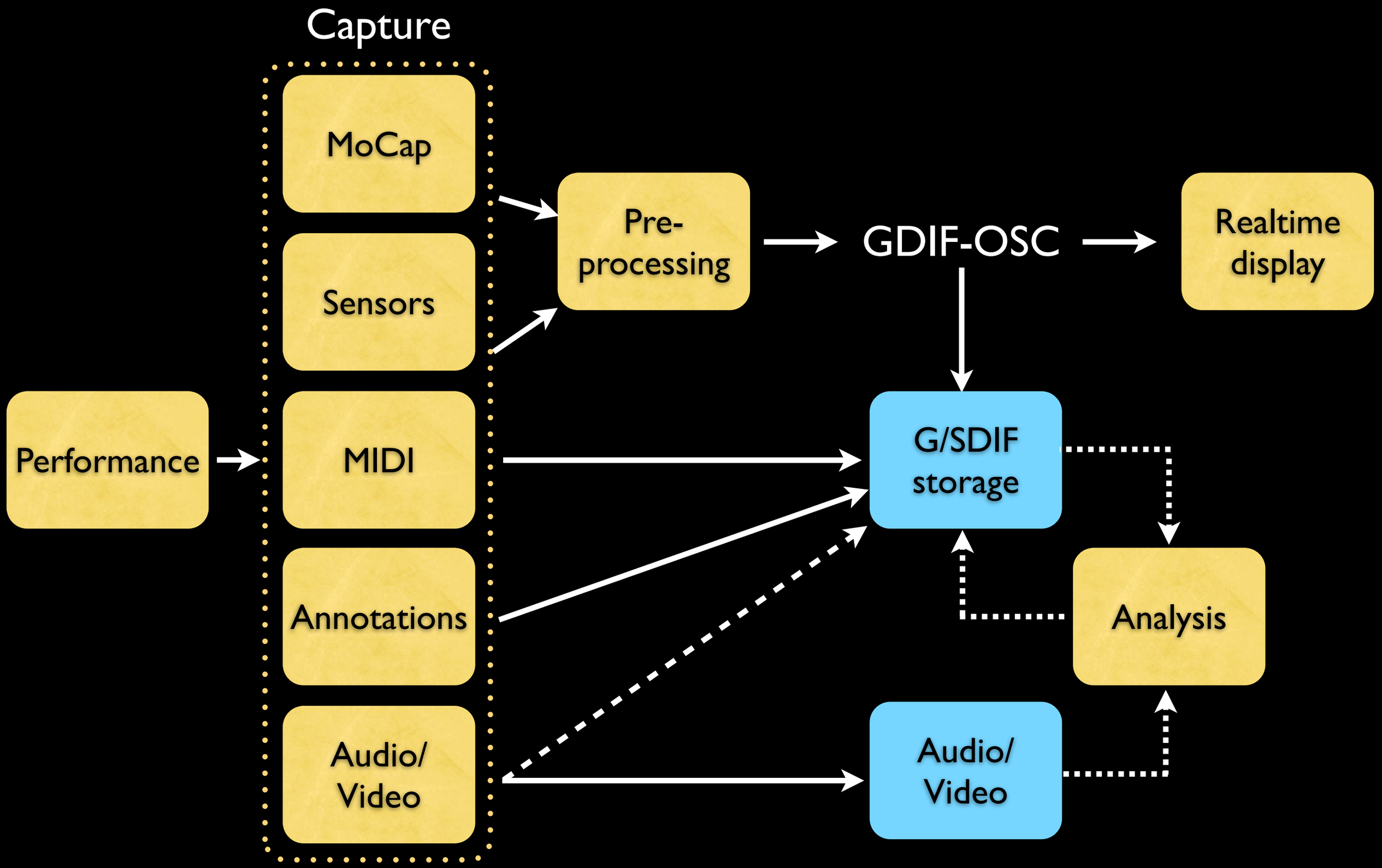

Capture
MoCap
Sensors
Performance
Pre-
processing
GDIF-OSC
Realtime
display


Capture
MoCap
Sensors
Performance
Pre-
processing
GDIF-OSC
Realtime
display
G/SDIF
storage


Capture
MoCap
Sensors
MIDI
Performance
Pre-
processing
GDIF-OSC
Realtime
display
G/SDIF
storage


Capture
MoCap
Sensors
MIDI
Annotations
Performance
Pre-
processing
GDIF-OSC
Realtime
display
G/SDIF
storage


Capture
MoCap
Sensors
MIDI
Annotations
Audio/
Video
Performance
Pre-
processing
GDIF-OSC
Realtime
display
G/SDIF
storage
Audio/
Video


Capture
MoCap
Sensors
MIDI
Annotations
Audio/
Video
Performance
Pre-
processing
GDIF-OSC
Realtime
display
G/SDIF
storage
Analysis
Audio/
Video

GDIF/SDIF file

GDIF/SDIF file

Name value tables

Type declarations

GDIF/SDIF file

Name value tables
Type declarations

MIDI stream	MoCap stream	Polhemus stream	EMG stream	AV sync stream

GDIF/SDIF file

Name value tables
Type declarations

MIDI stream

1MID frame

MoCap stream

XACC frame

Polhemus stream

XPOR frame

EMG stream

XEMG frame

AV sync stream

XAVS frame

GDIF/SDIF file

Name value tables
Type declarations

MIDI stream

1MID frame

s	D1	D2

MoCap stream

XACC frame

x	y	z
x	y	z
x	y	z
x	y	z
x	y	z
x	y	z
x	y	z
x	y	z
x	y	z
x	y	z

Polhemus stream

XPOR frame

x	y	z	az	el	rl
x	y	z	az	el	rl

EMG stream

XEMG frame

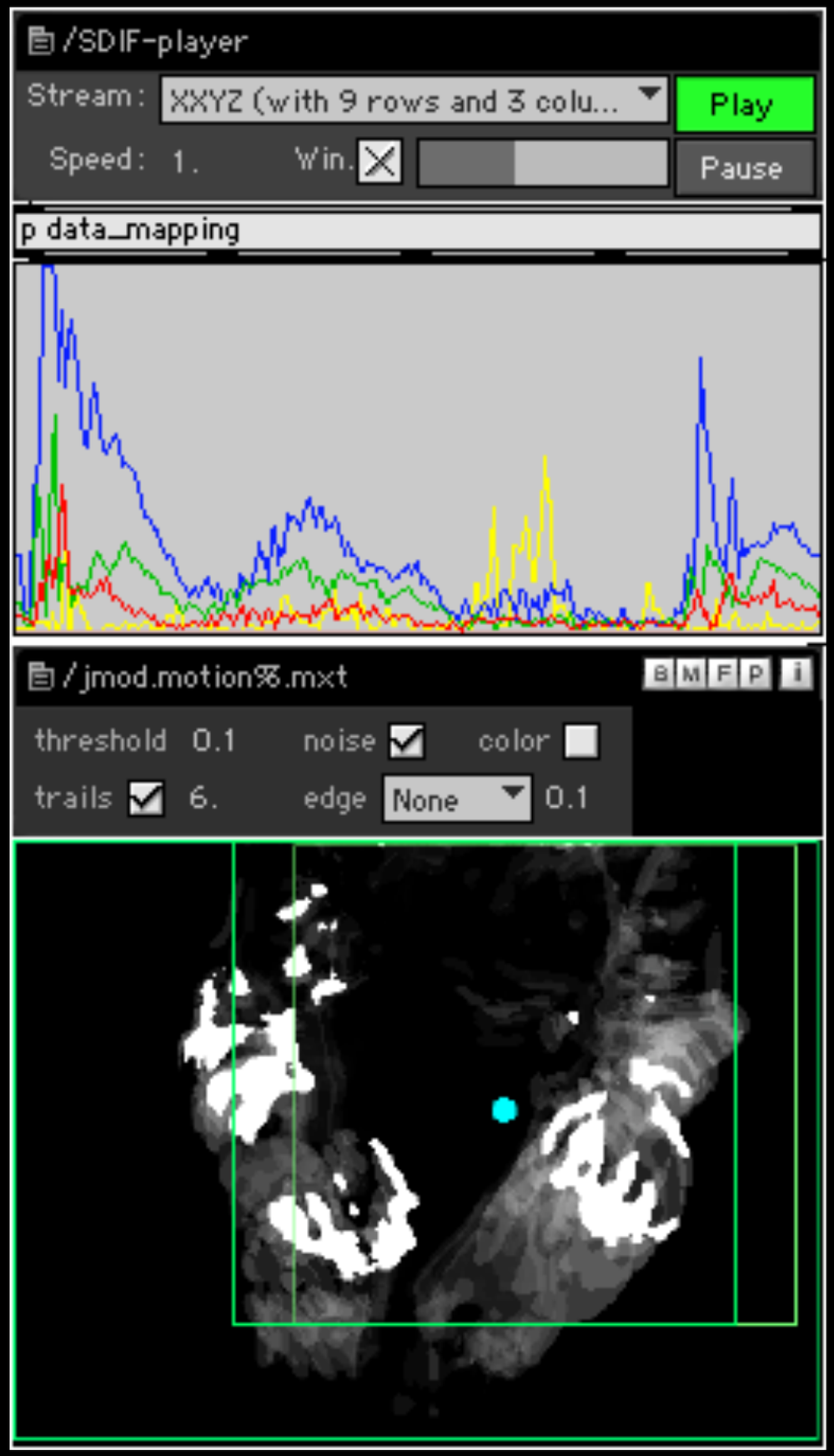
I1	I2
r1	r2

AV sync stream

XAVS frame

sync

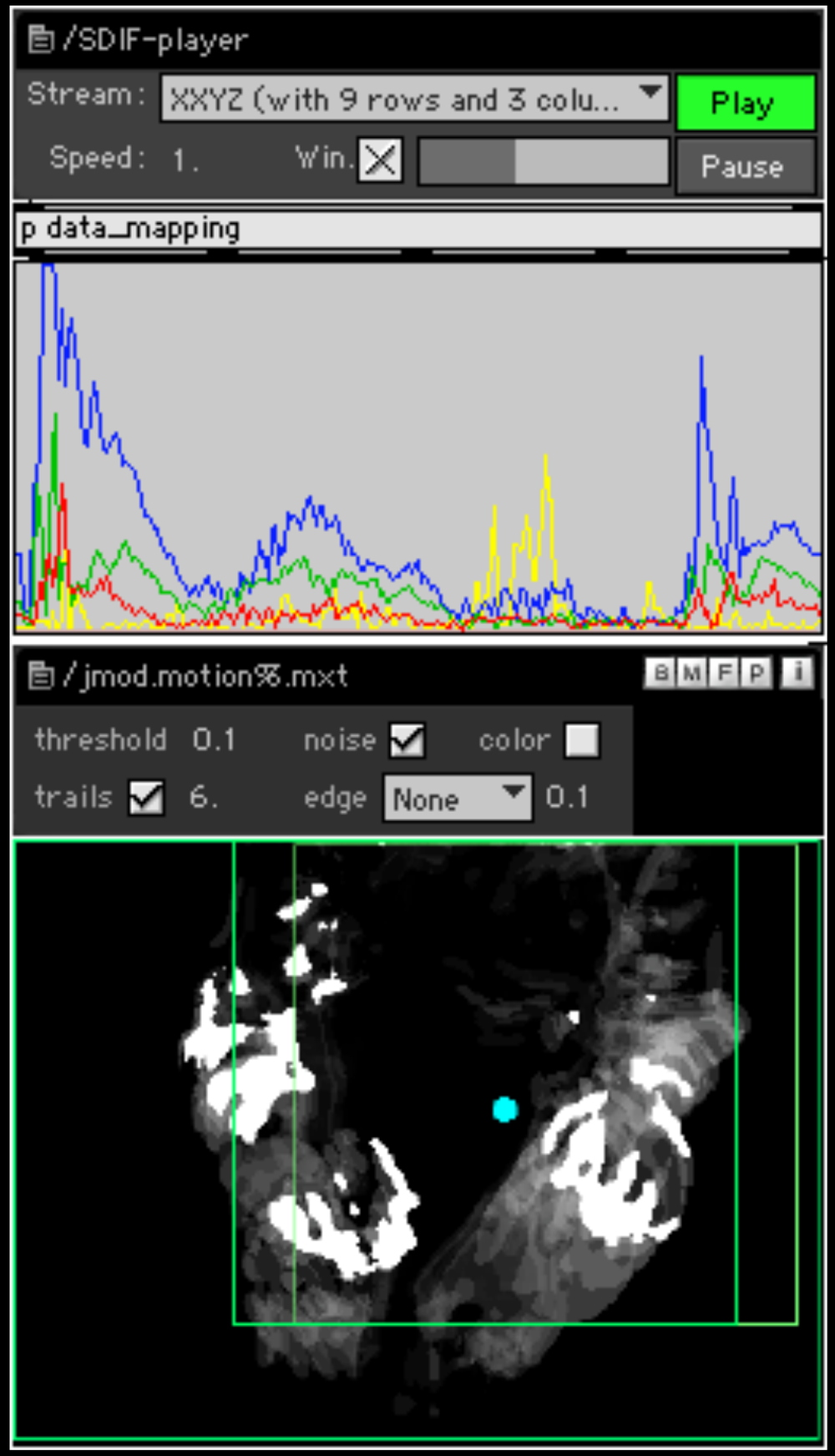
Musical Gestures Toolbox



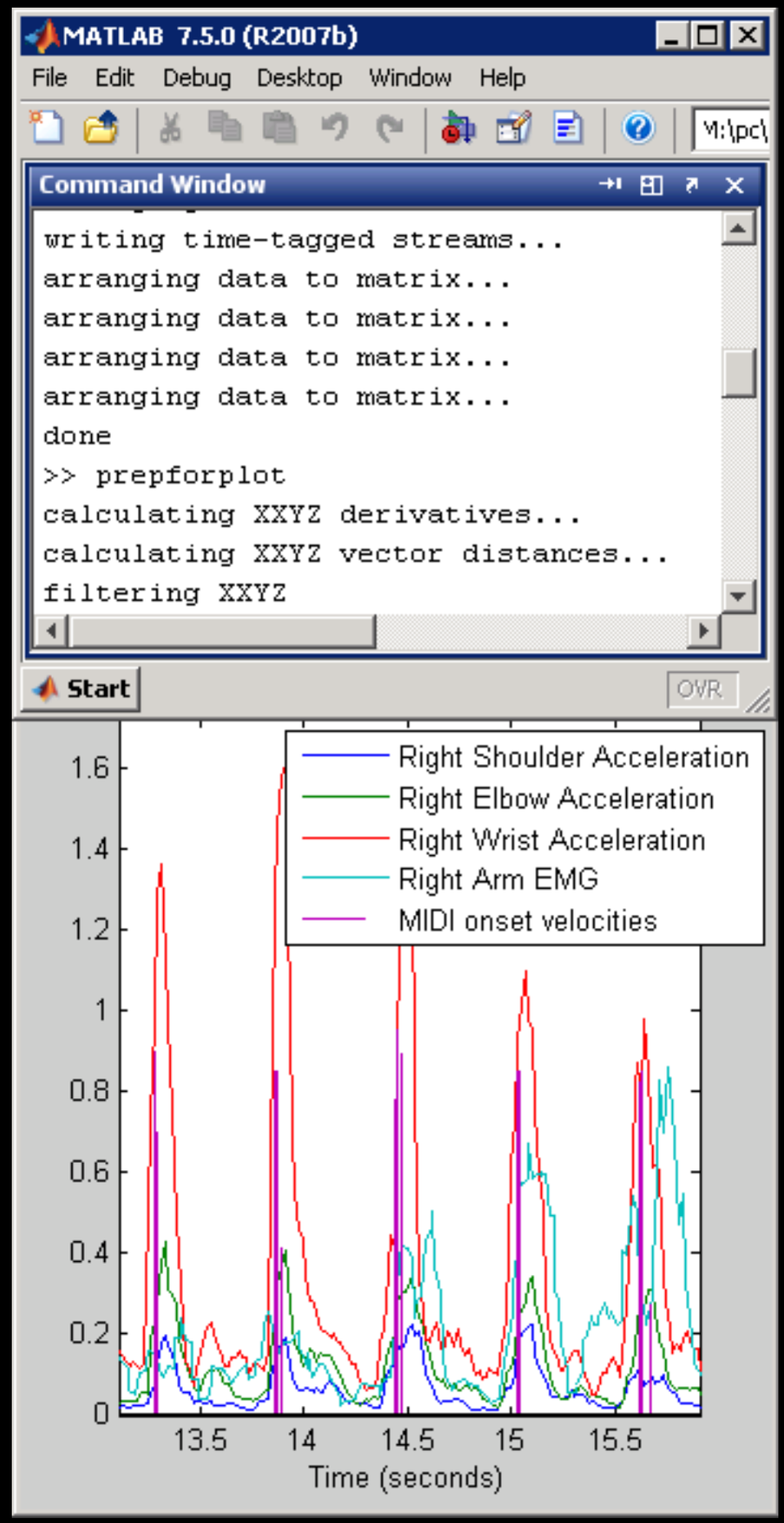
Max: FTM +Jamoma

Musical Gestures Toolbox

Musical Gestures Toolbox



Max: FTM +Jamoma

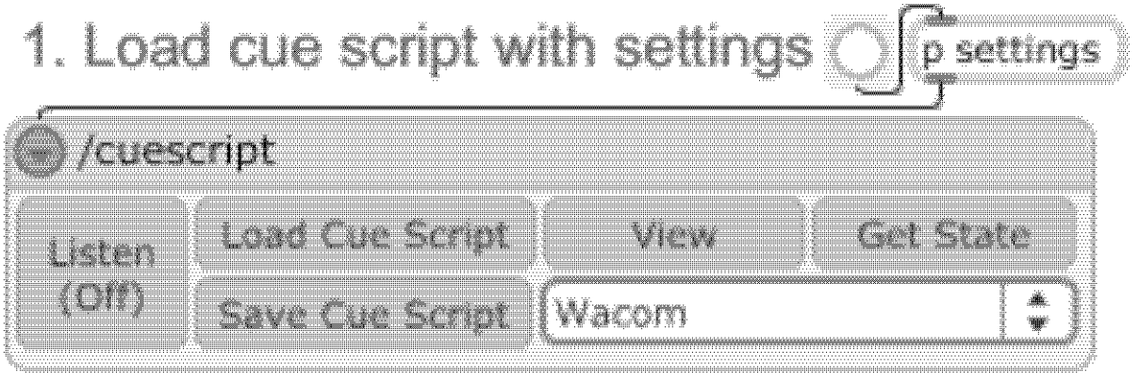


Matlab

The patch can playback sound, and will record data from several input devices, as well as audio and video, synchronised in one S/GDIF file.

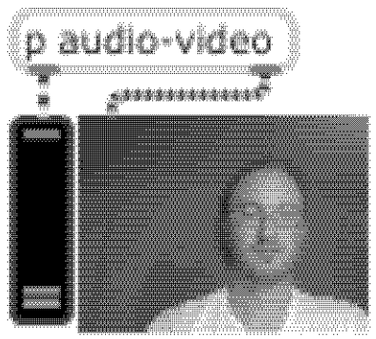
(STSH) from the 20
Interaction Design (SI
Stockholm, 20 June -

1. Load cue script with settings

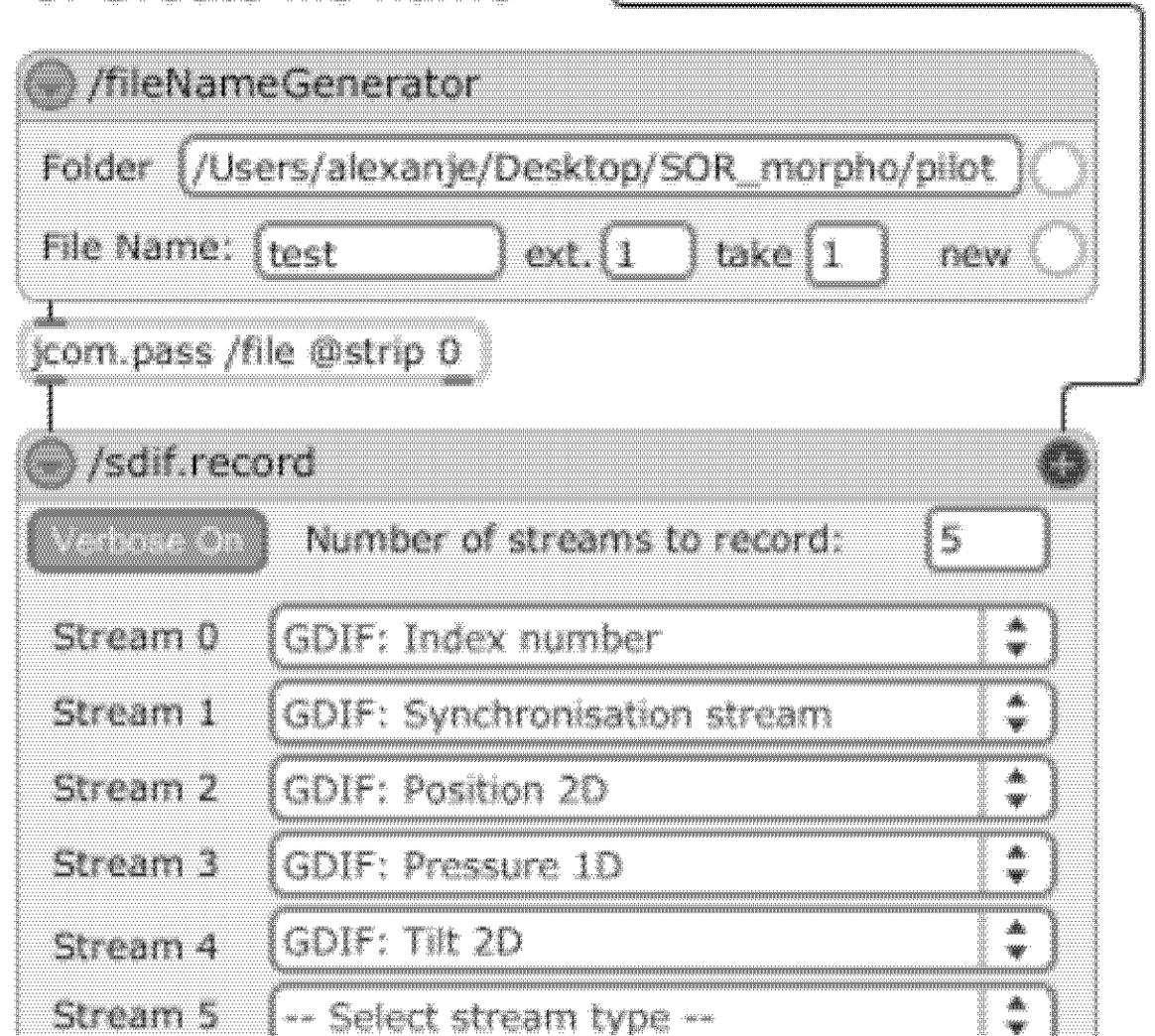


2. Check input device

3. Check audio and video



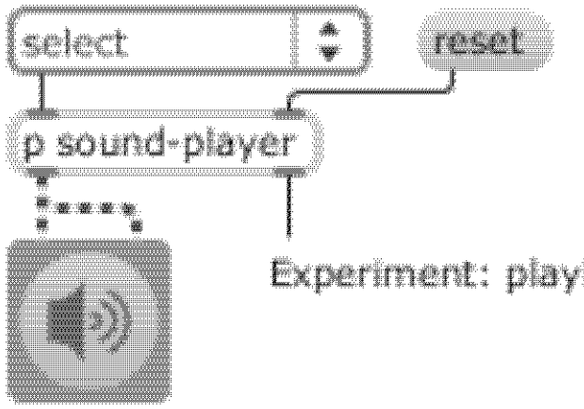
3. Create file name



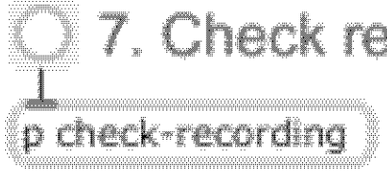
4. Type in information in the Name Value Tables

6. Start experiment

Press spacebar for next sound.
R for repetition.



7. Check recording



To-do:
- The cuescript loads the right streams
they are not selected.
- Fix issues with oscnet
- Normalize sounds?
- sdif.record: Fix problems when chang
number of streams, reducing from 5 to
creates problems

Things to think about:
- Same volume
- headphones or speakers?

1. Choose an SDIF file

2. Choose what SDIF stream(s) to read

3. Use the control functions in the left module to control play, stop, pause, position and speed

pendialog

set $1, print

s file

repend /file

ftm.sdif.info @outnvt $nvt

/play $1

/sdif.play.XIDX

tream XIDX (with 1 rows and 1 columns)

peed 1. gael-wacom-voice2.sdif

/sdif.play.XPO2

Stream XPO2 (with 1 rows and 2 columns)

Speed 1. gael-wacom-voice2.sdif

/sdif.play.XPR1

Stream XPR1 (with 1 rows and 1 columns)

Speed 1. gael-wacom-voice2.sdif

/sdif.play.XSNC

Stream XSNC (with 1 rows and 1 colu

Speed 1. gael-wacom-

com.oscroute /time

16956.

m.iter @mode row

50 sound index

s sound-index

p sound-playback

playing file number 50 , 2 files played.

ile_number $1

/fileBrowser1

"/Users/alexanje/In

ll depth 1 01_ga_ex_explosions_mix_1...

com.oscroute /file

jcom.oscroute /number_items

pen $1, 1

0

fplay~

p lcd-maker

p video-player

To-do:

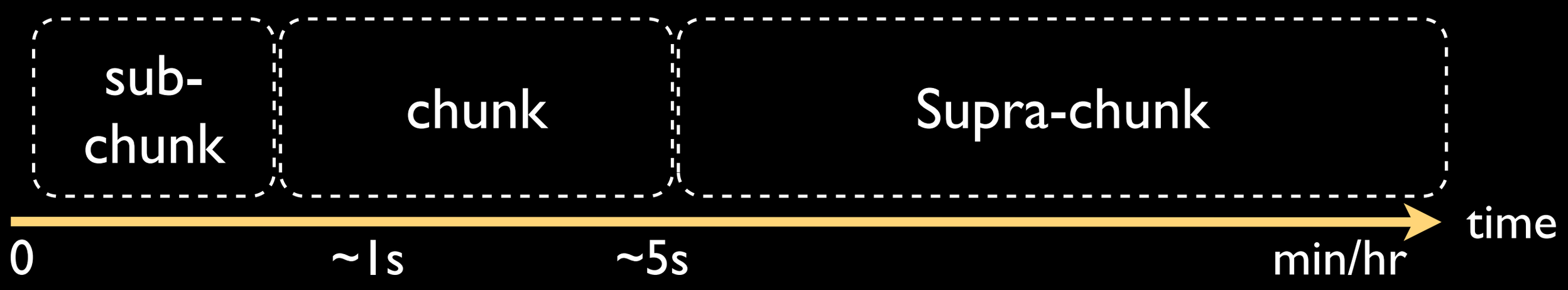
- add soundfilename to file?
- add soundfolderpath to NVT?

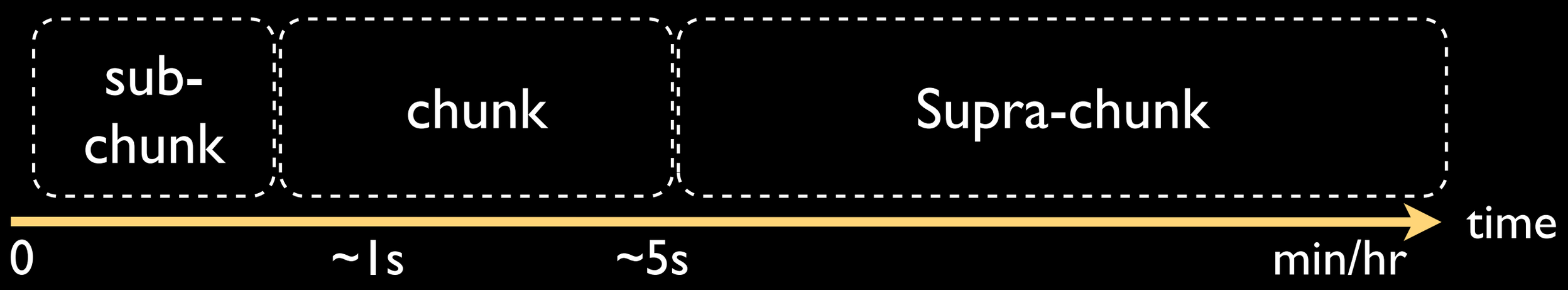
Visualization & Navigation

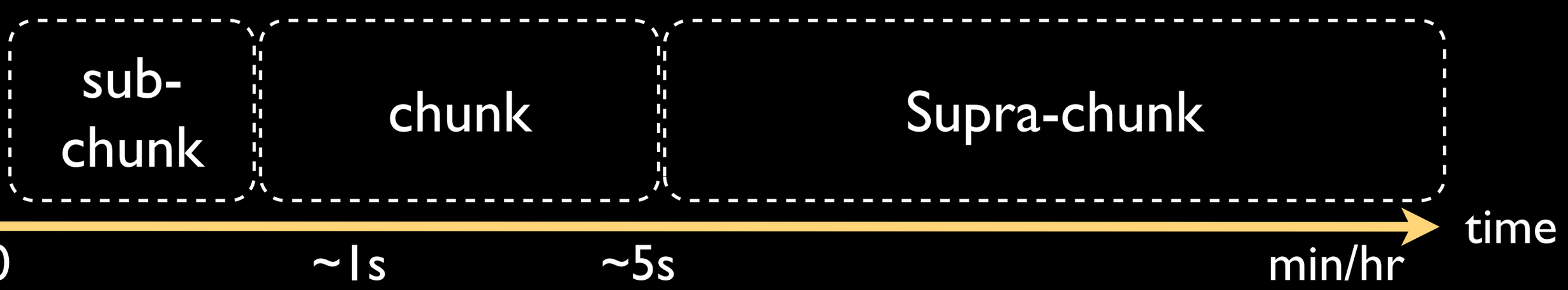

time
0
~1s
~5s
min/hr

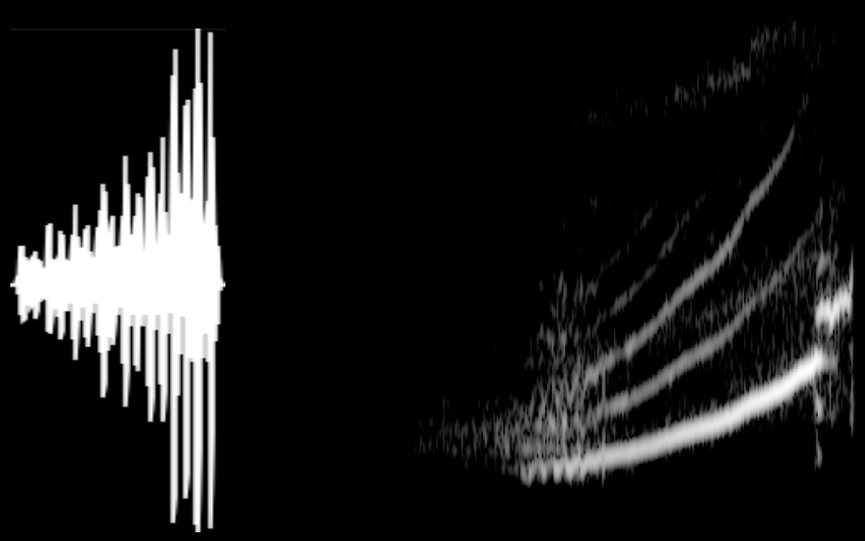

sub-
chunk
time
0
~1s
~5s
min/hr

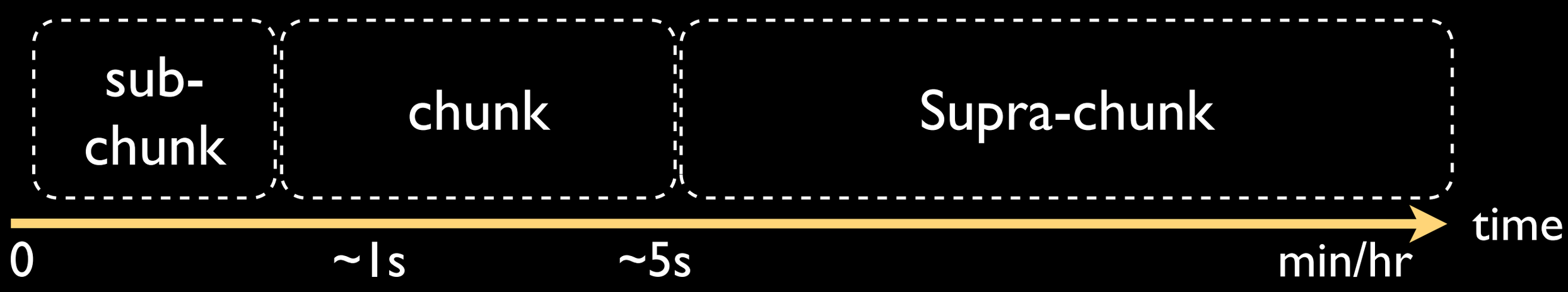

sub-
chunk
chunk
time
0
~1s
~5s
min/hr

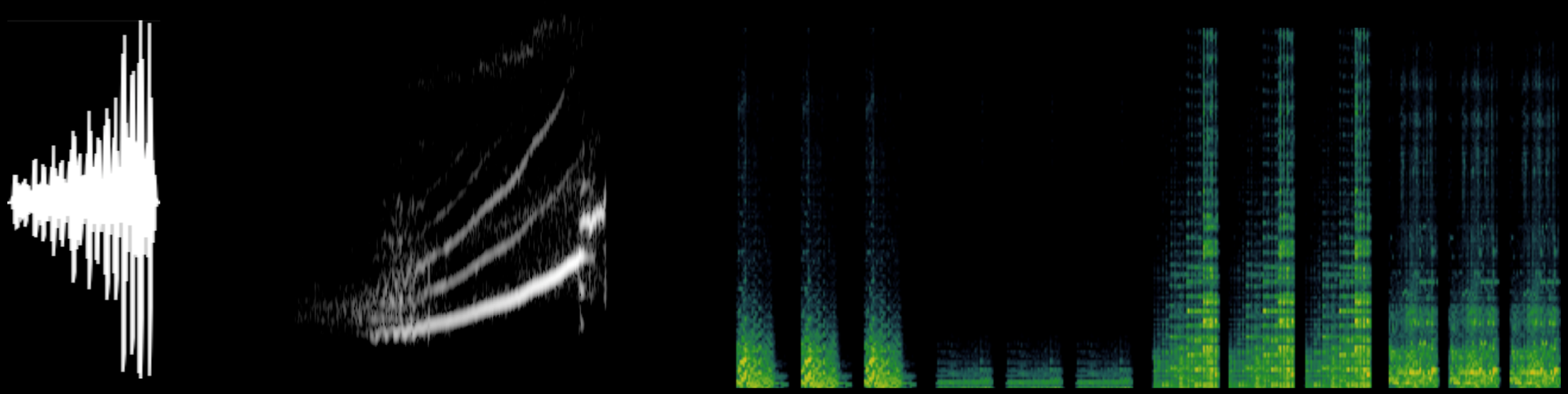

sub-
chunk
chunk
Supra-chunk
time
0
~1s
~5s
min/hr


sub-
chunk
chunk
Supra-chunk
time
0
~1s
~5s
min/hr


sub-
chunk
chunk
Supra-chunk
time
0
~1s
~5s
min/hr



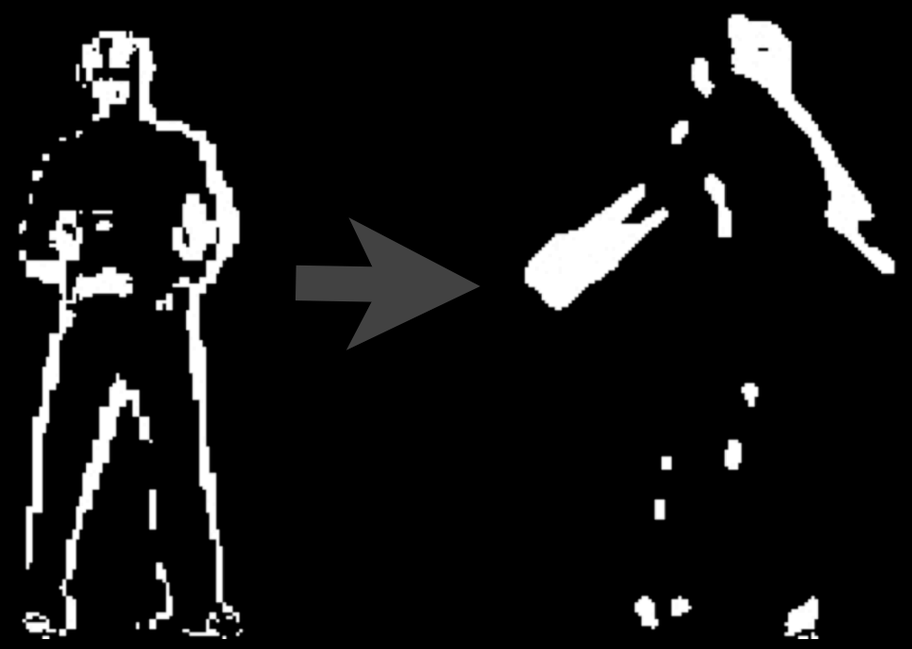

sub-
chunk
chunk
Supra-chunk
time
0
~1s
~5s
min/hr



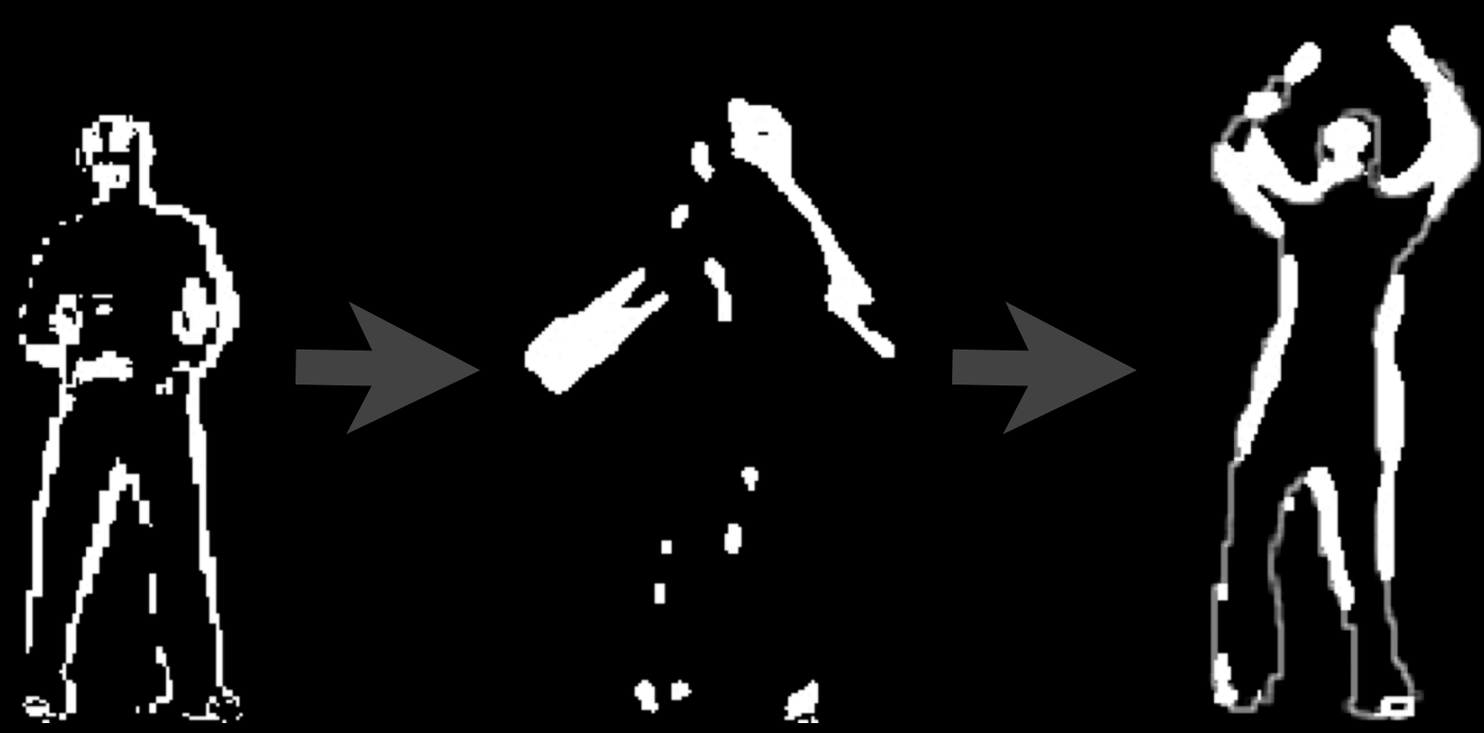
visualization of **movement**?

Video

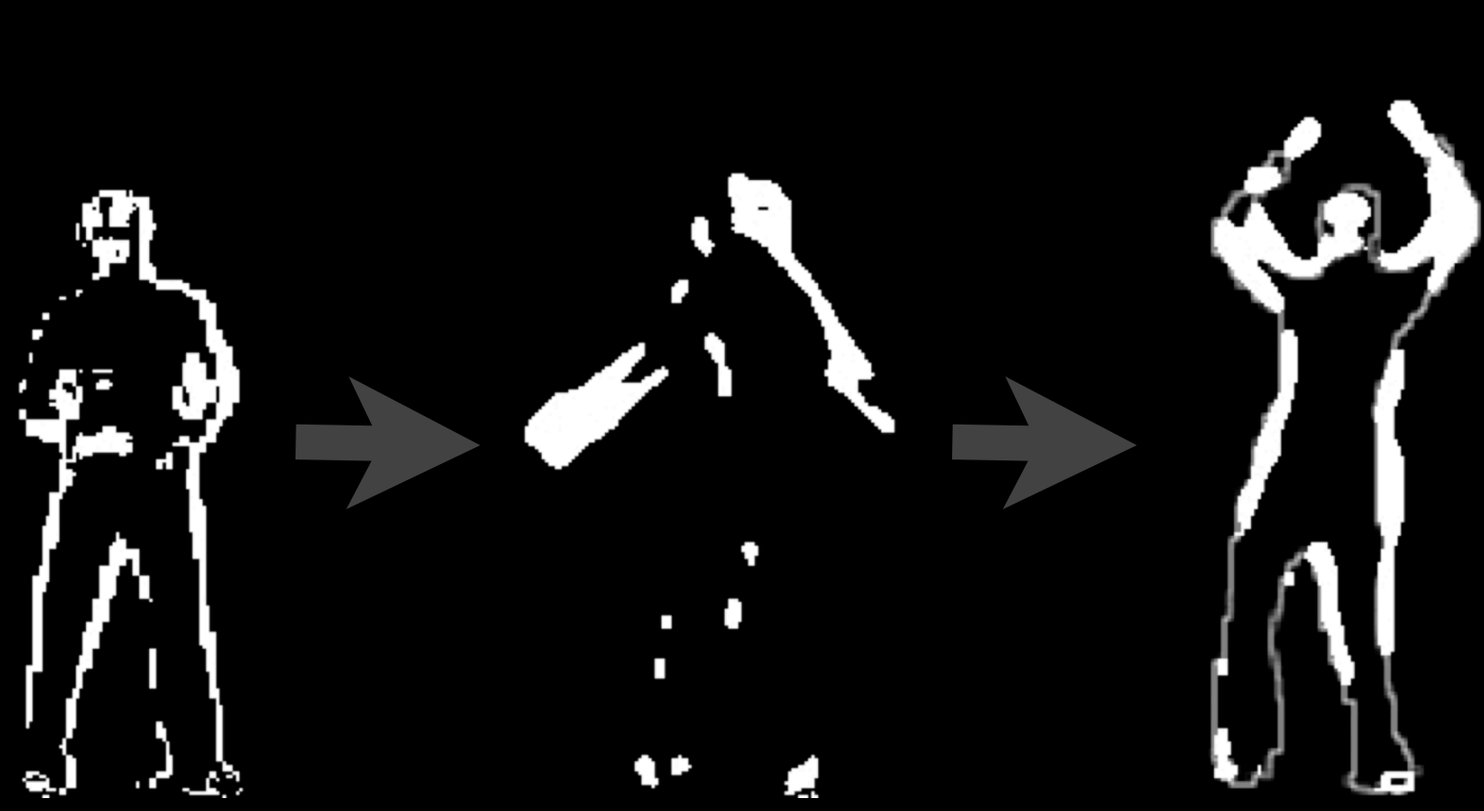
Motion Image



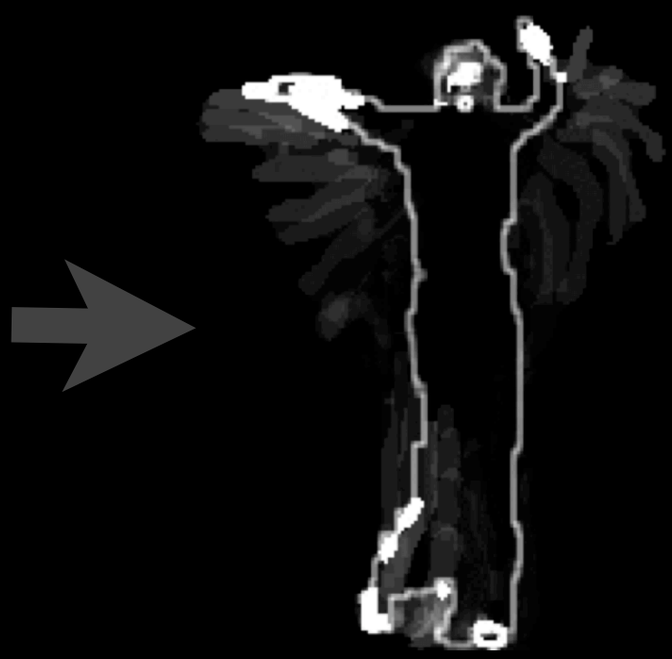
Motion Image

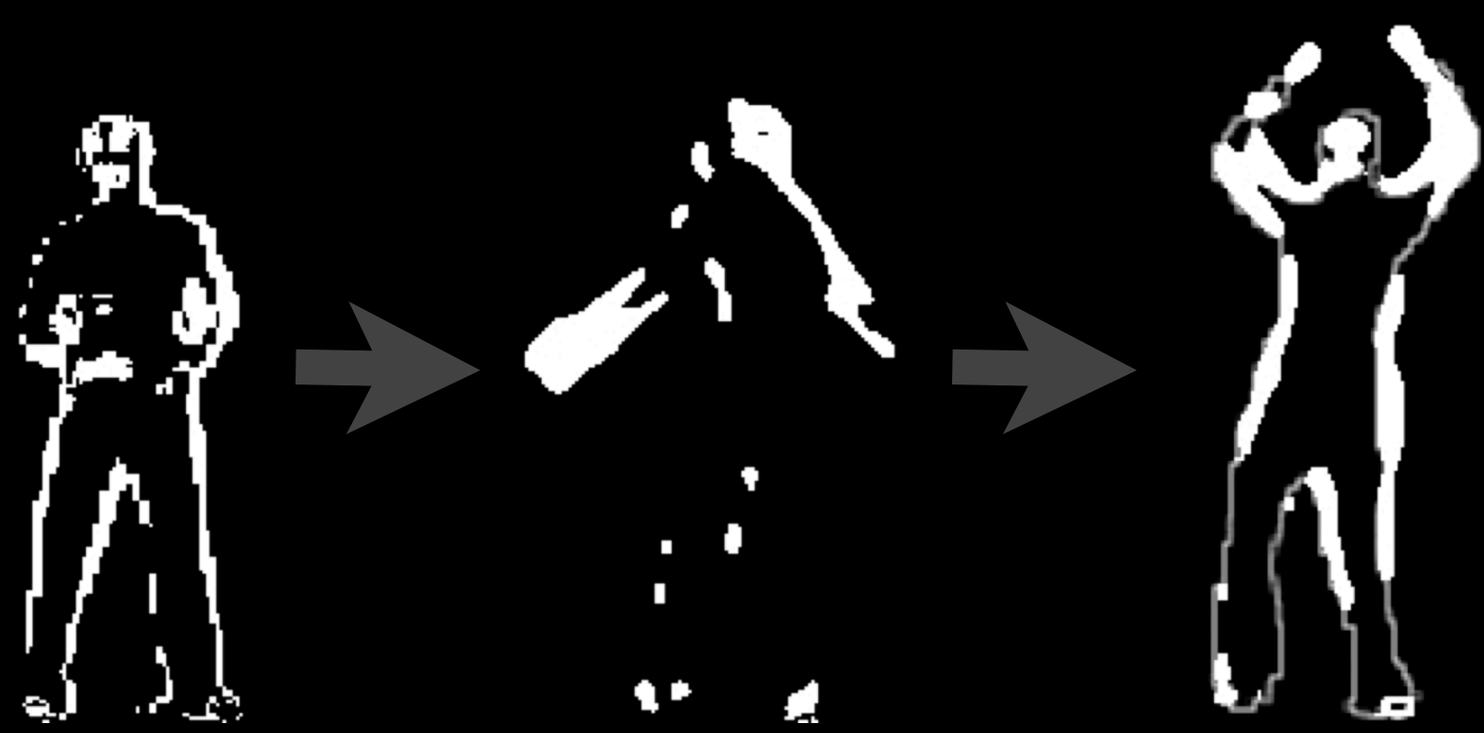


Motion Image

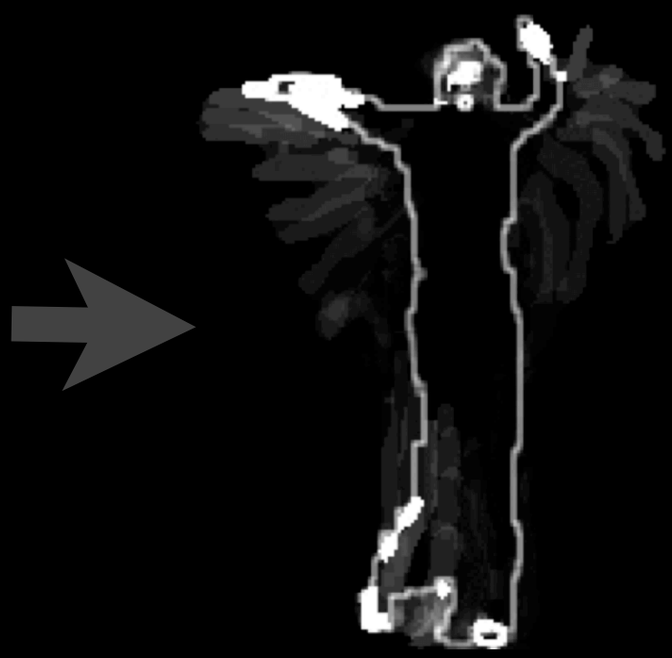


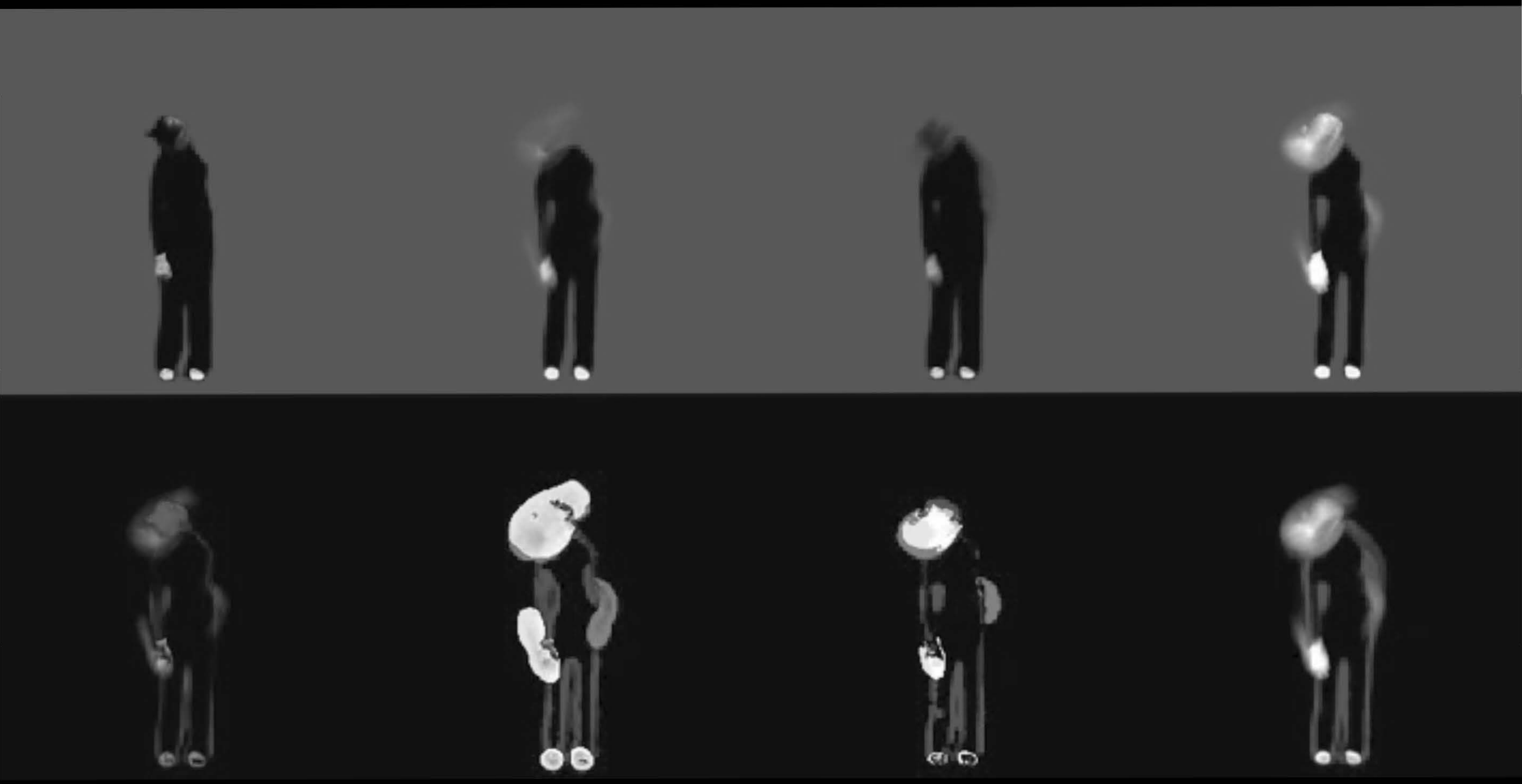
Motion Image





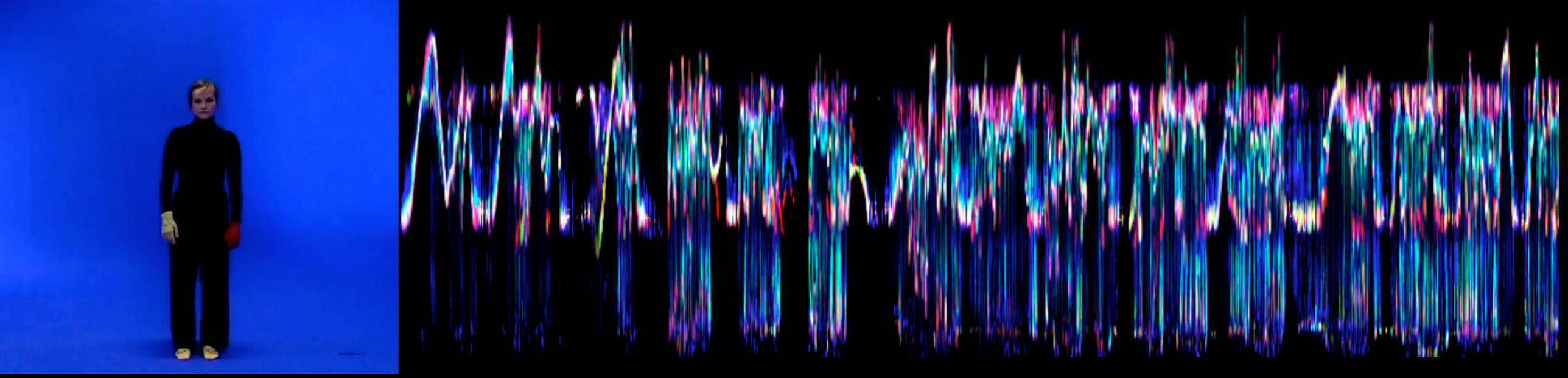
Motion Image



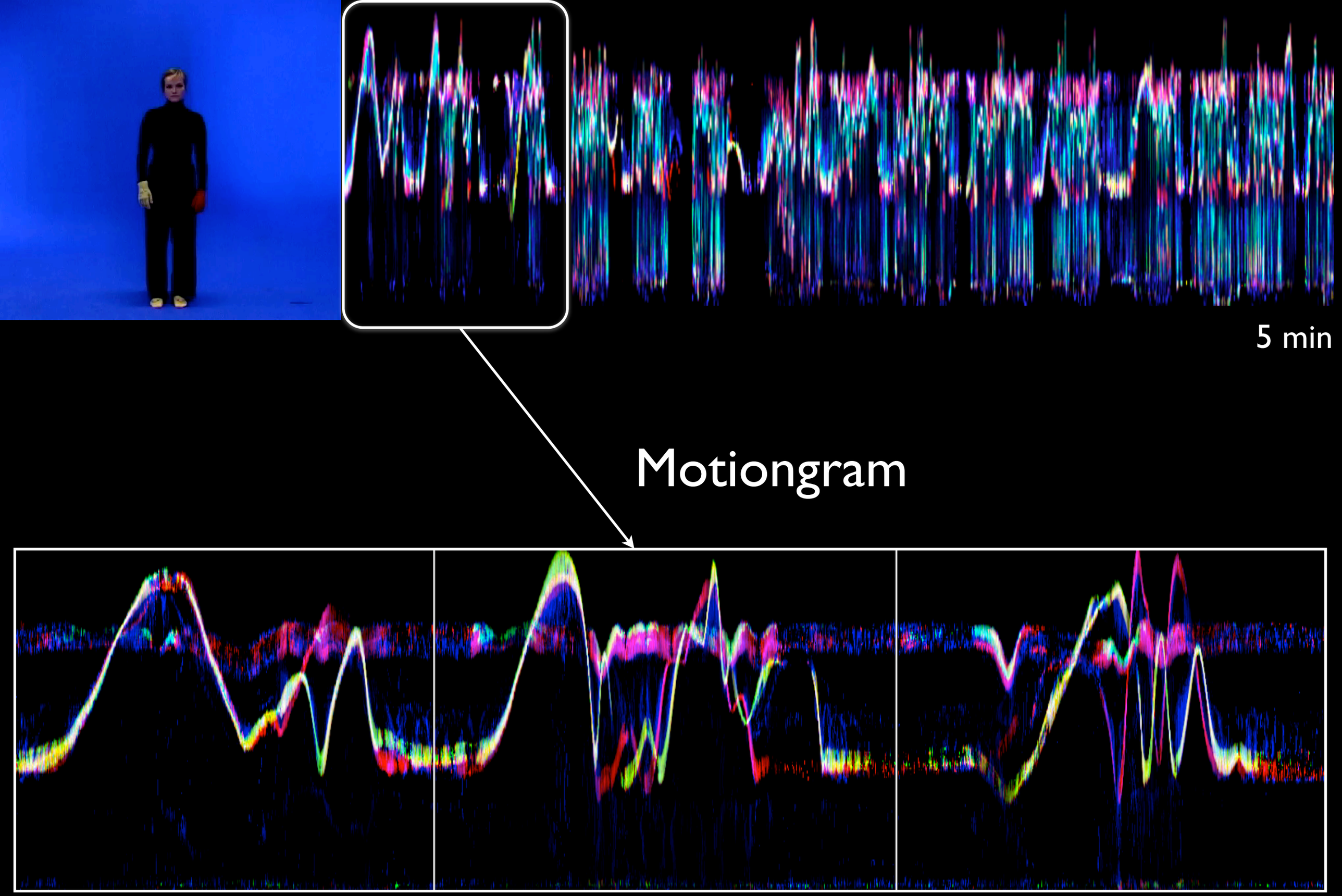


Motion History Image

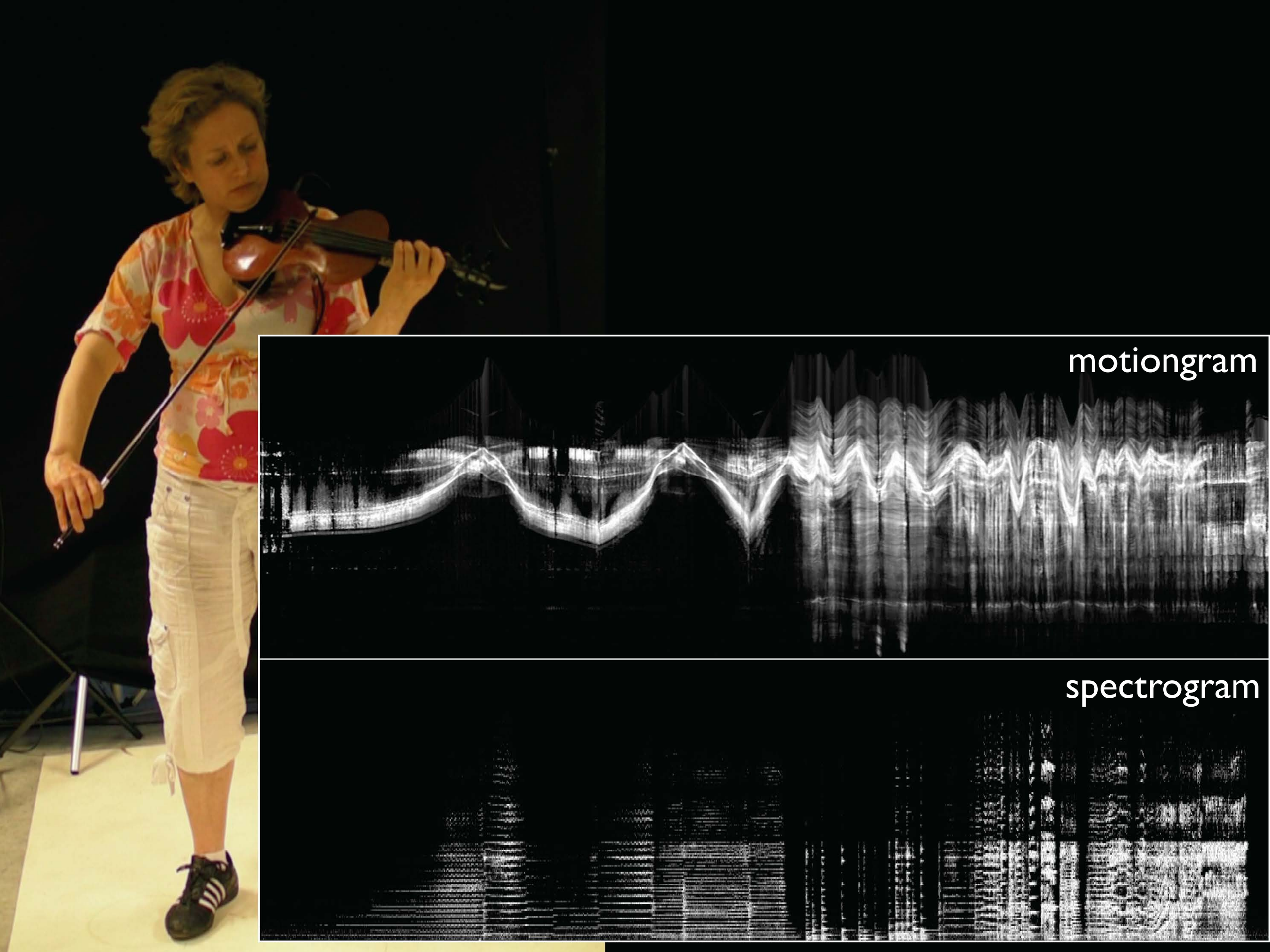
Keyframes

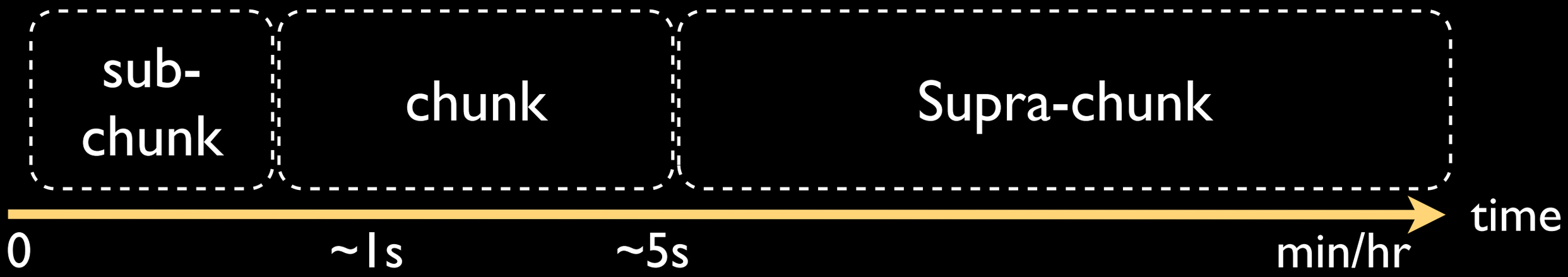


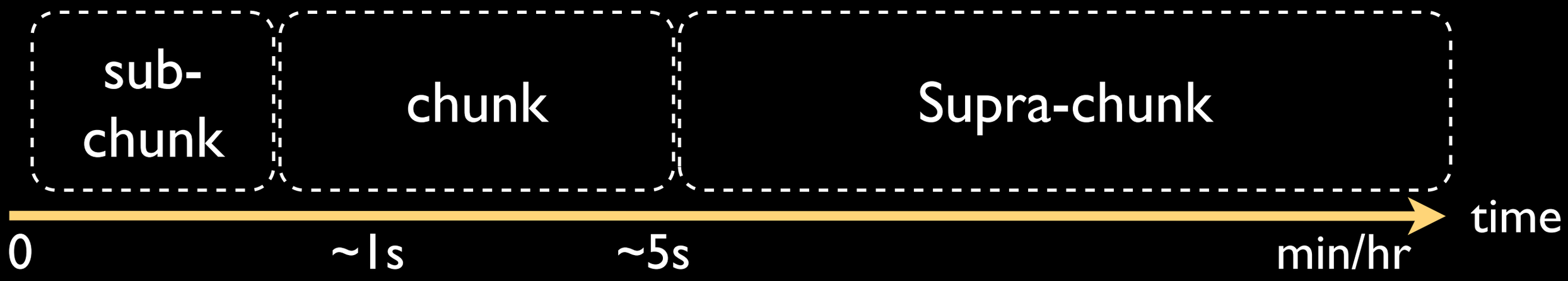
Motiongram

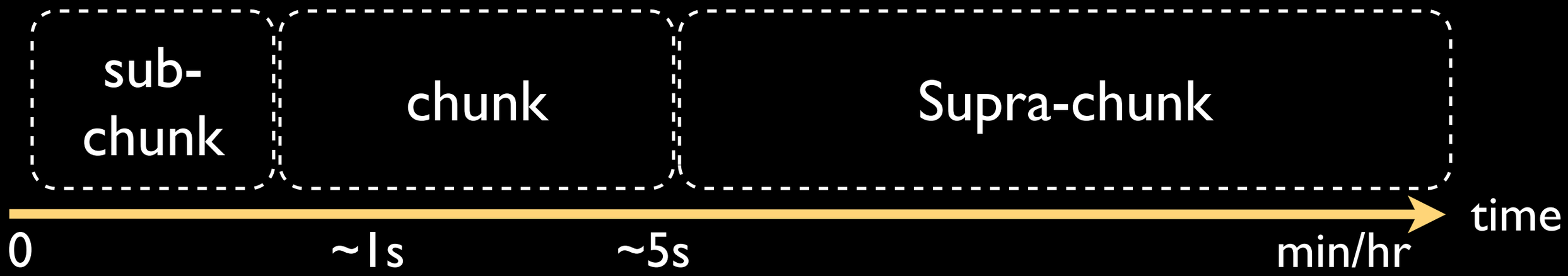

5 min
Motiongram
40 sec

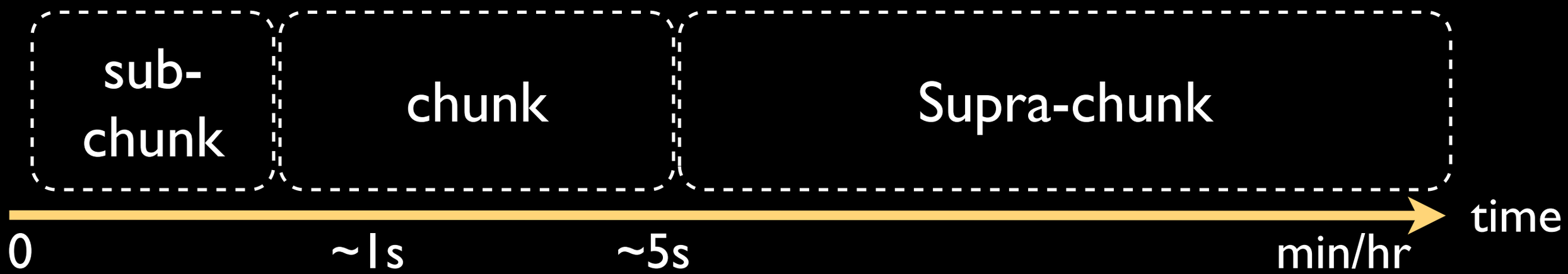

spectrogram

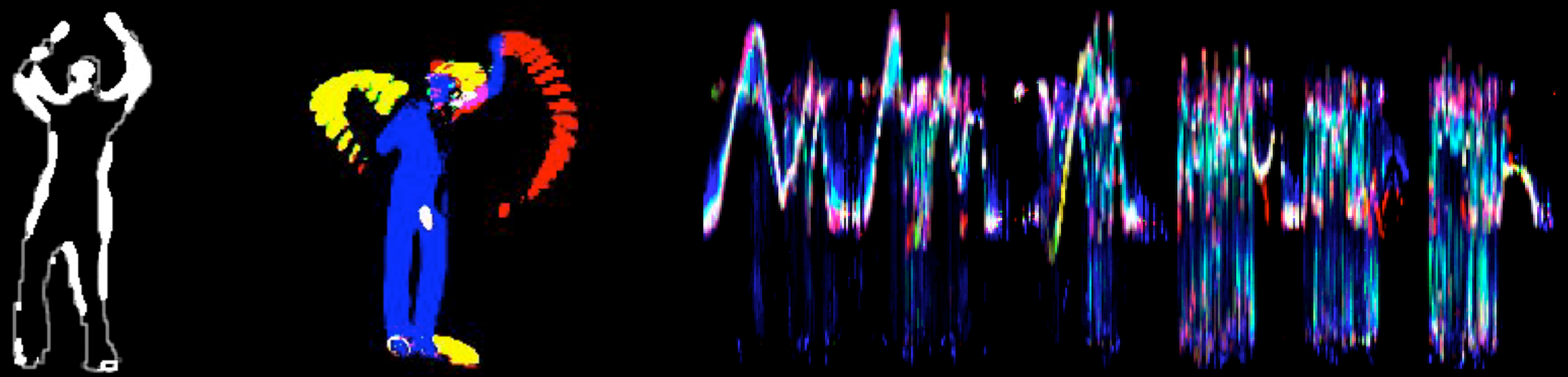

motiongram
spectrogram


sub-
chunk
chunk
Supra-chunk
time
0
~1s
~5s
min/hr


sub-
chunk
chunk
Supra-chunk
time
0
~1s
~5s
min/hr


sub-
chunk
chunk
Supra-chunk
time
0
~1s
~5s
min/hr


sub-
chunk
chunk
Supra-chunk
time
0
~1s
~5s
min/hr

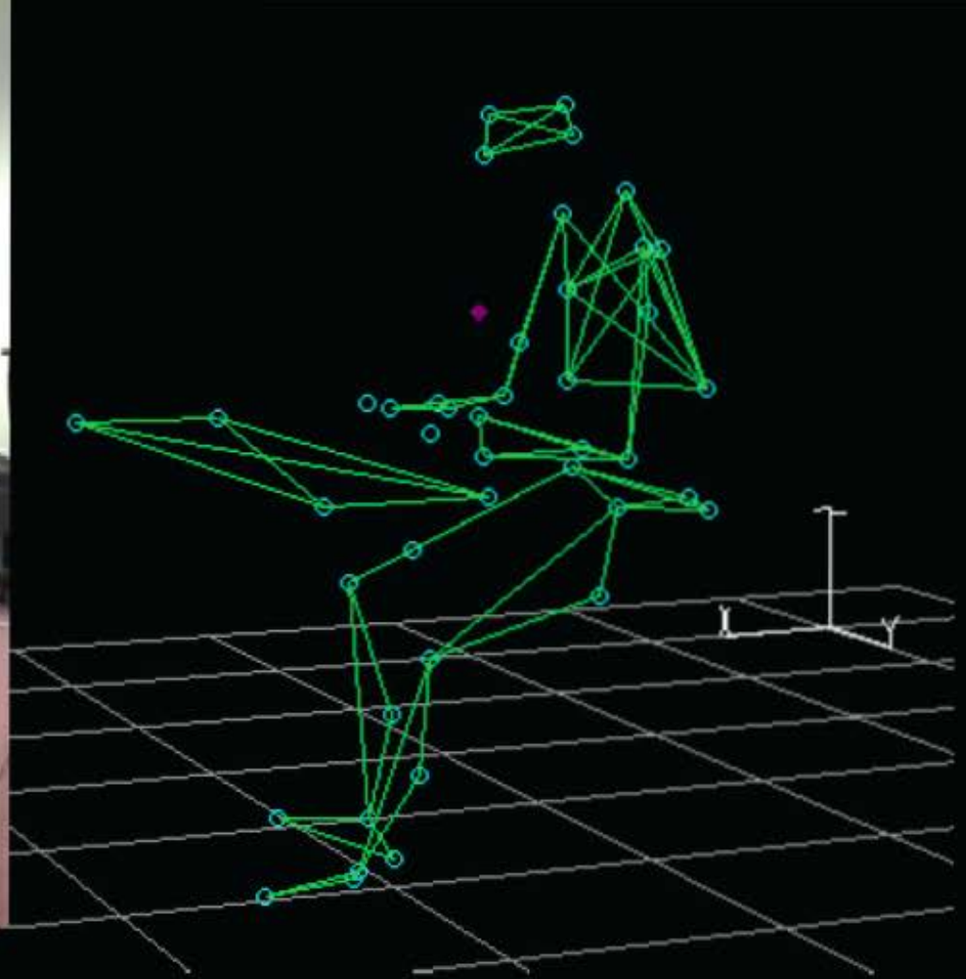


visualization of **MoCap/sensors**

?

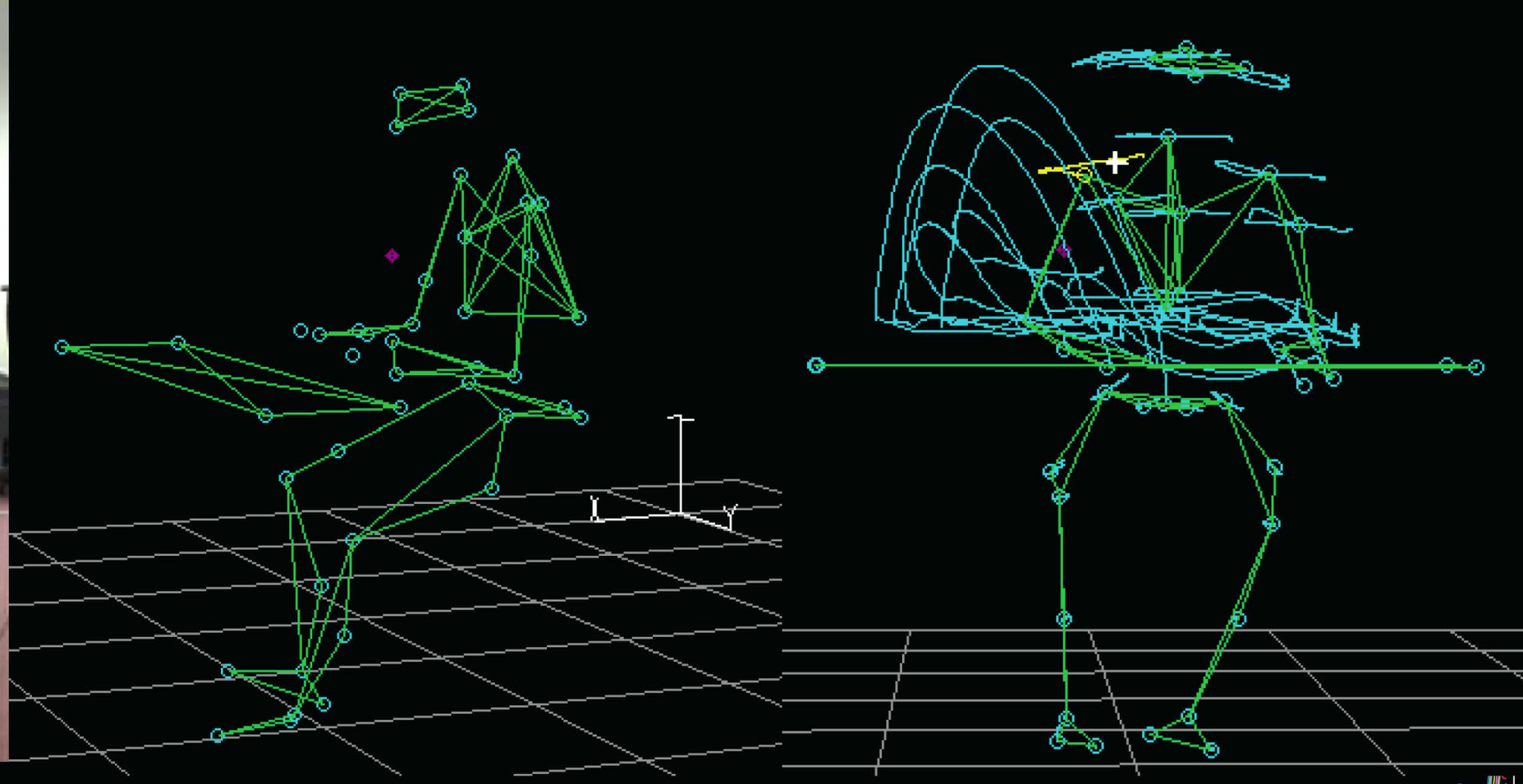

YAMAHA

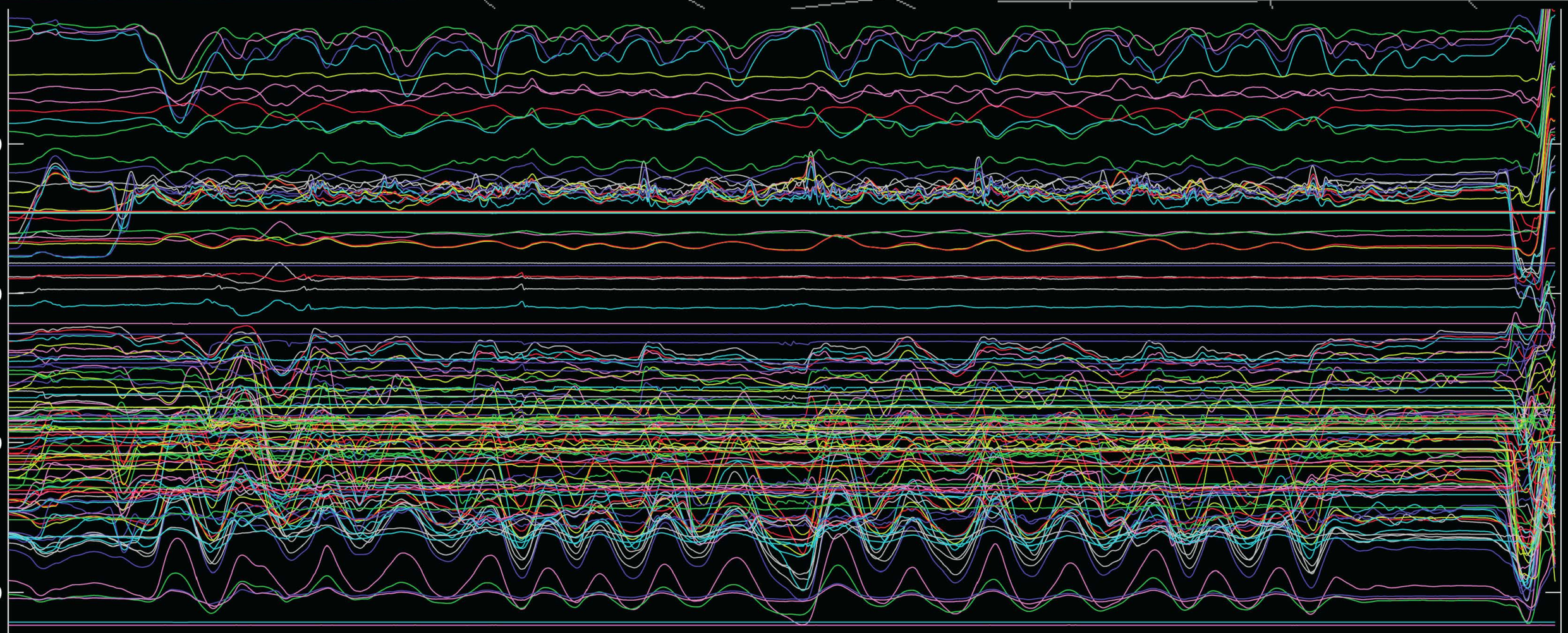

YAMAHA



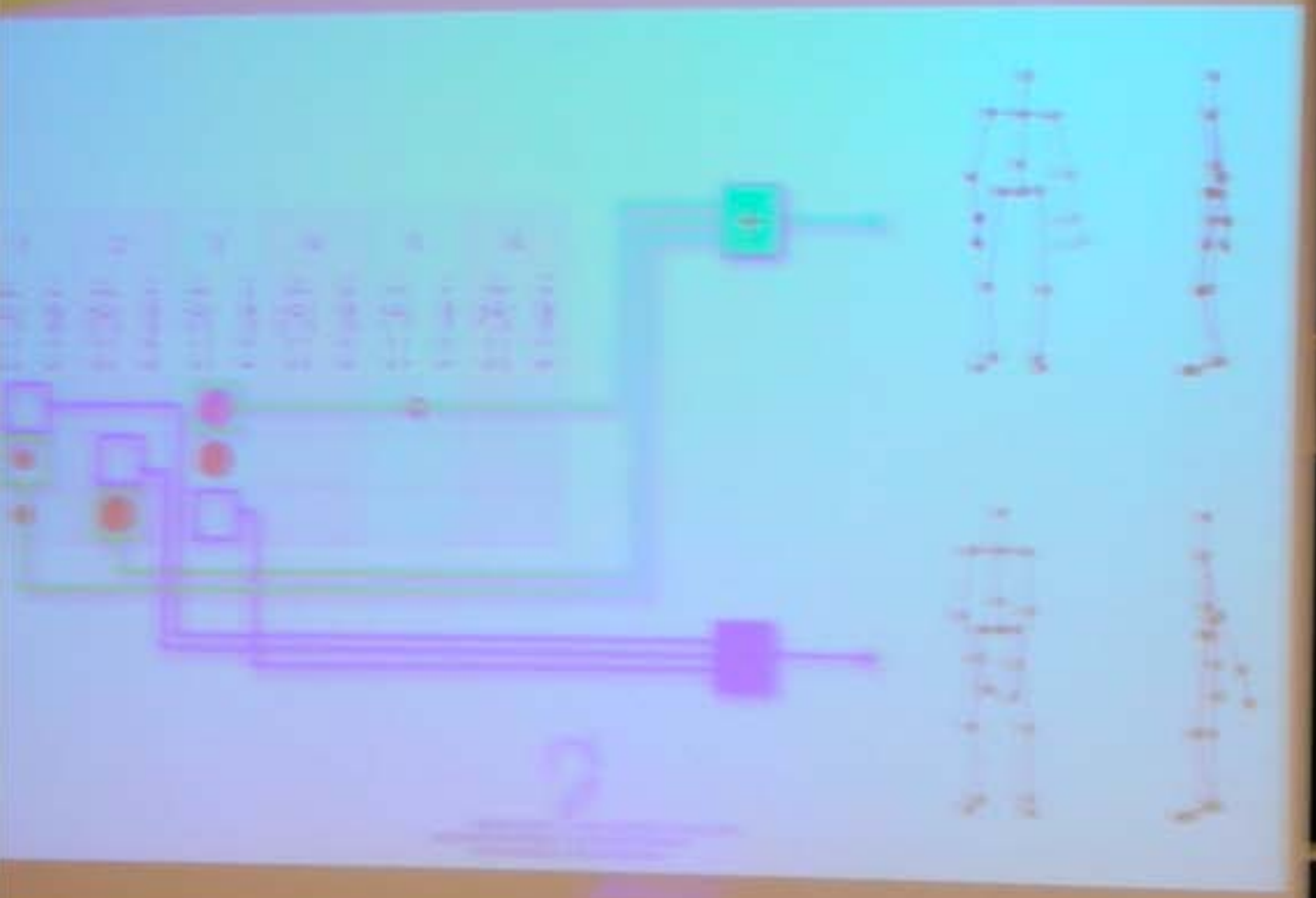

YAMAHA


YAMAHA




1000
500
0
−500

Movement Synthesis with Linear Combinations of Eigeneigenmovements



Movement Synthesis w
Combinations of Eigeneige

capture data for a single *mf* stro

shoulder

elbo

knuckle

Different

Different

number of markers

Different

number of markers

placement of markers

Different

number of markers

placement of markers

representation (XYZ, YPR)

Different

number of markers
placement of markers
representation (XYZ, YPR)
absolute/relative

Different

number of markers
placement of markers
representation (XYZ, YPR)
absolute/relative
position, acceleration

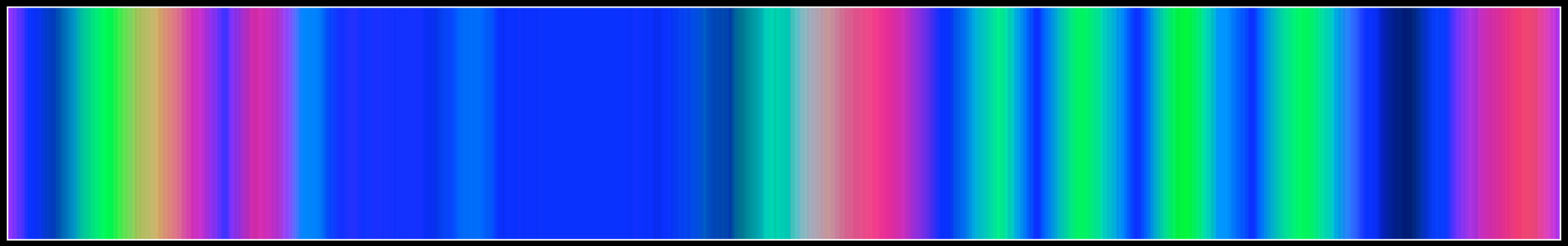
Mocapgram

Mocapgram

X = red
Y = green
Z = blue

X = red
Y = green
Z = blue

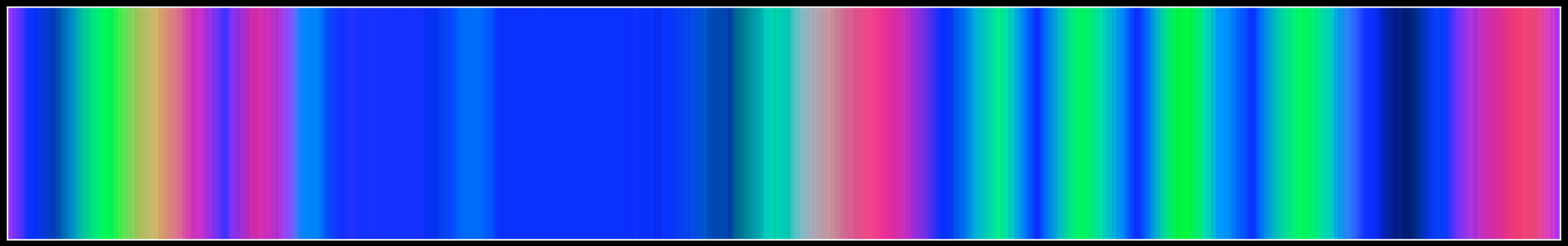
Mocapgram



3D accelerometer

X = red
Y = green
Z = blue

Mocapgram

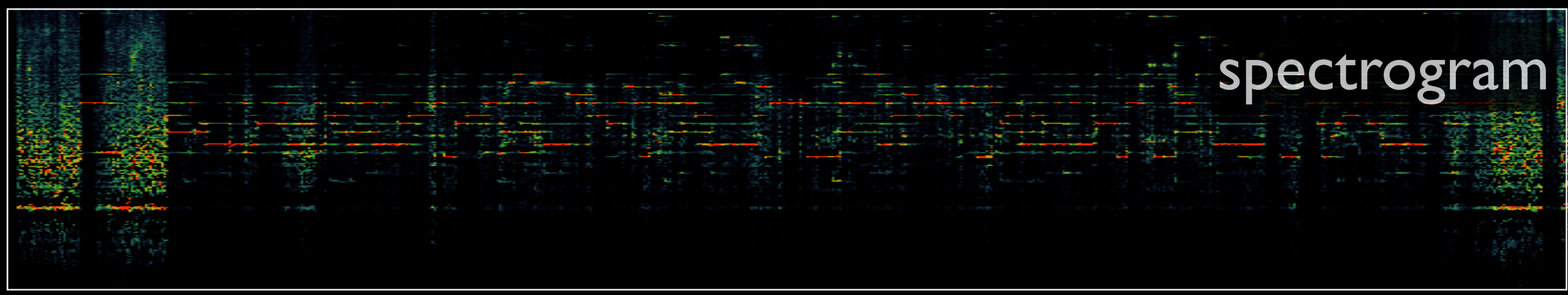


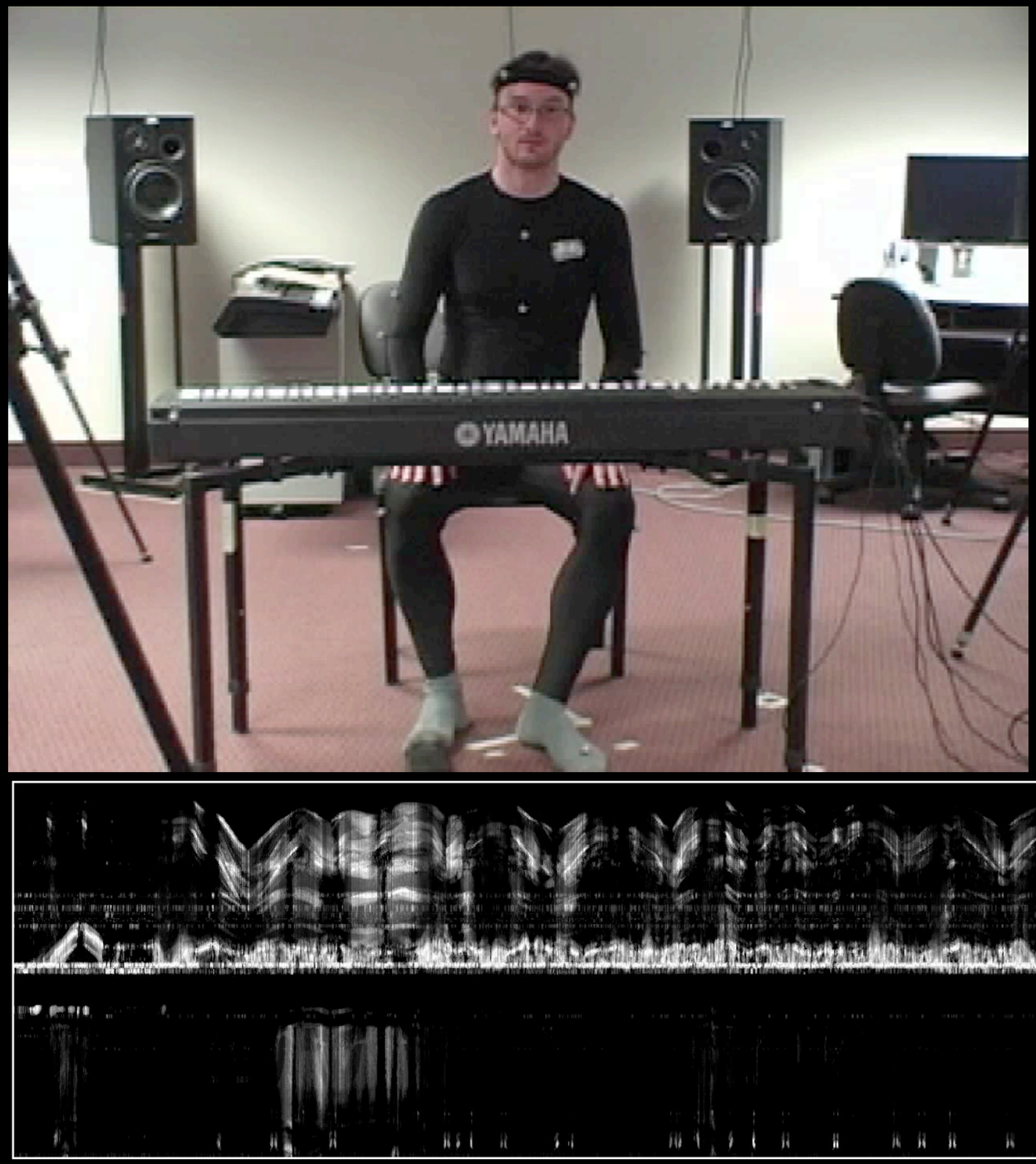
3D accelerometer

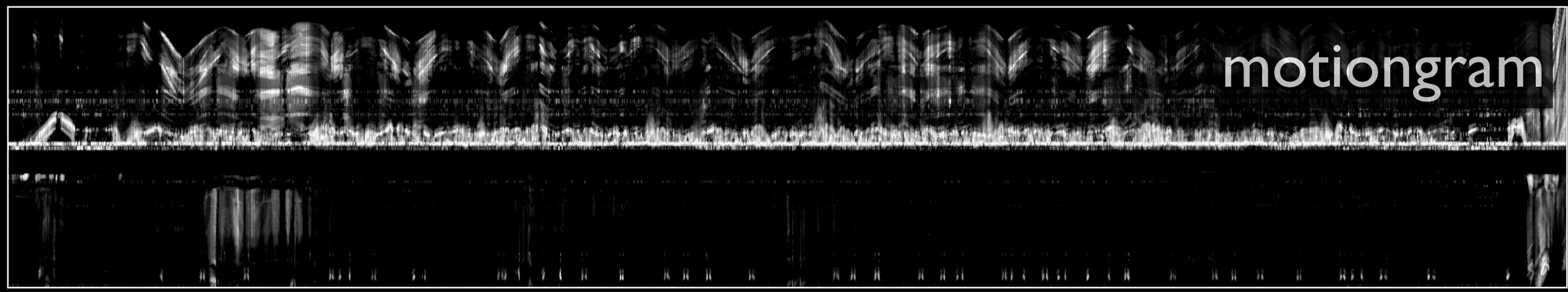
frame difference

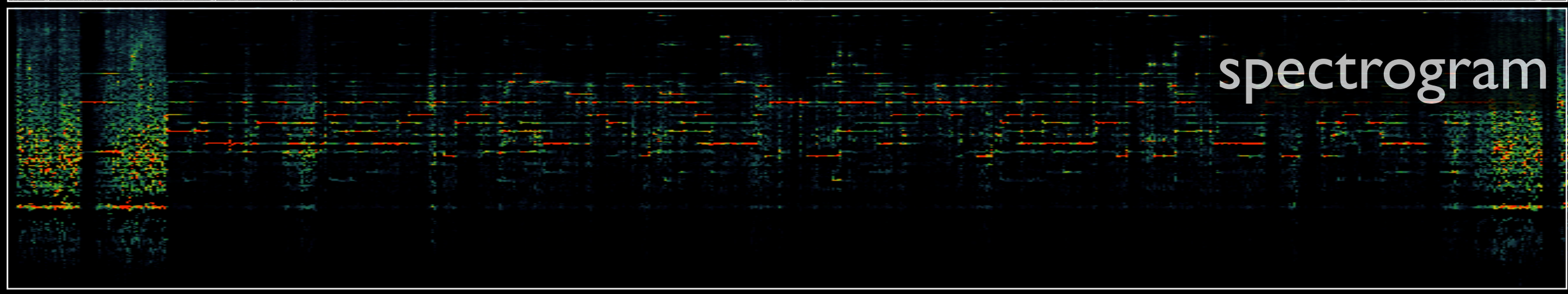

YAMAHA

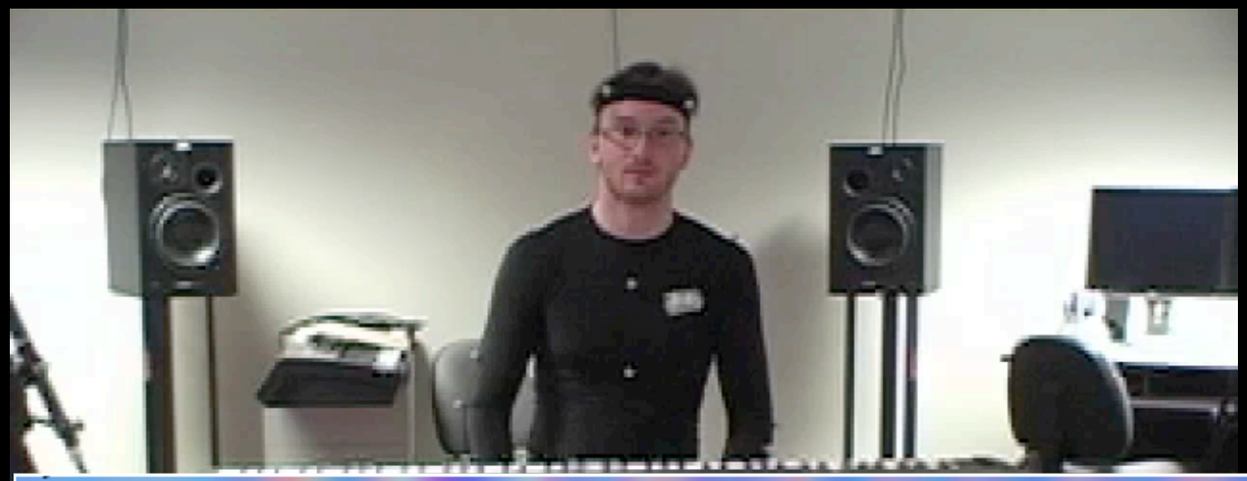

YAMAHA


spectrogram


YAMAHA


motiongram

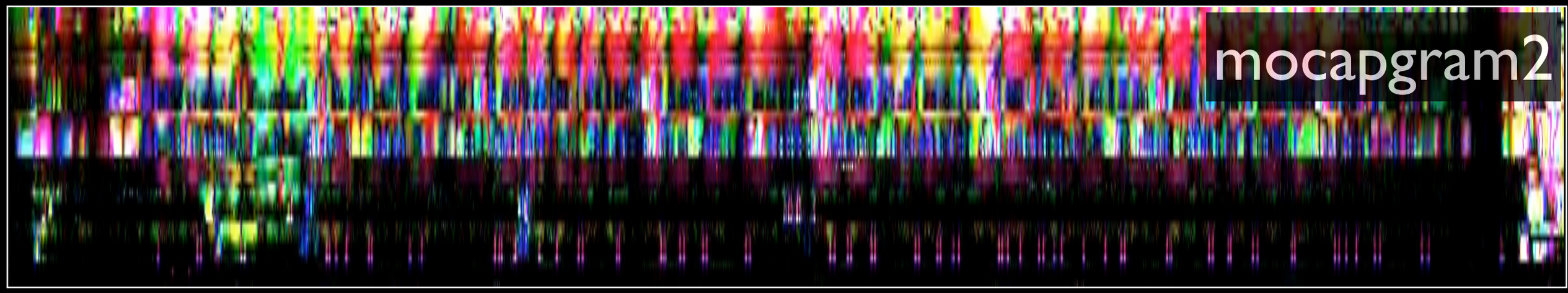

spectrogram

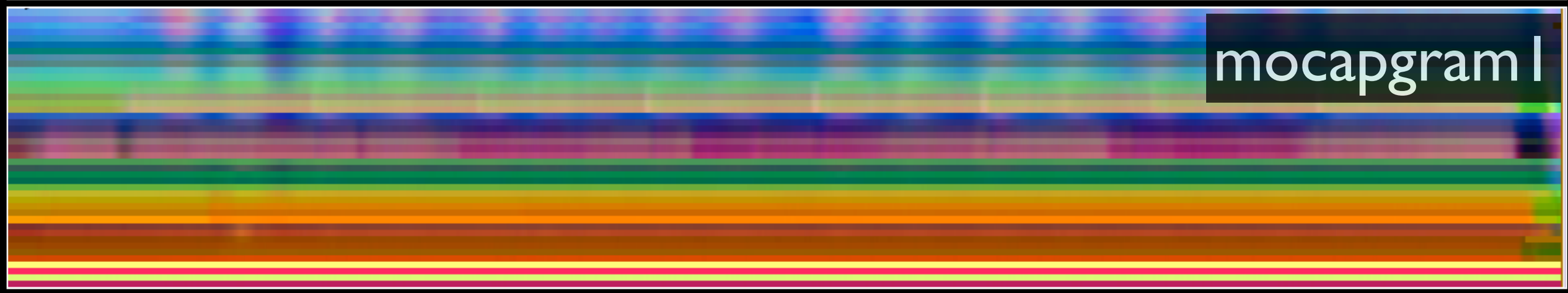


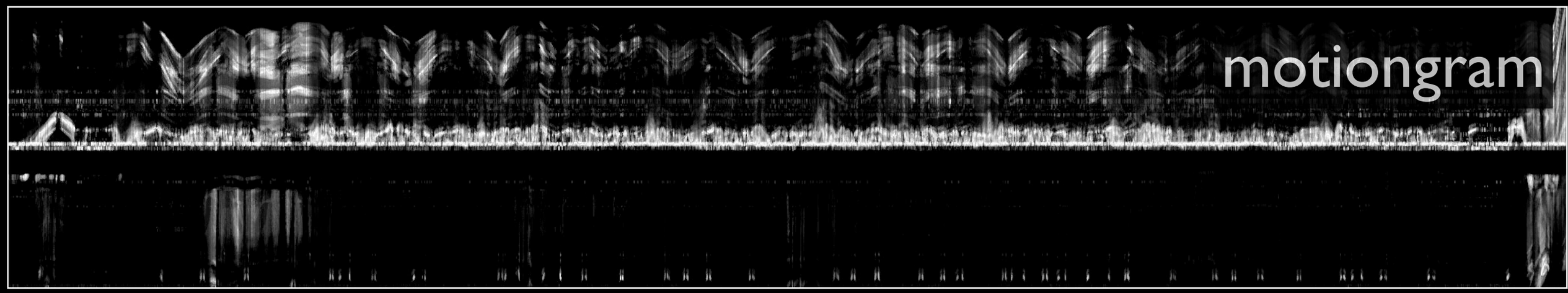
mocapgram I

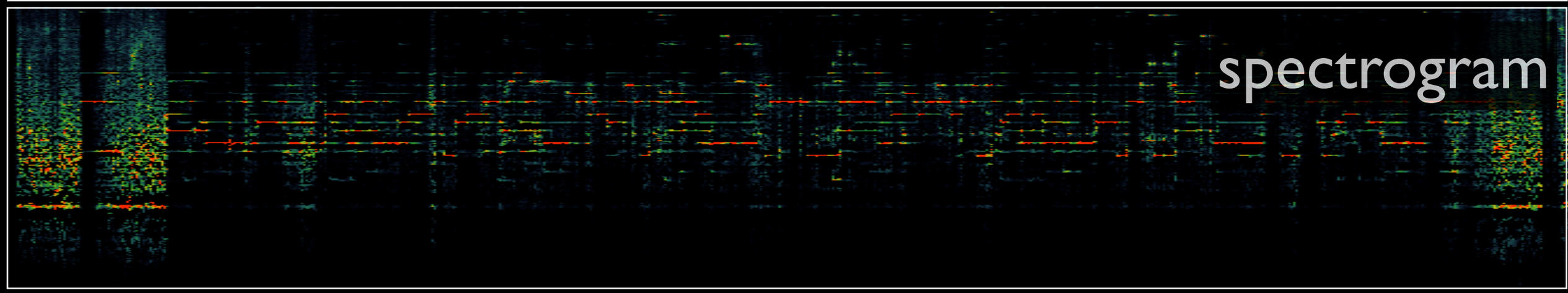
motiongram

spectrogram

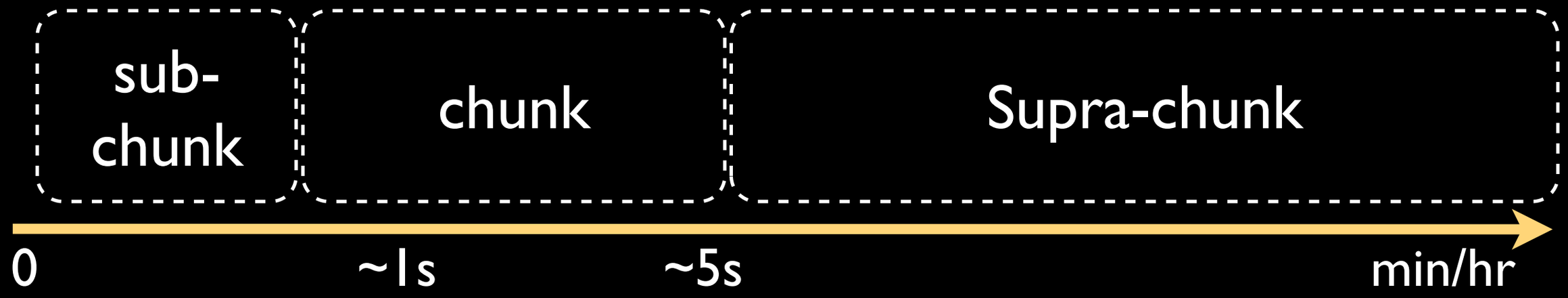

mocapgram2

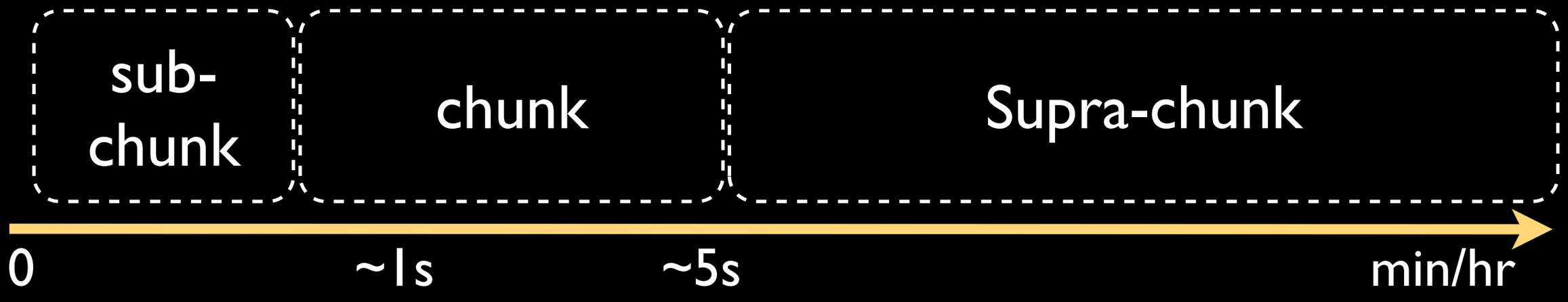

mocapgram1


motiongram

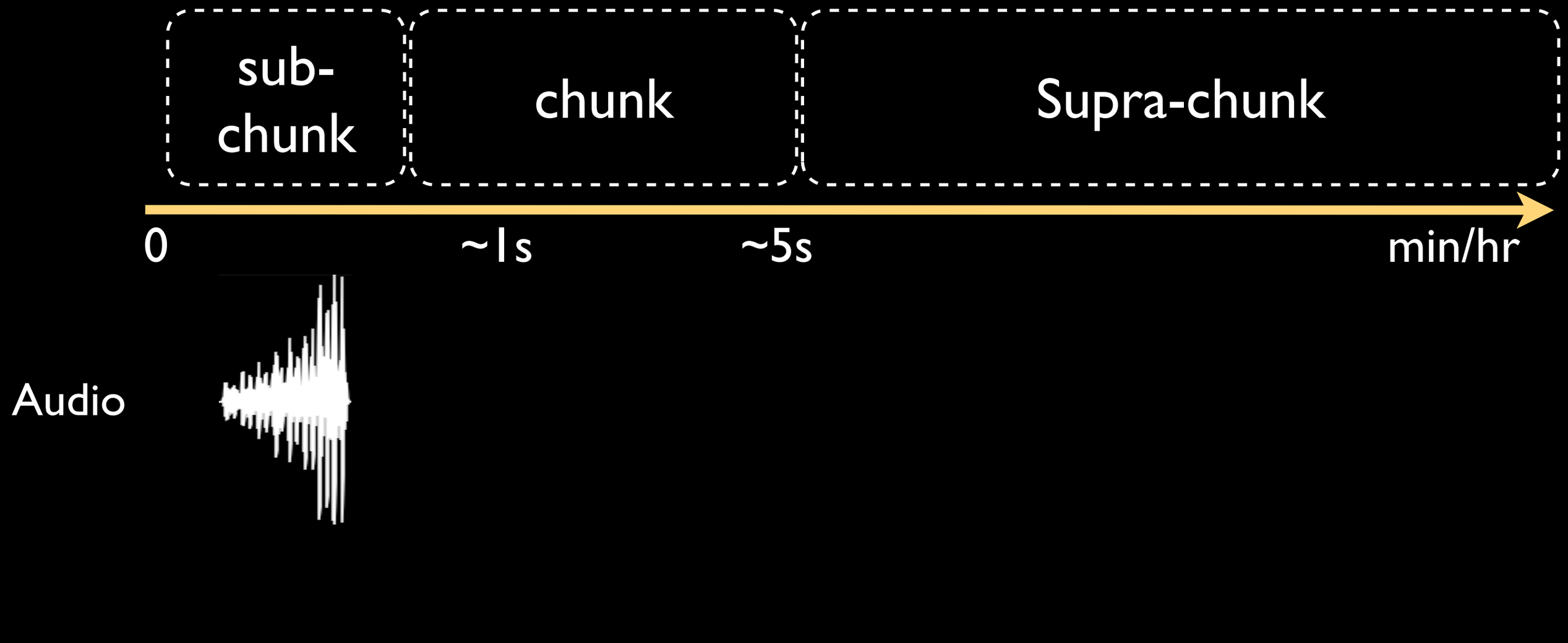

spectrogram

GDIF


sub-
chunk
chunk
Supra-chunk
0
~1s
~5s
min/hr



Audio


sub-
chunk
chunk
Supra-chunk
0
~1s
~5s
min/hr
Audio

sub-chunk

chunk

Supra-chunk

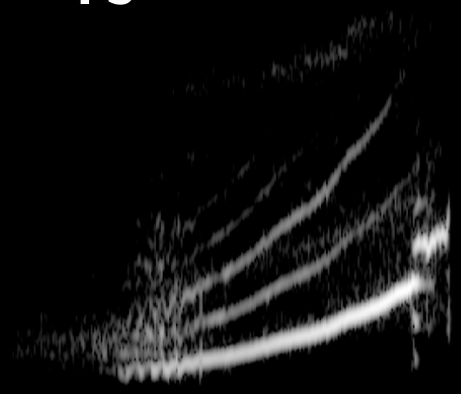
0

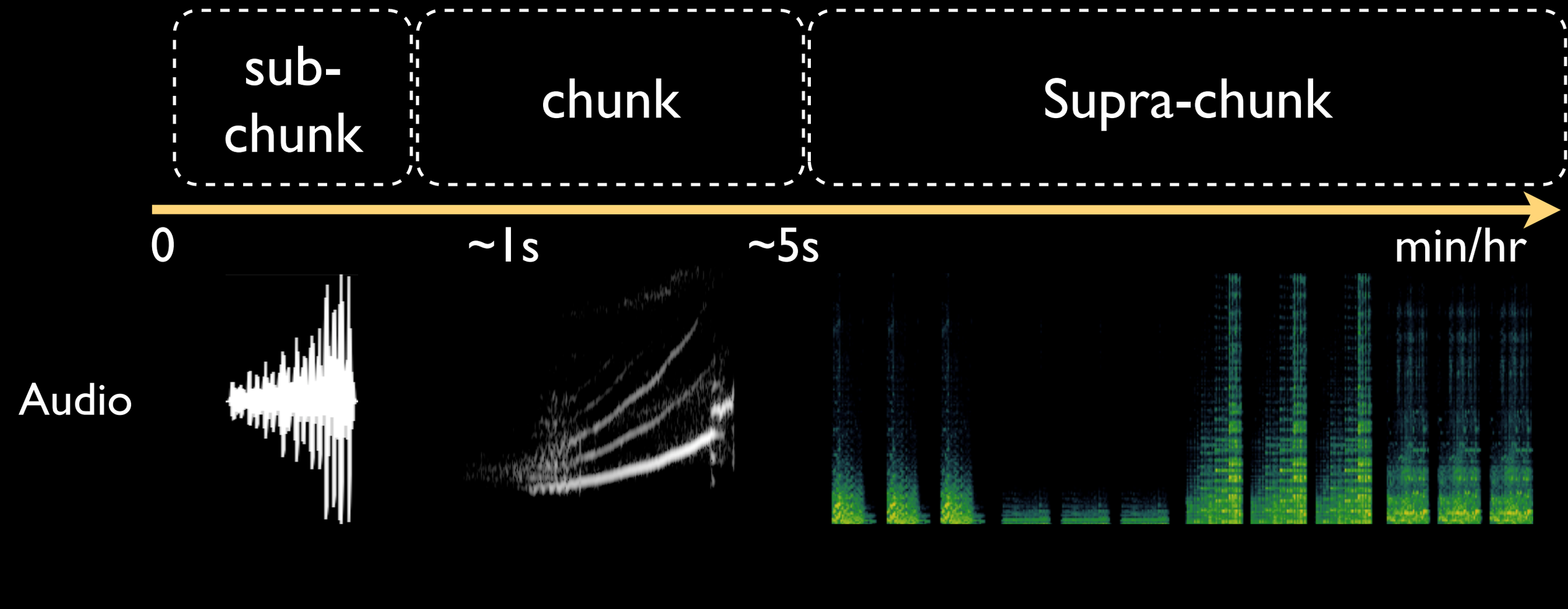
~1s

~5s

min/hr

Audio




sub-
chunk
chunk
Supra-chunk
0
~1s
~5s
min/hr
Audio

sub-chunk

chunk

Supra-chunk

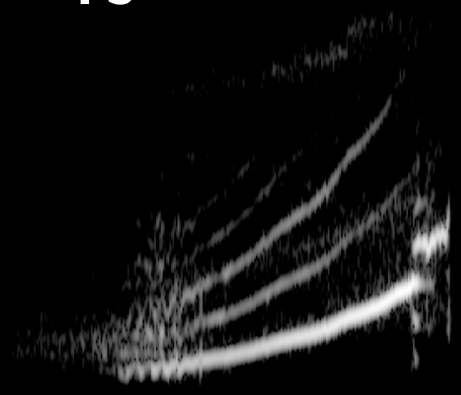
0

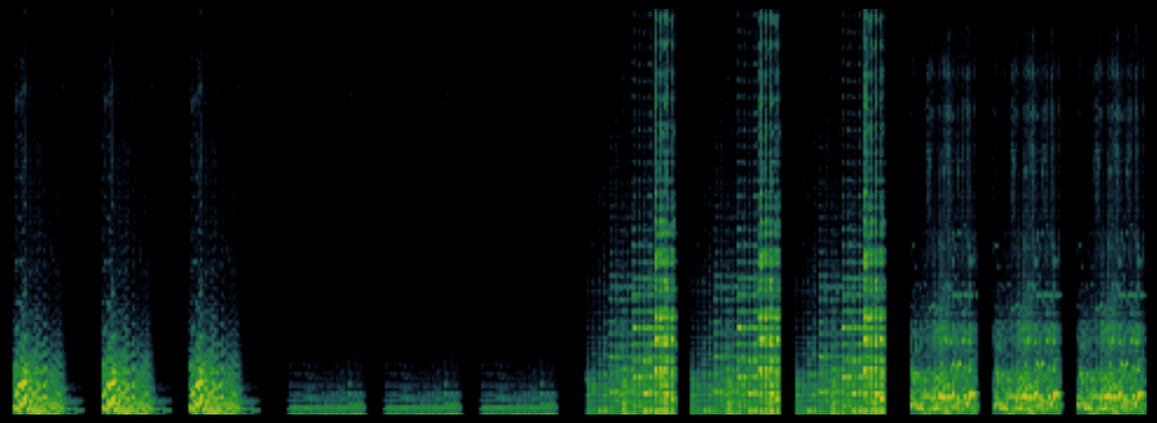
~1s

~5s

min/hr

Audio





Video

sub-chunk

chunk

Supra-chunk

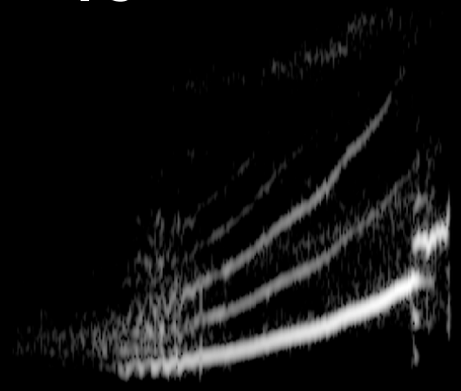
0

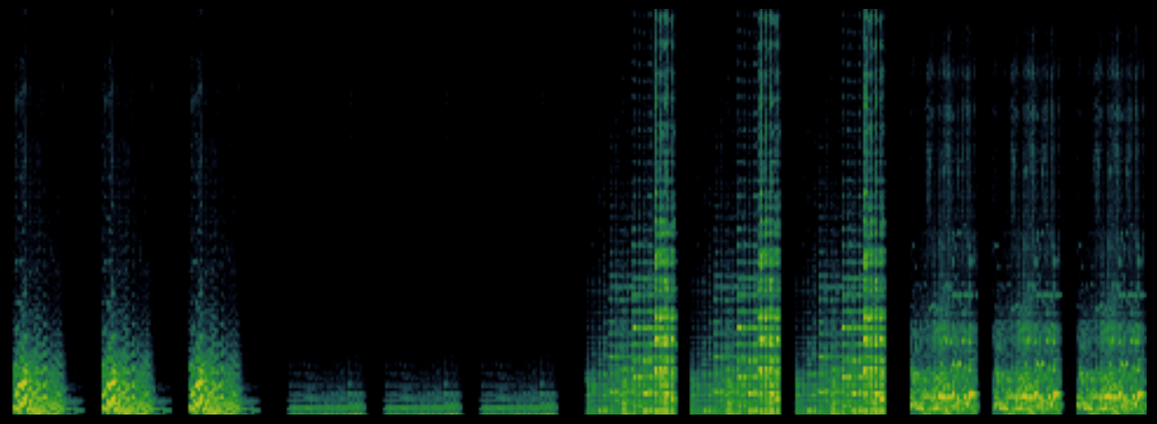
~1s

~5s

min/hr

Audio





Video

sub-chunk

chunk

Supra-chunk

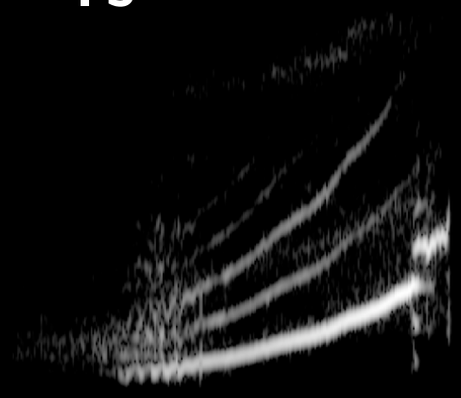
0

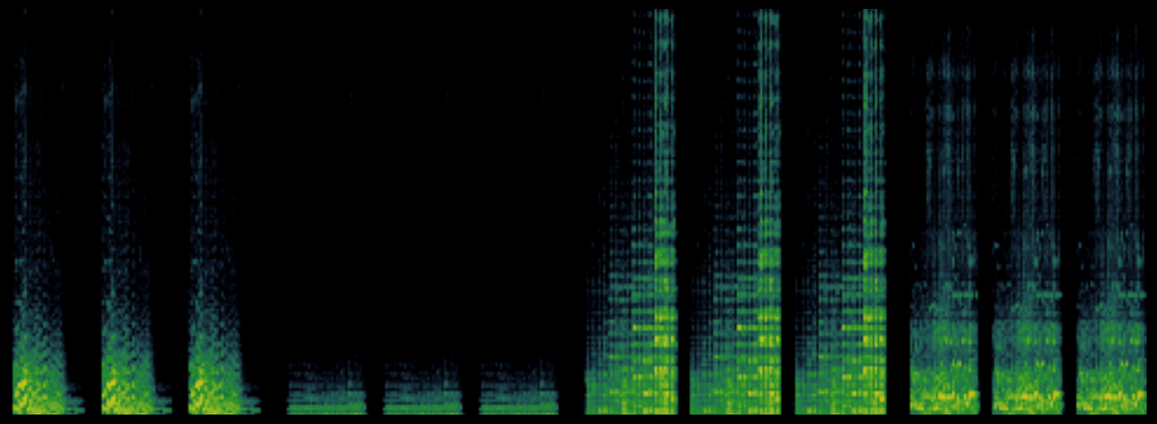
~1s

~5s

min/hr

Audio





Video

sub-chunk

chunk

Supra-chunk

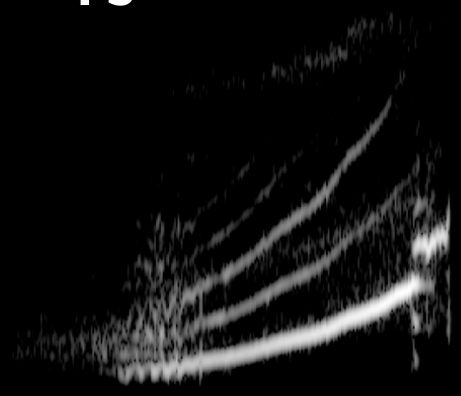
0

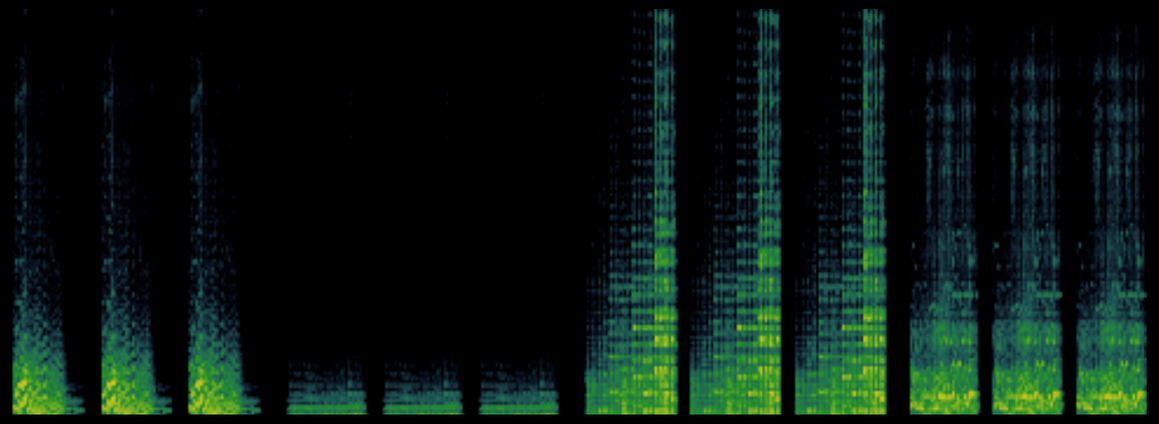
~1s

~5s

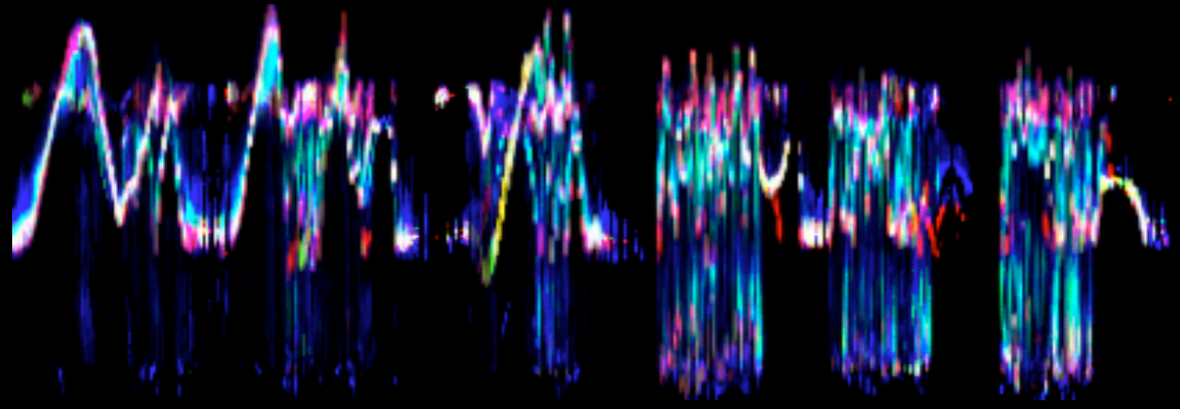
min/hr

Audio





Video



sub-chunk

chunk

Supra-chunk

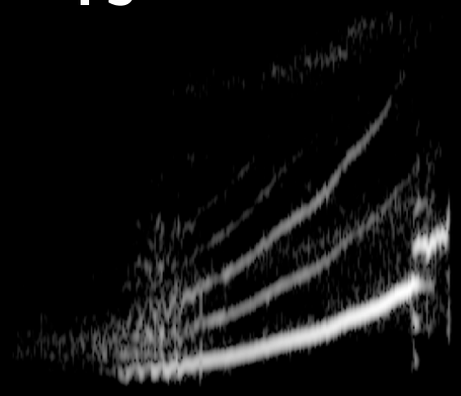
0

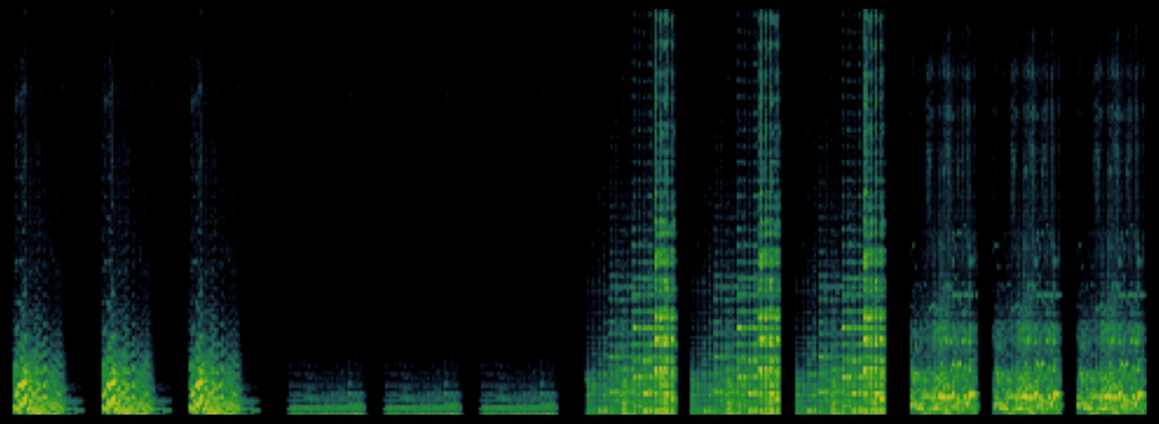
~1s

~5s

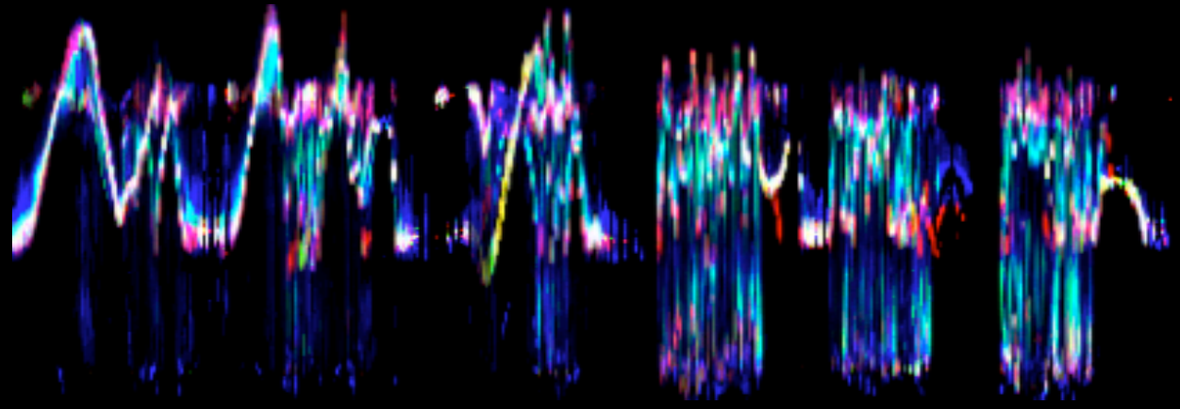
min/hr

Audio





Video



MoCap/
sensors

sub-chunk

chunk

Supra-chunk

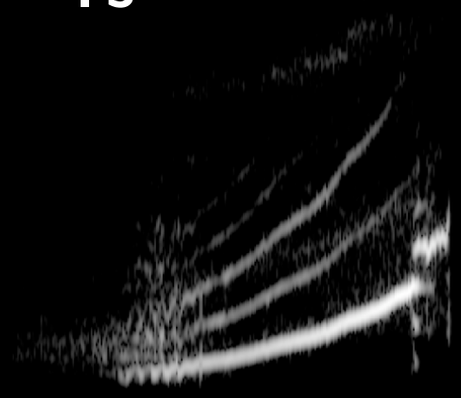
0

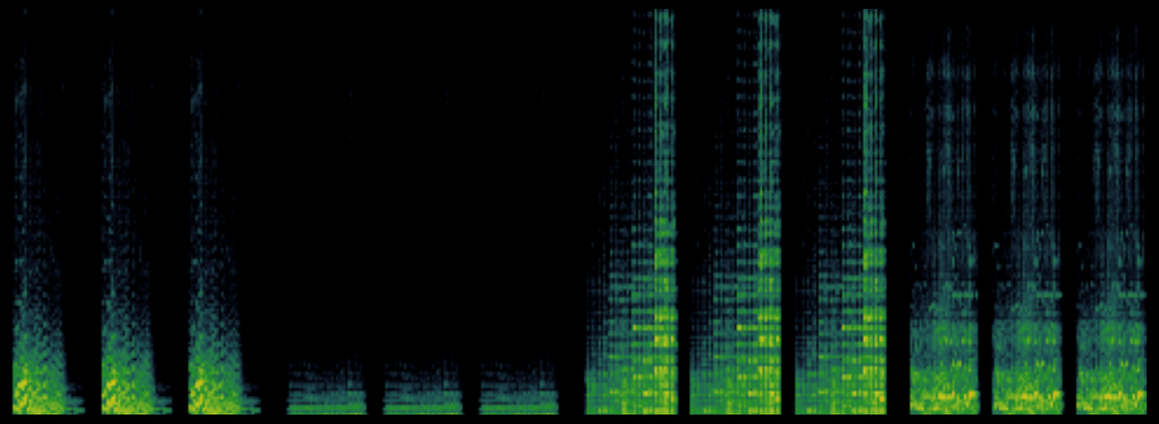
~1s

~5s

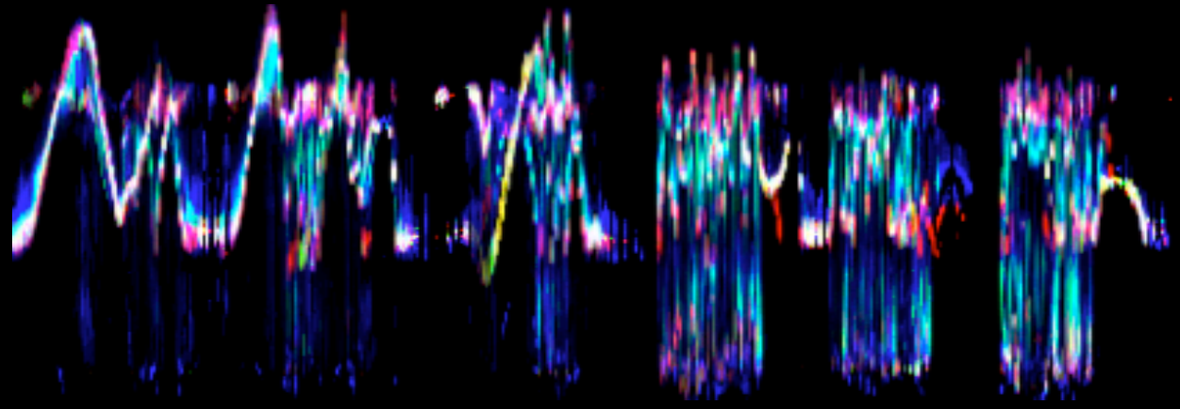
min/hr

Audio

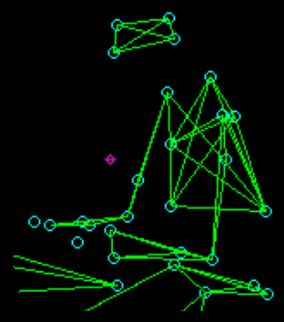




Video



MoCap/ sensors



sub-chunk

chunk

Supra-chunk

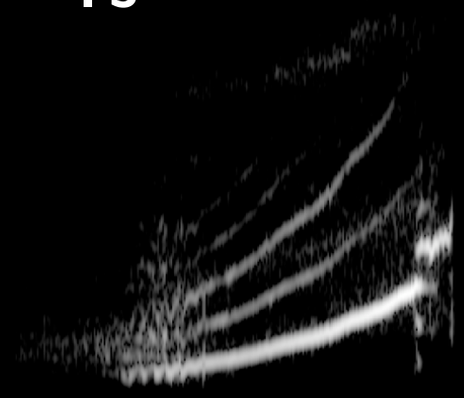
0

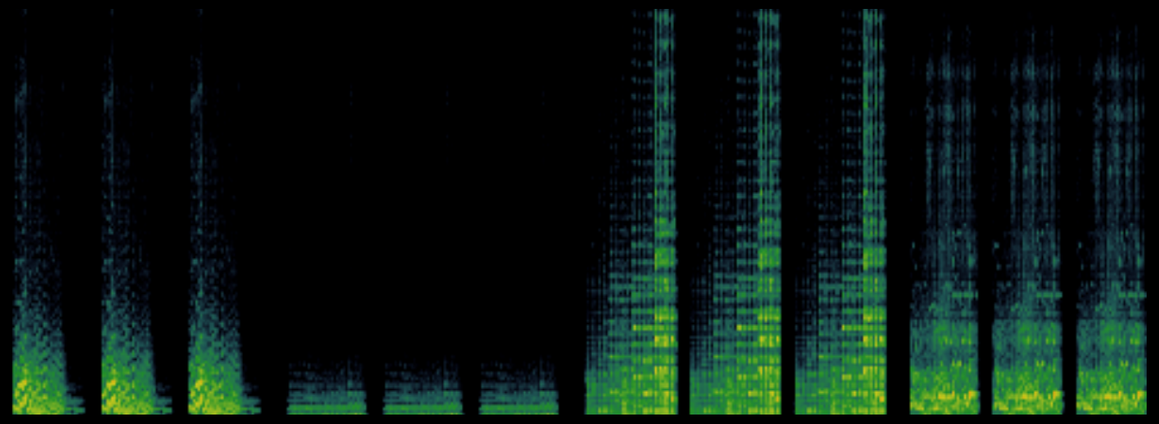
~1s

~5s

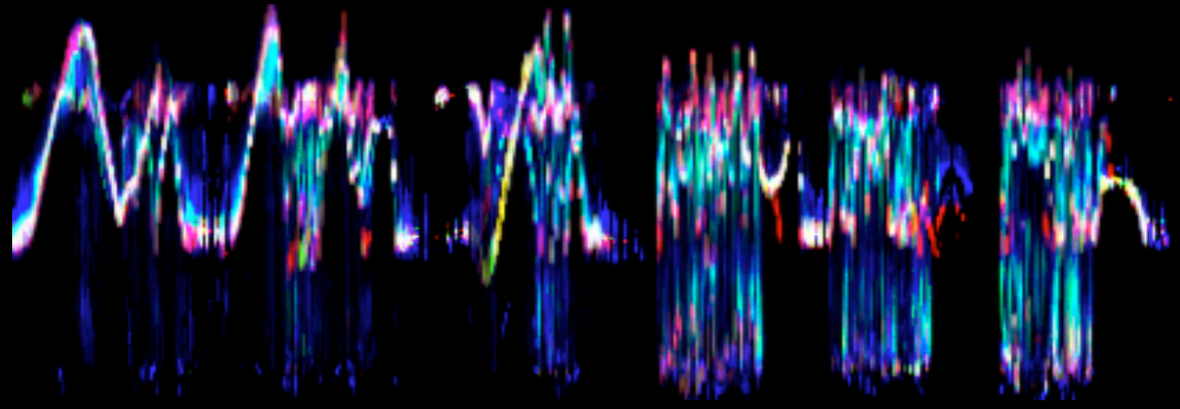
min/hr

Audio

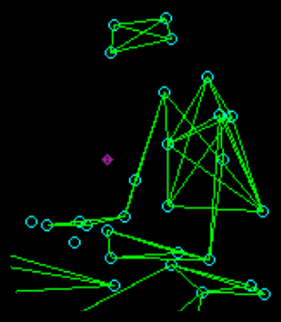


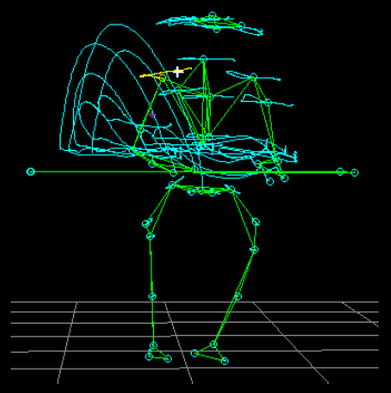


Video



MoCap/ sensors





sub-chunk

chunk

Supra-chunk

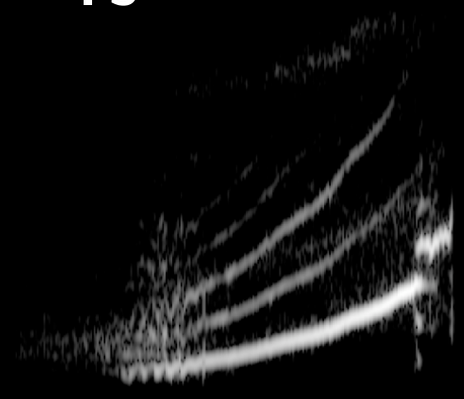
0

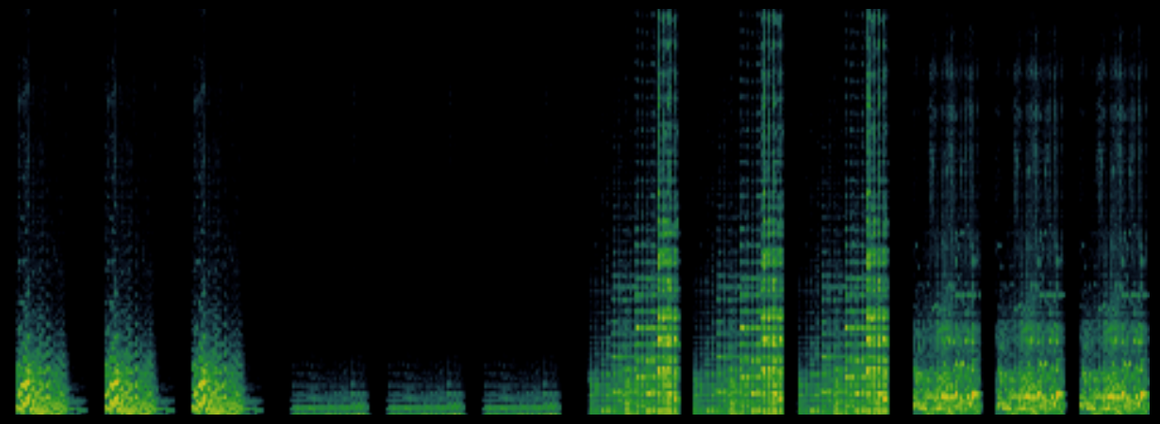
~1s

~5s

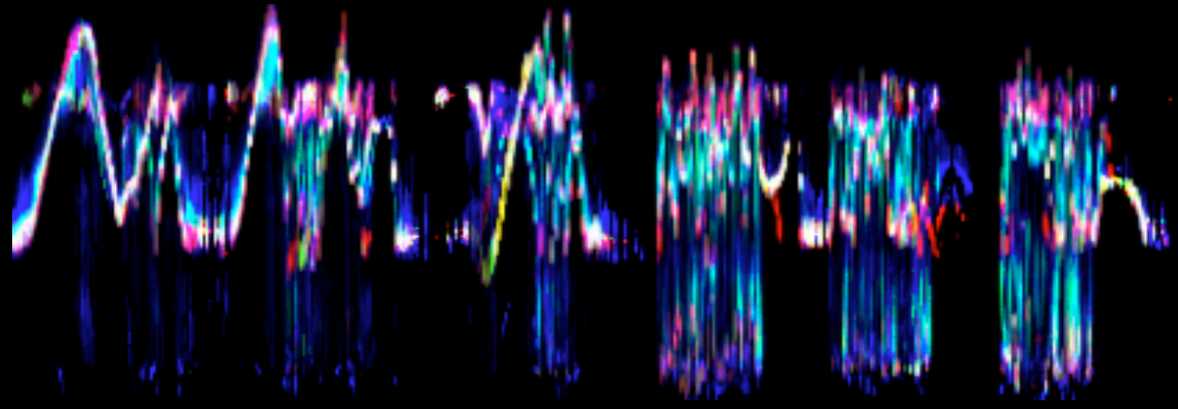
min/hr

Audio

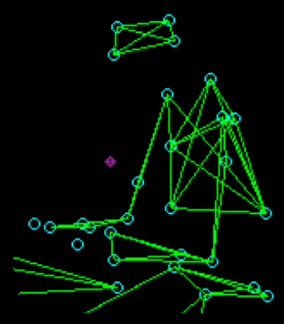


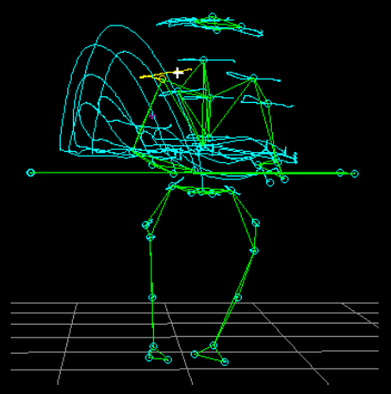


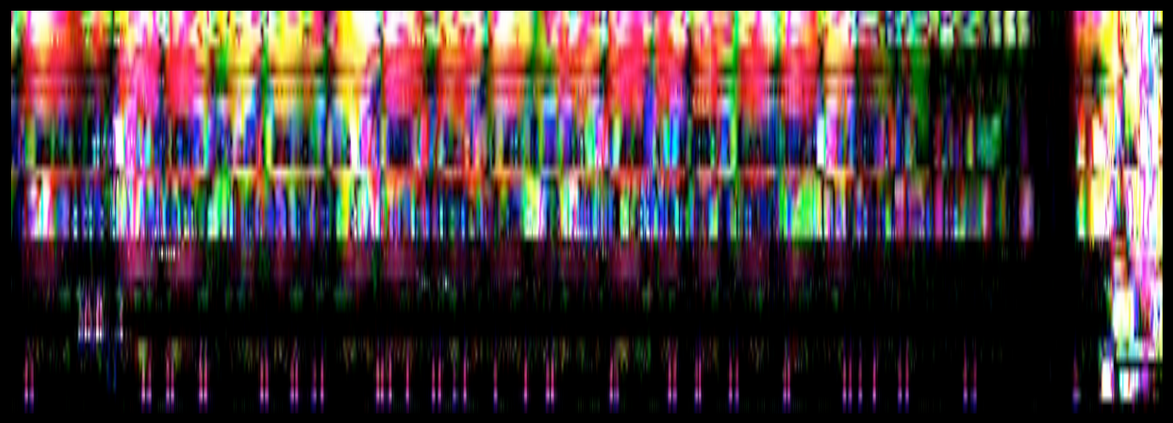
Video



MoCap/ sensors







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