INTERFERENCE REDUCTION IN MUSIC RECORDINGS

INTERFERENCE REDUCTION IN MUSIC RECORDINGS

COMBINING KERNEL ADDITIVE MODELLING (KAM) WITH NON-NEGATIVE MATRIX FACTORISATION (NMF)

FREEDOM
LEWHITE
JOY PHOENIX
PHILIP WHALEN
CLUB

FREEDOM
LEWHITE
JOY PHOENIX
PHILIP WHALEN
CLUB

FREEDOM
LEWHITE
JOY PHOENIX
PHILIP WHALEN
CLUB

SOURCE SEPARATION

SOURCE 1

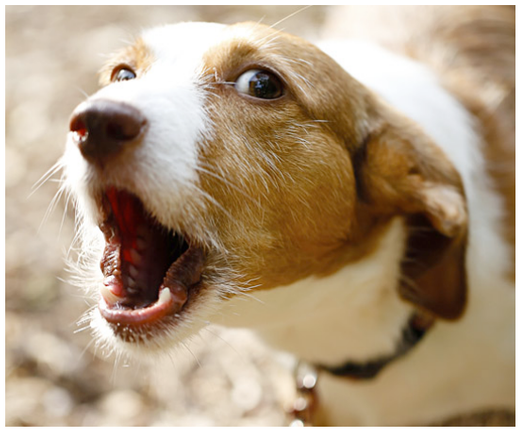
SOURCE 2

SOURCE 3

Mix

SOURCE 1

SOURCE 2



SOURCE 3

Mix

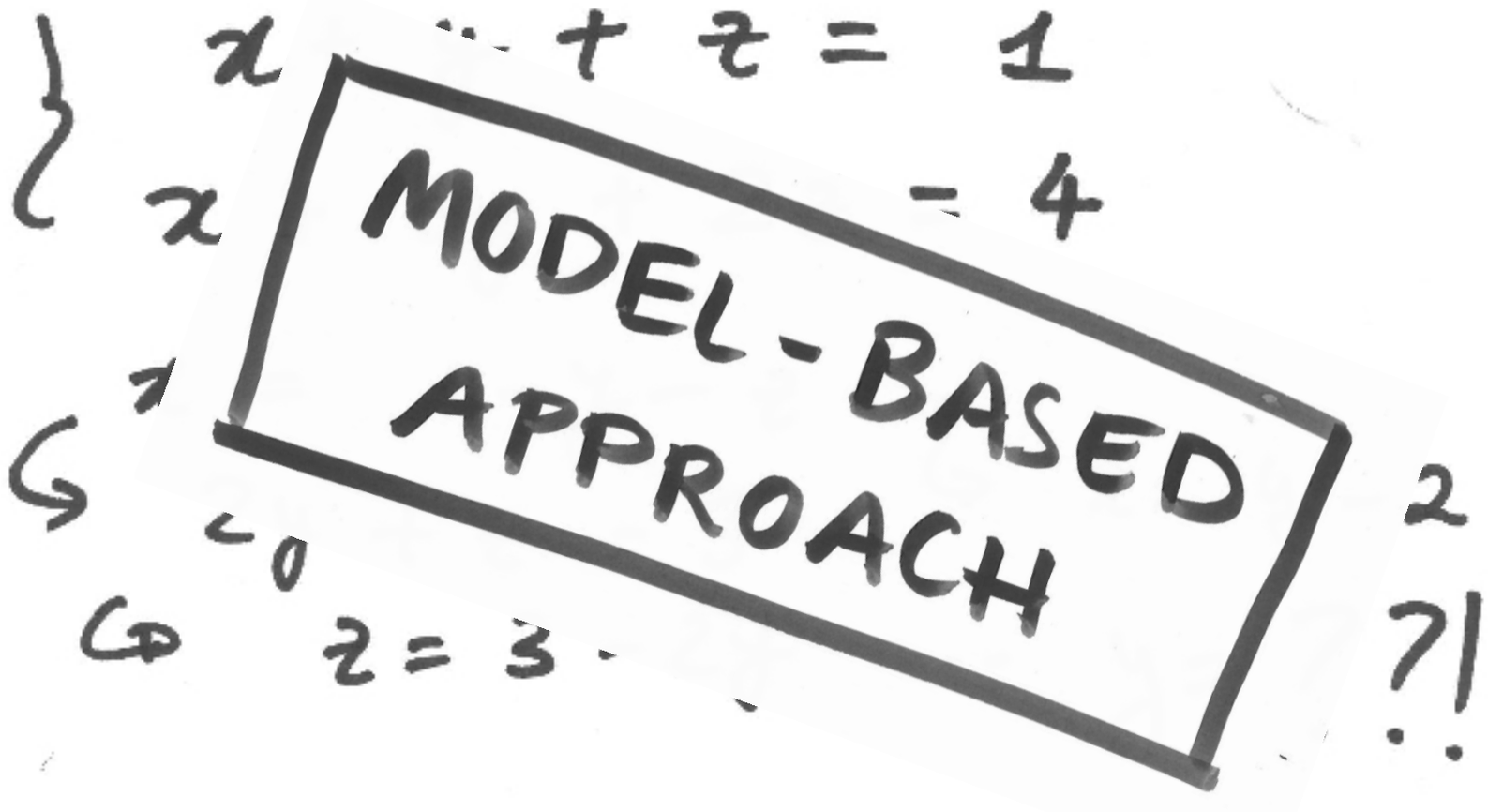
UNDERDETERMINED SYSTEM

$$\begin{cases} x + y + z = 1 \\ x + 3y + 2z = 4 \end{cases}$$

$$\hookrightarrow \begin{cases} x = 1 - y - z \\ 2y + z = 3 \end{cases} \hookrightarrow x = y - 2$$

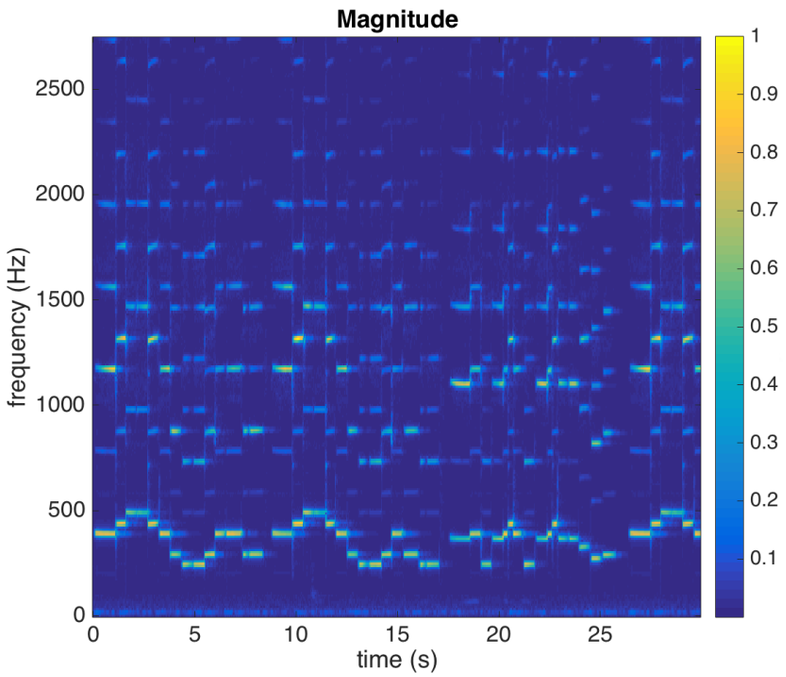
$$\hookrightarrow z = 3 - 2y \quad \cdots \quad y = ??!$$

UNDERDETERMINED SYSTEM



NON-NEGATIVE MATRIX FACTORIZATION (NMF)

NON-NEGATIVE MATRIX FACTORIZATION (NMF)



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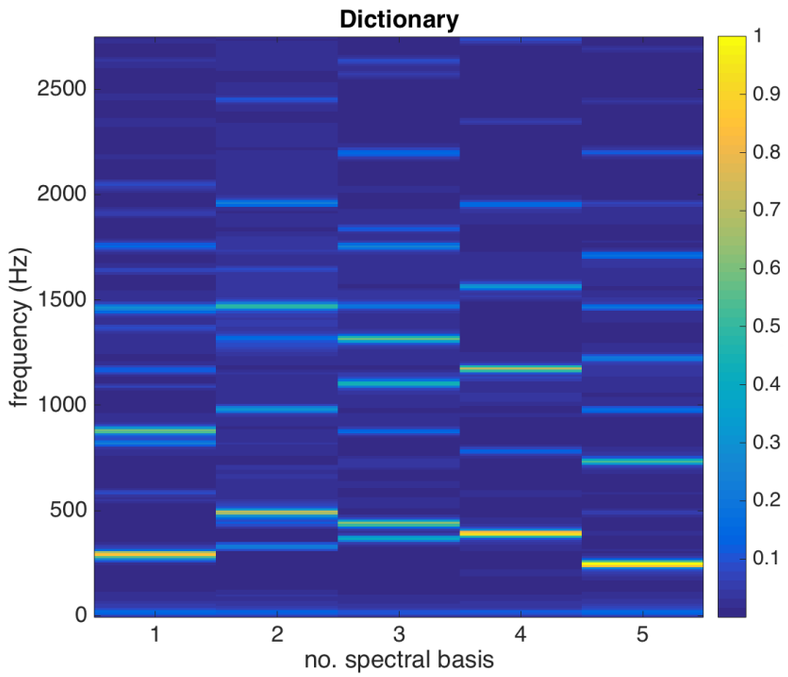

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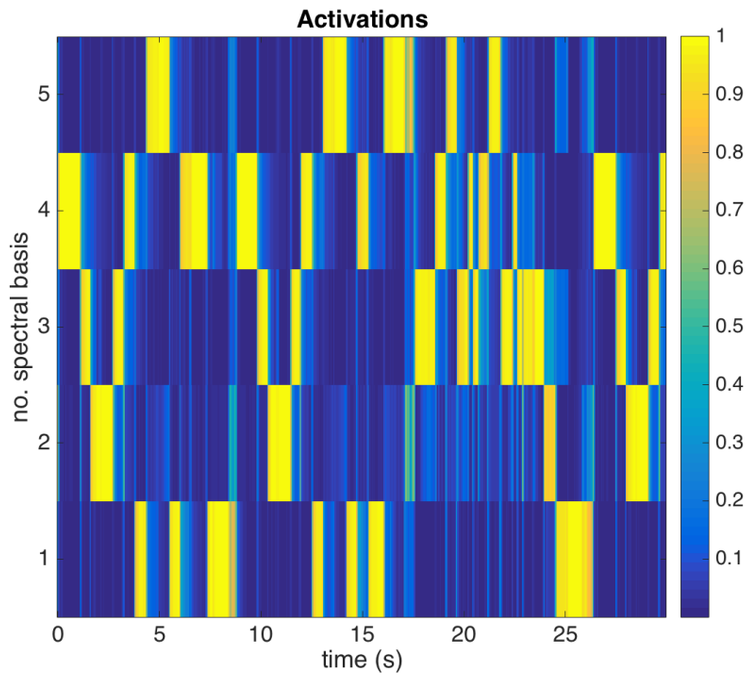
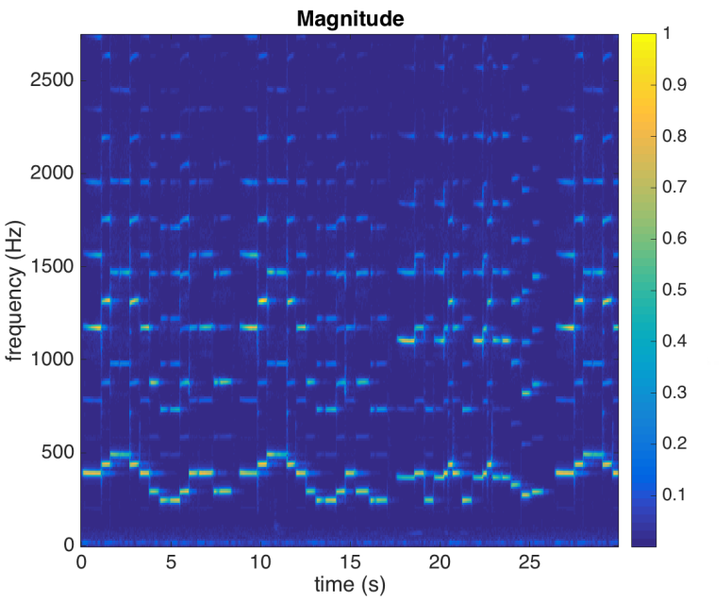


NON-NEGATIVE MATRIX FACTORIZATION (NMF)



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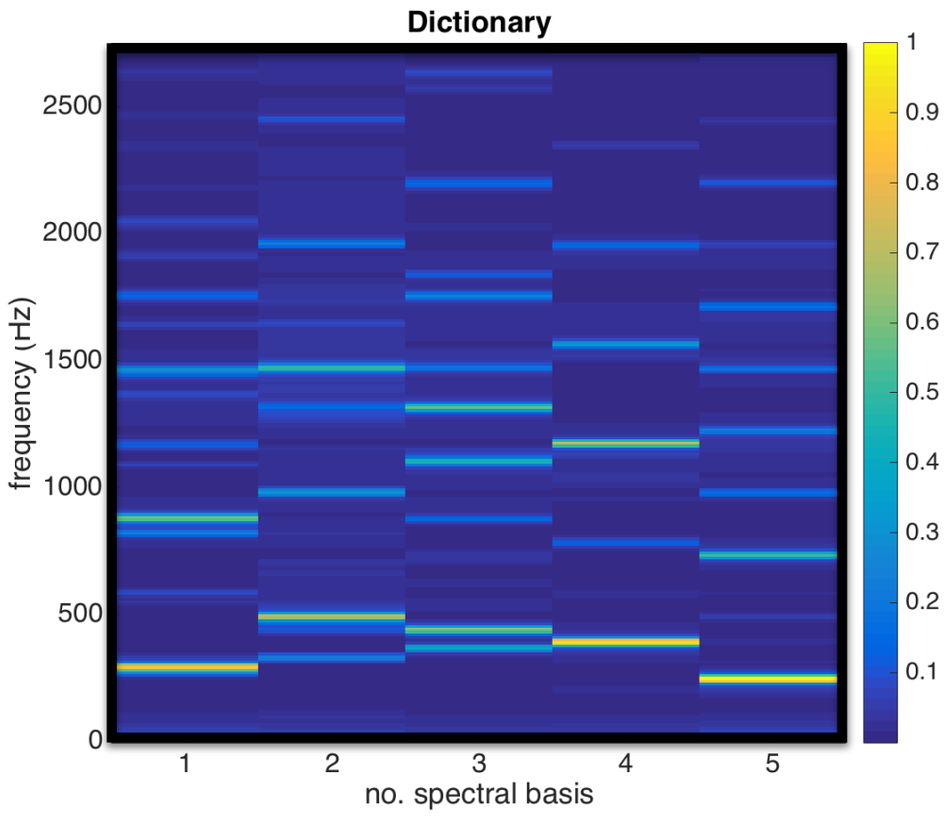

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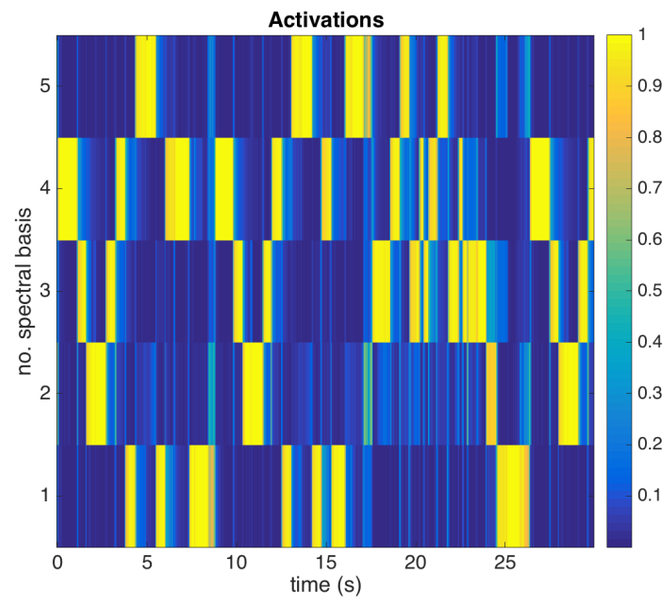
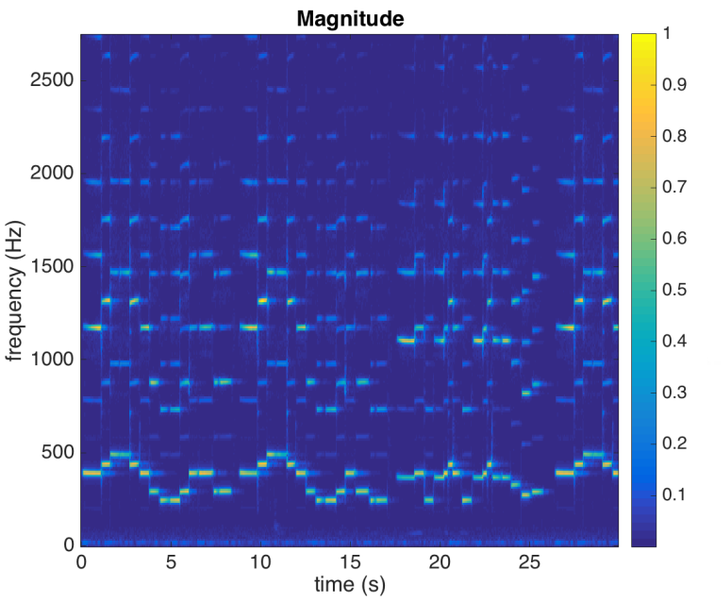


NON-NEGATIVE MATRIX FACTORIZATION (NMF)



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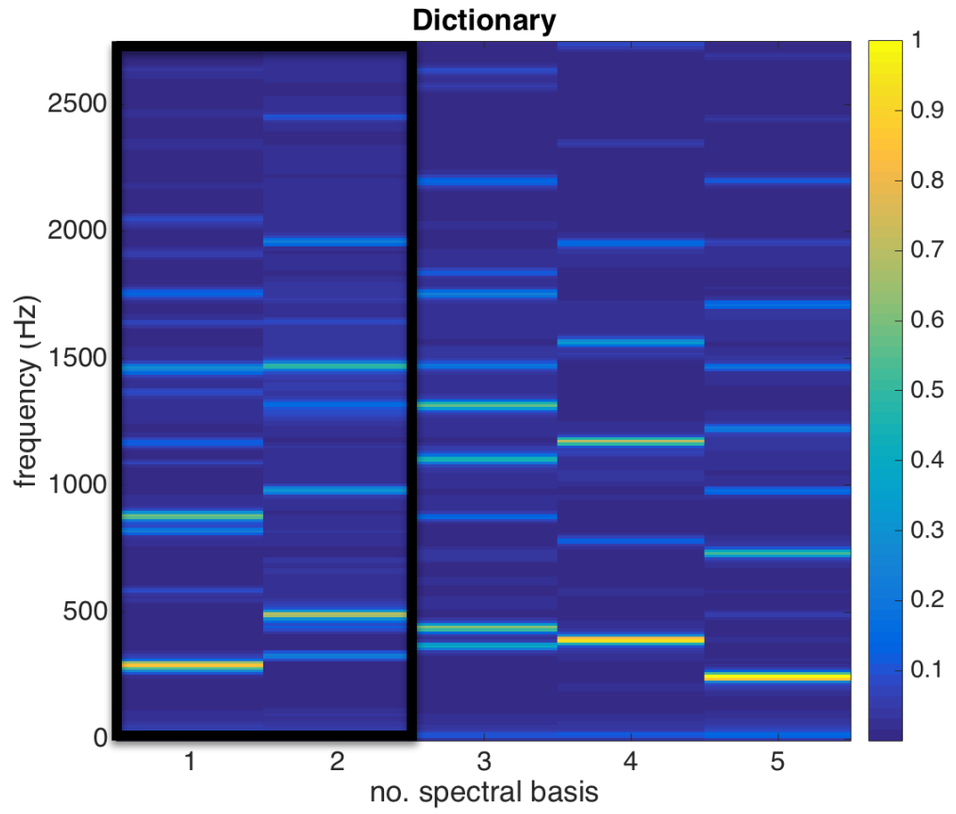

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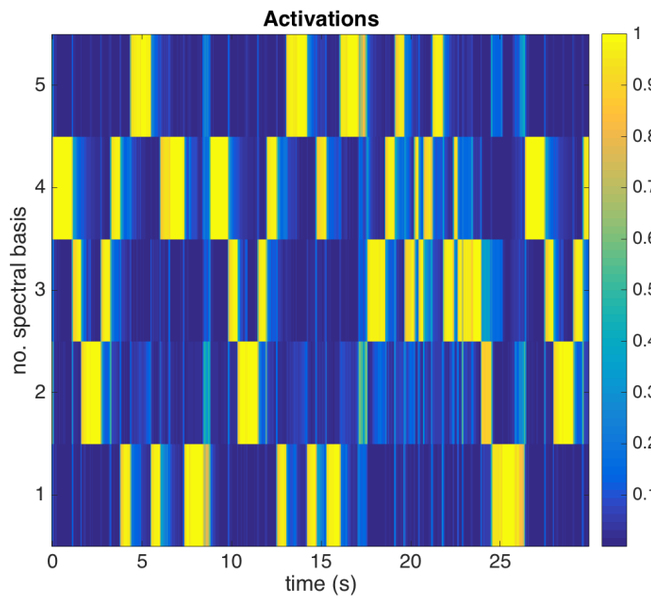
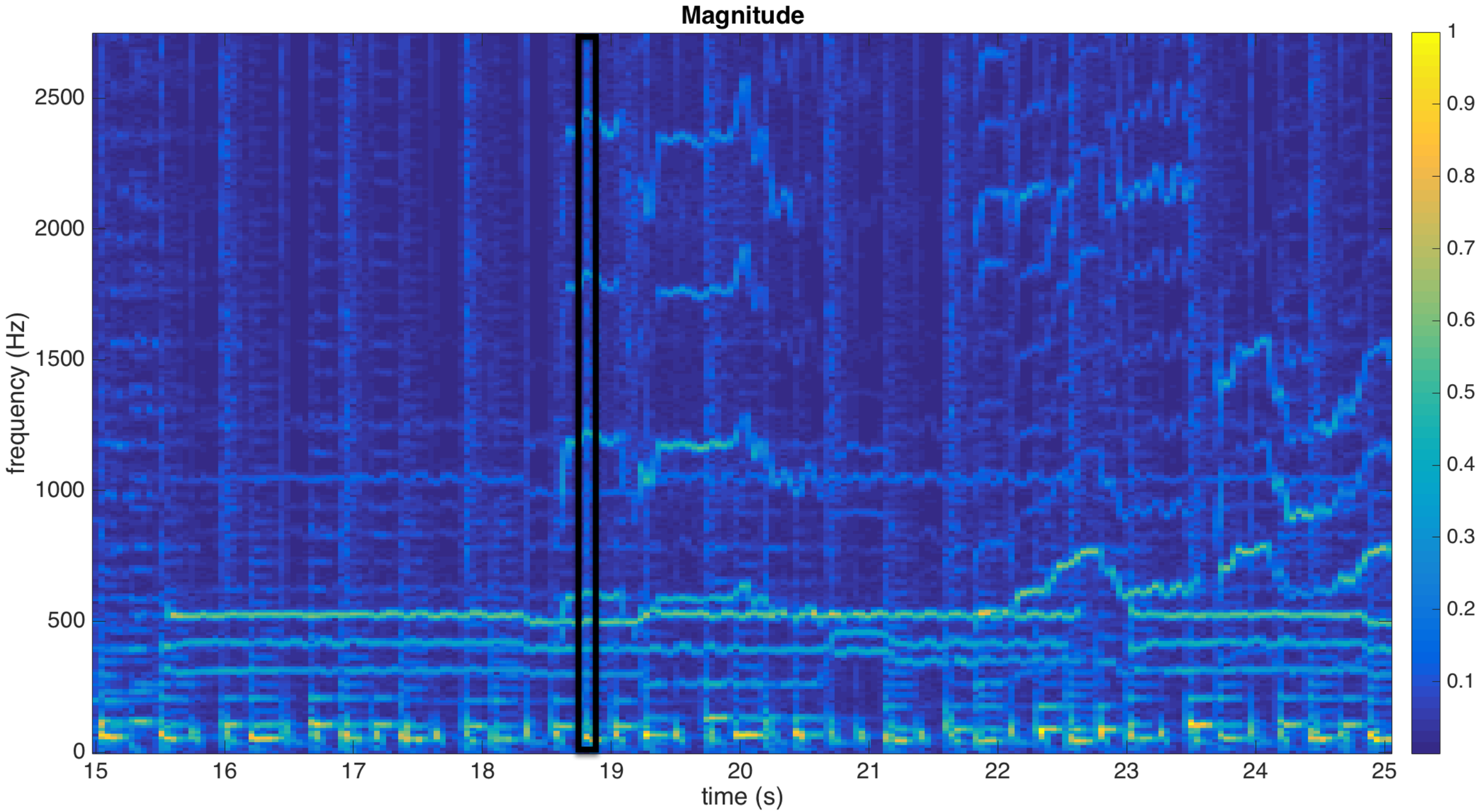
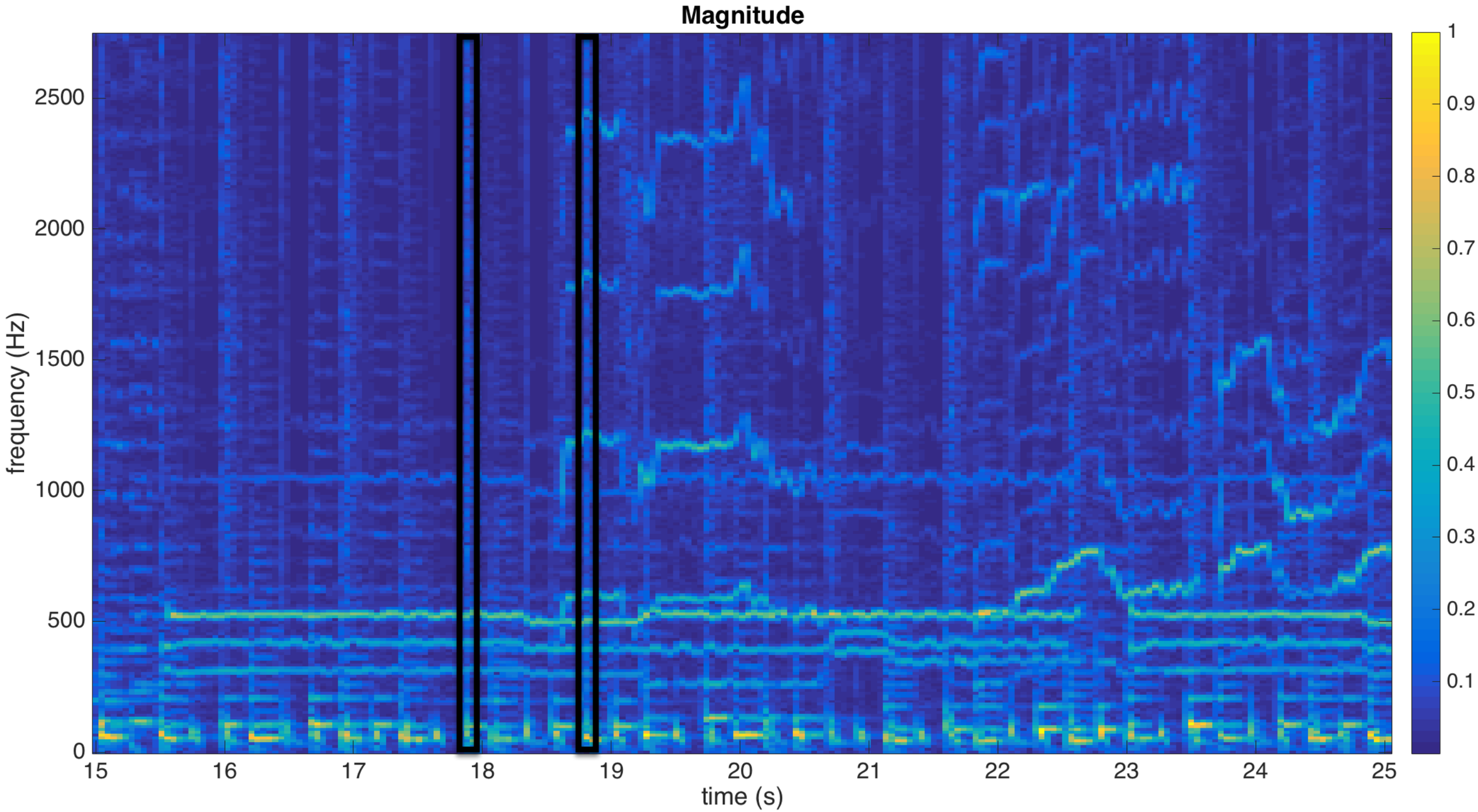


KERNEL ADDITIVE MODELS (KAM)

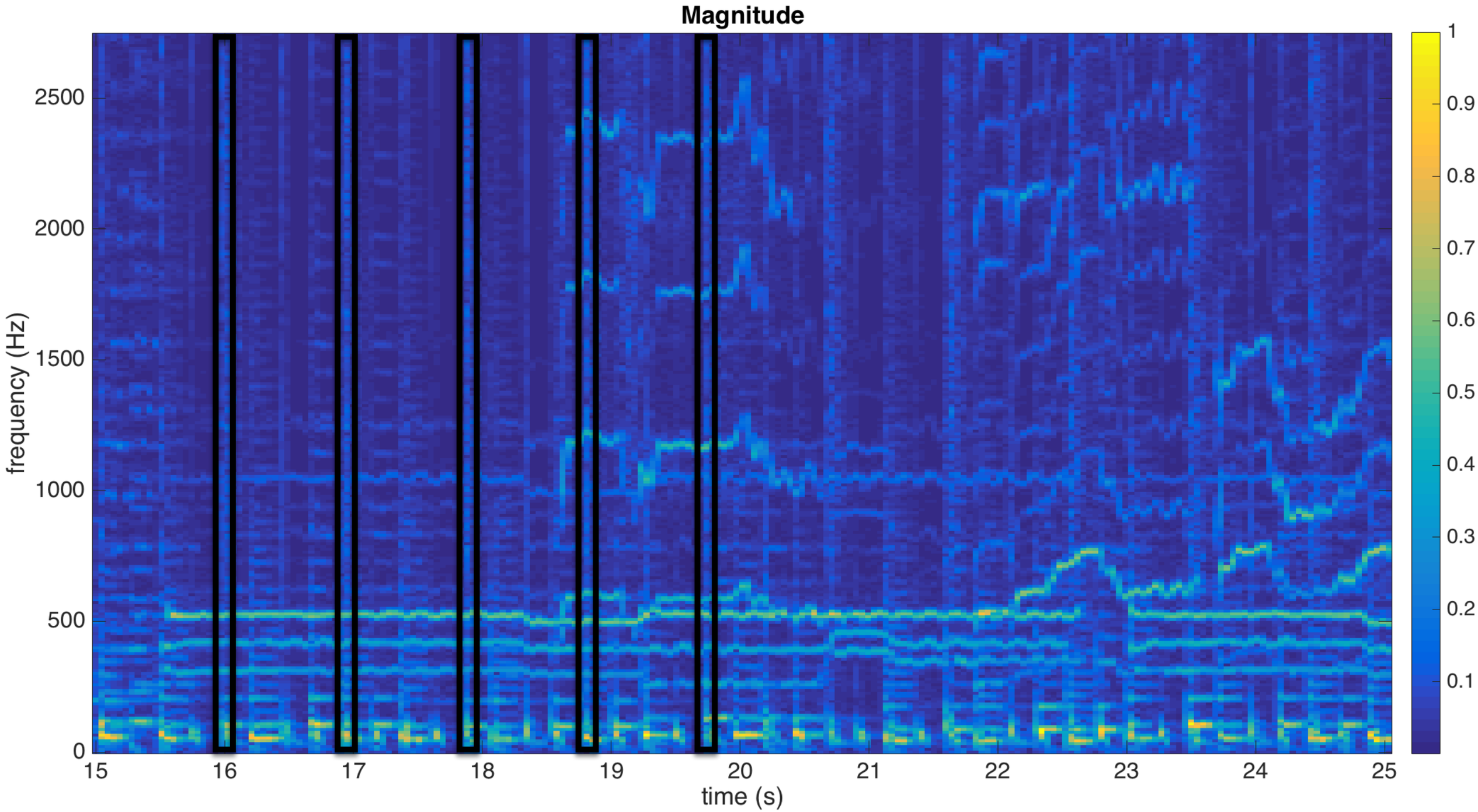
KERNEL ADDITIVE MODELS (KAM)



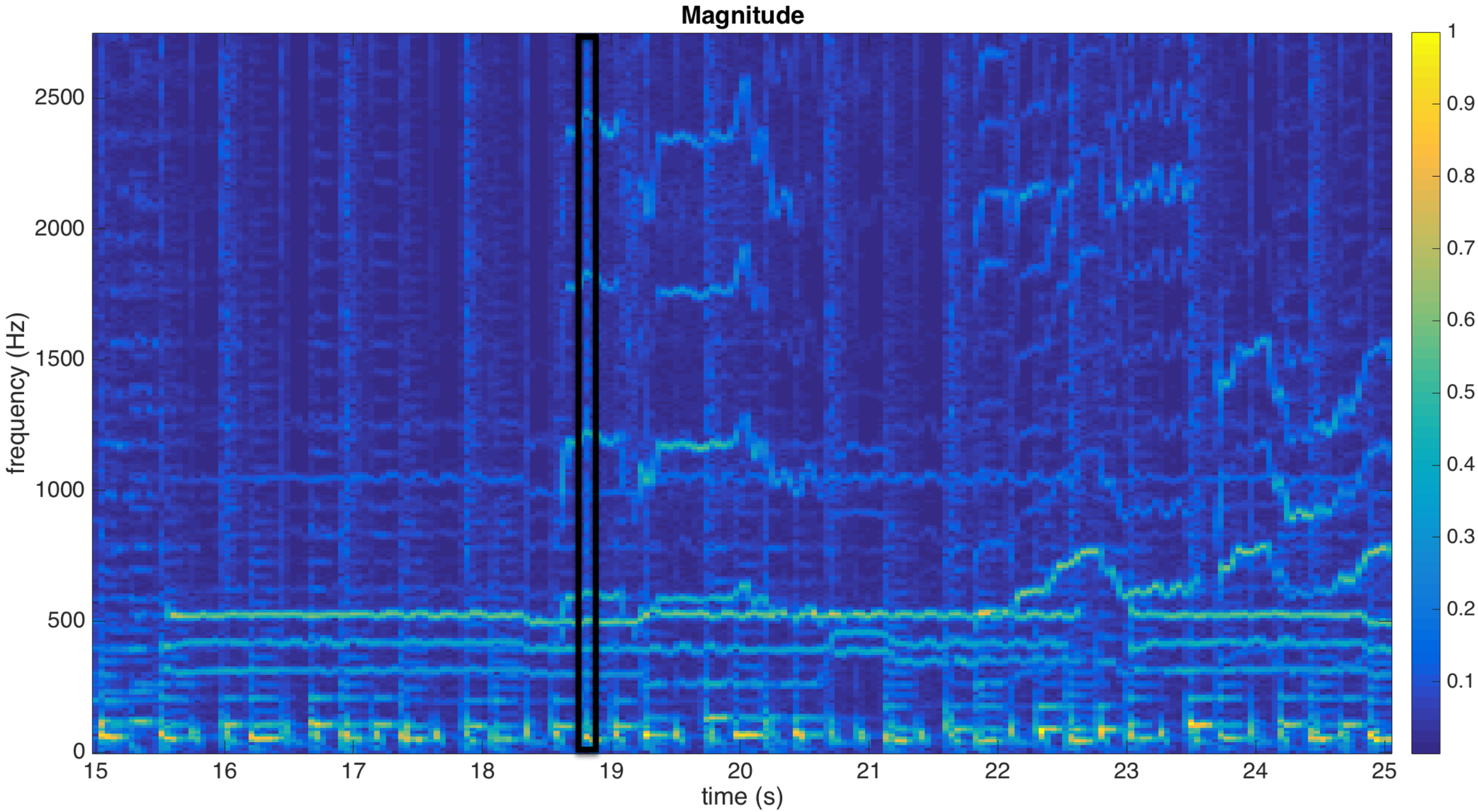
KERNEL ADDITIVE MODELS (KAM)

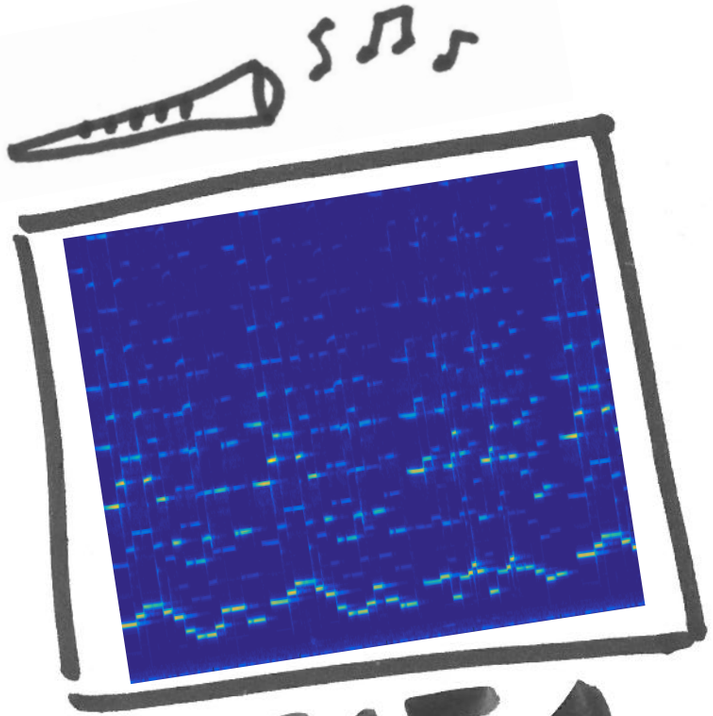


KERNEL ADDITIVE MODELS (KAM)



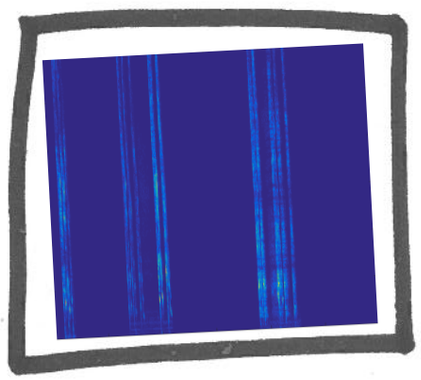
KERNEL ADDITIVE MODELS (KAM)



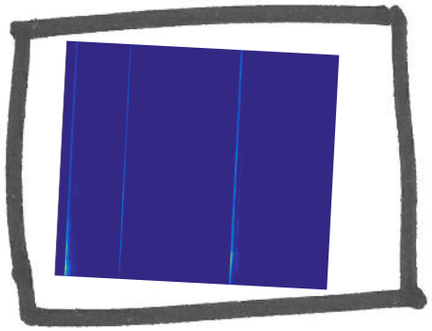


SOURCE 1

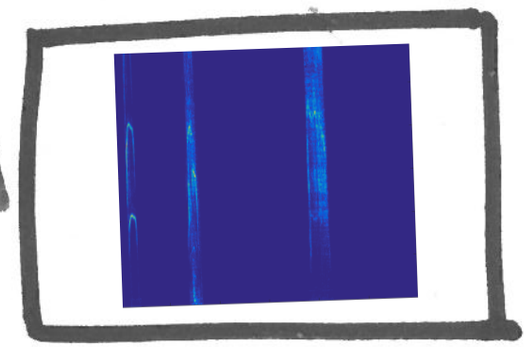
COUGHS



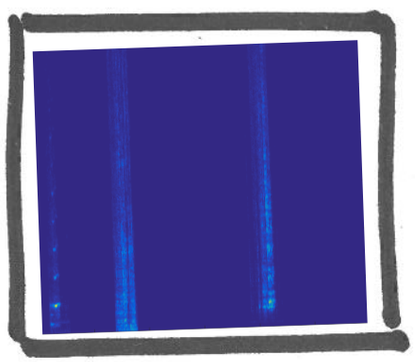
DOOR SLAM

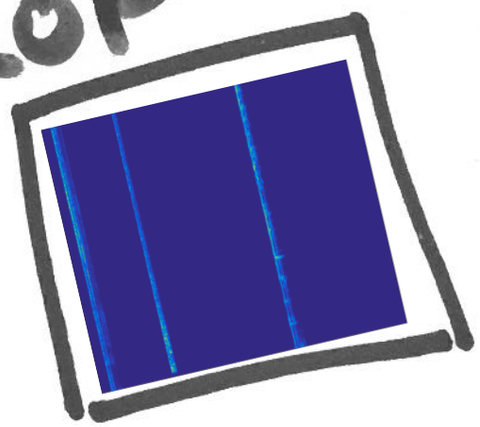


SCREAM

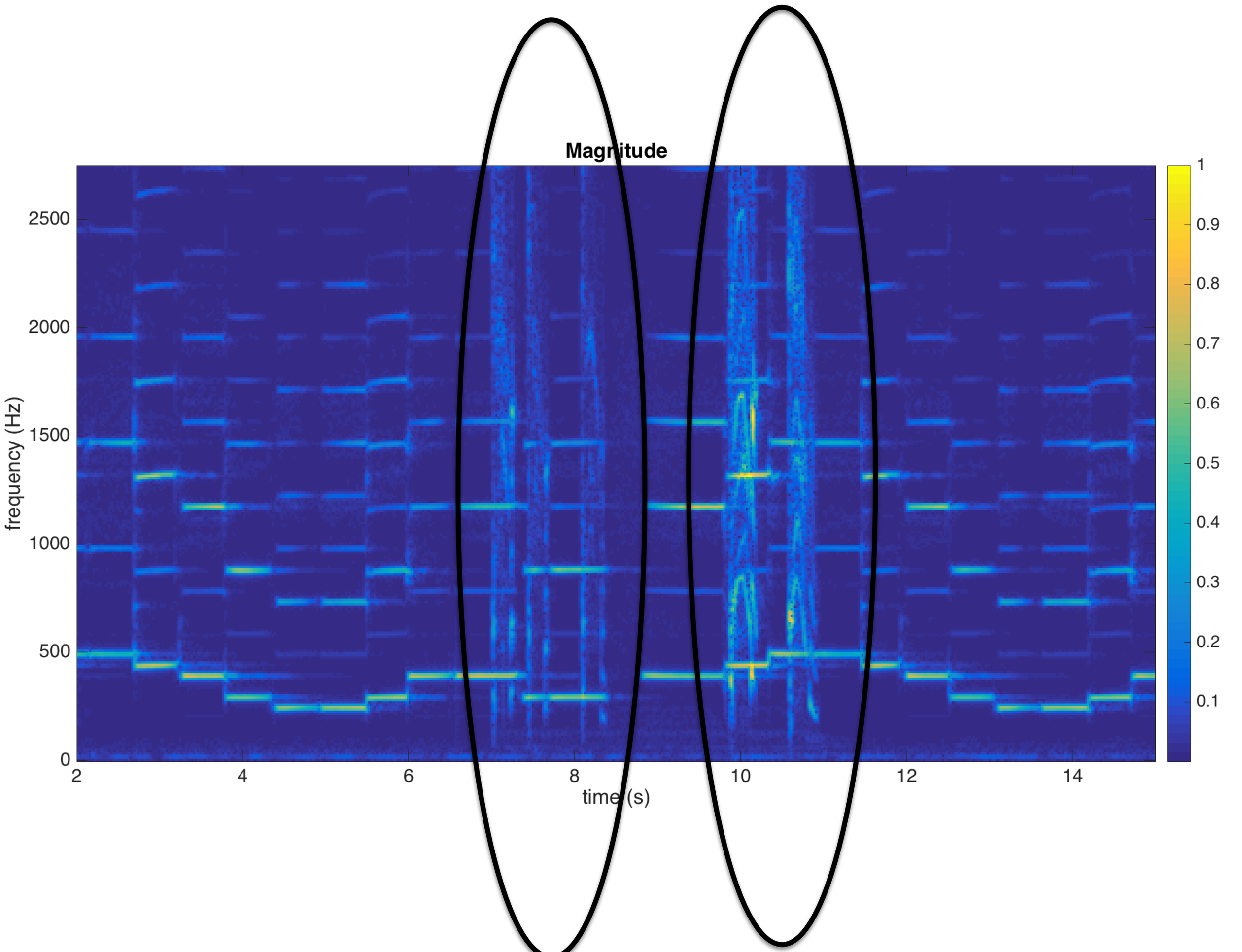


CHAIR DROP





MIX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2000
1500
1000
500
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frequency (Hz)
2
4
6
8
10
12
14
time (s)
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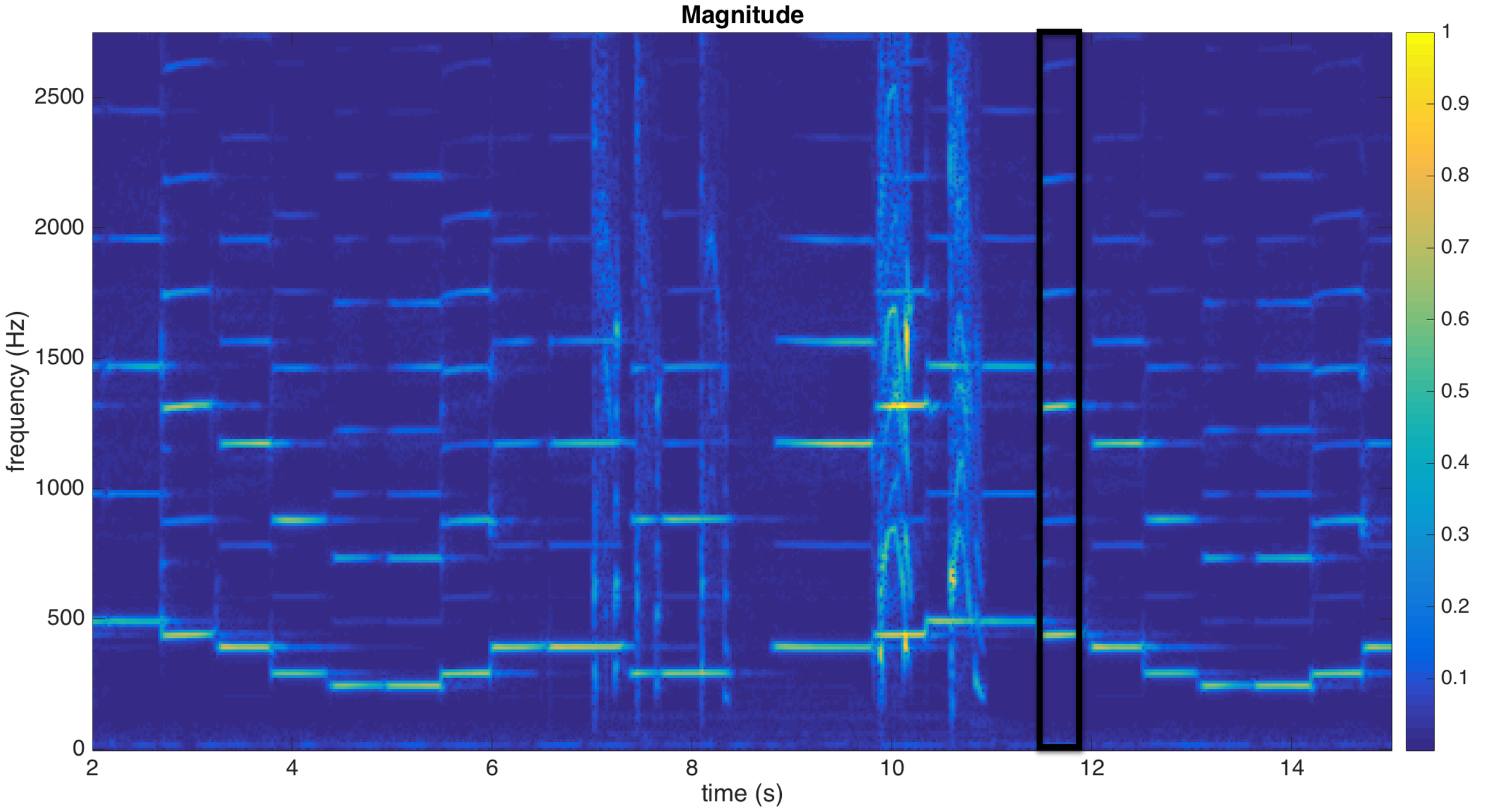
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1


Magnitude
frequency (Hz)
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time (s)
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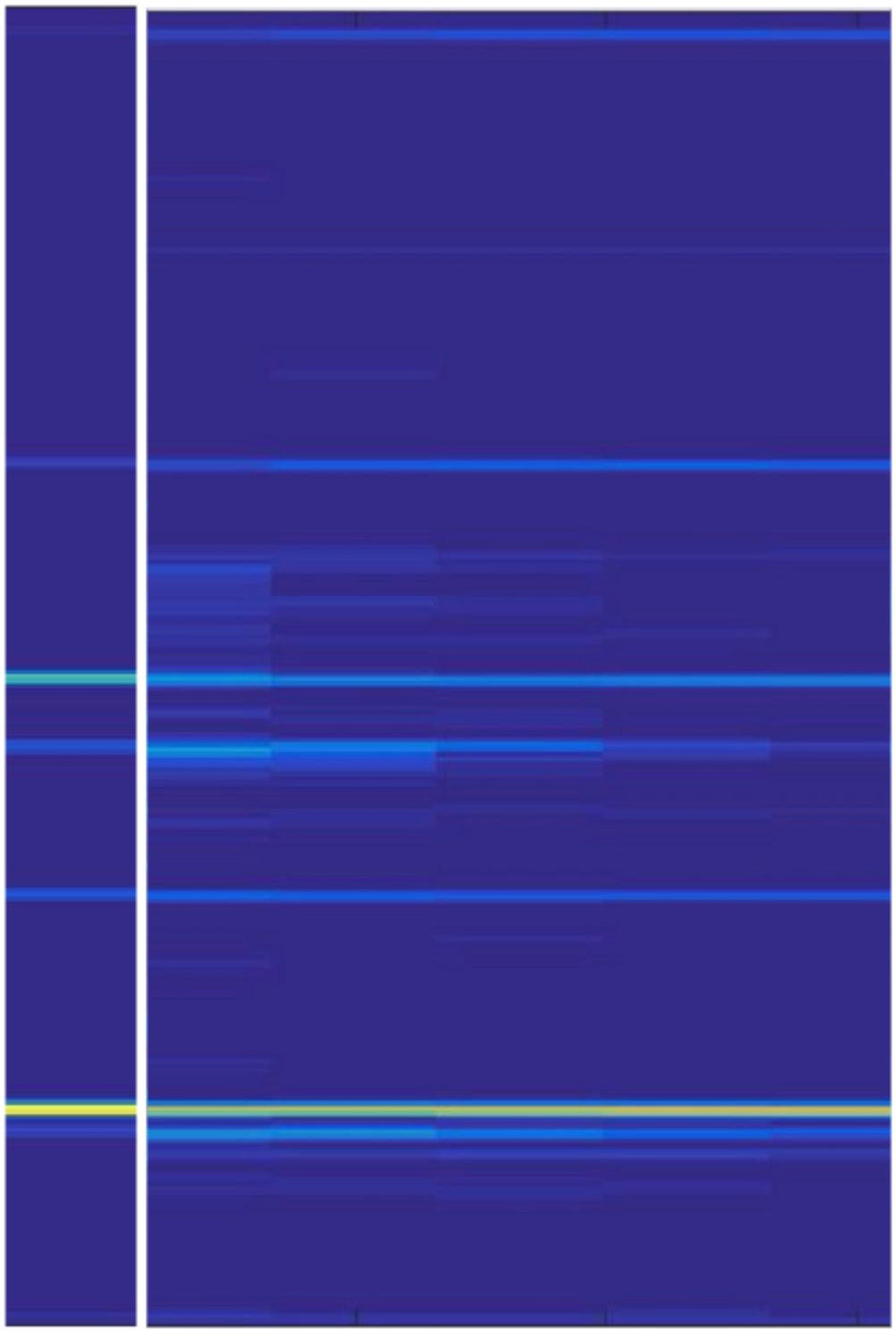
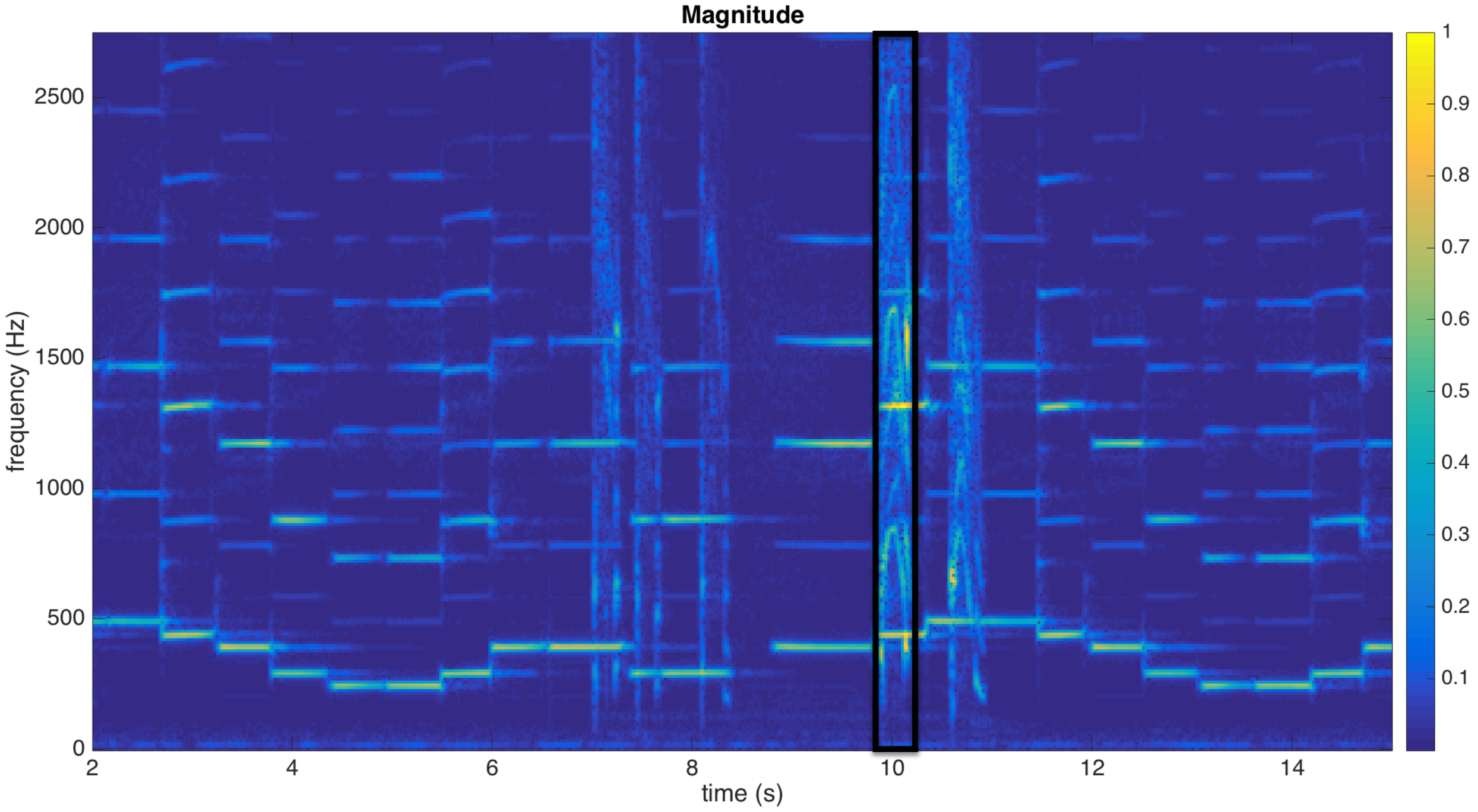

ORIGINAL
CLEAN
FRAME
CLOSE FRAMES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frequency (Hz)
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4
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time (s)
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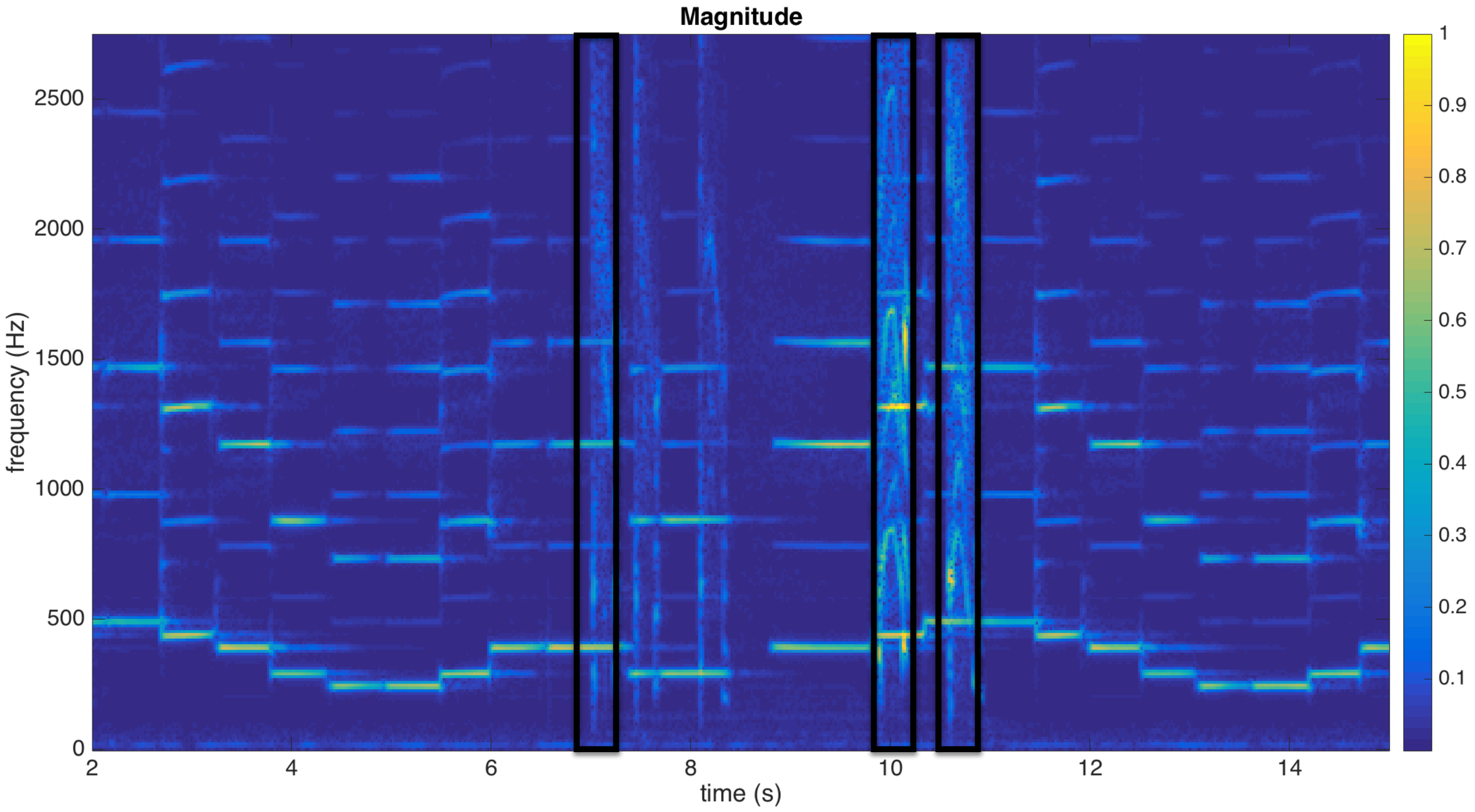
Magnitude
frequency (Hz)
2500
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1000
500
0
2
4
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8
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time (s)
1
0.9
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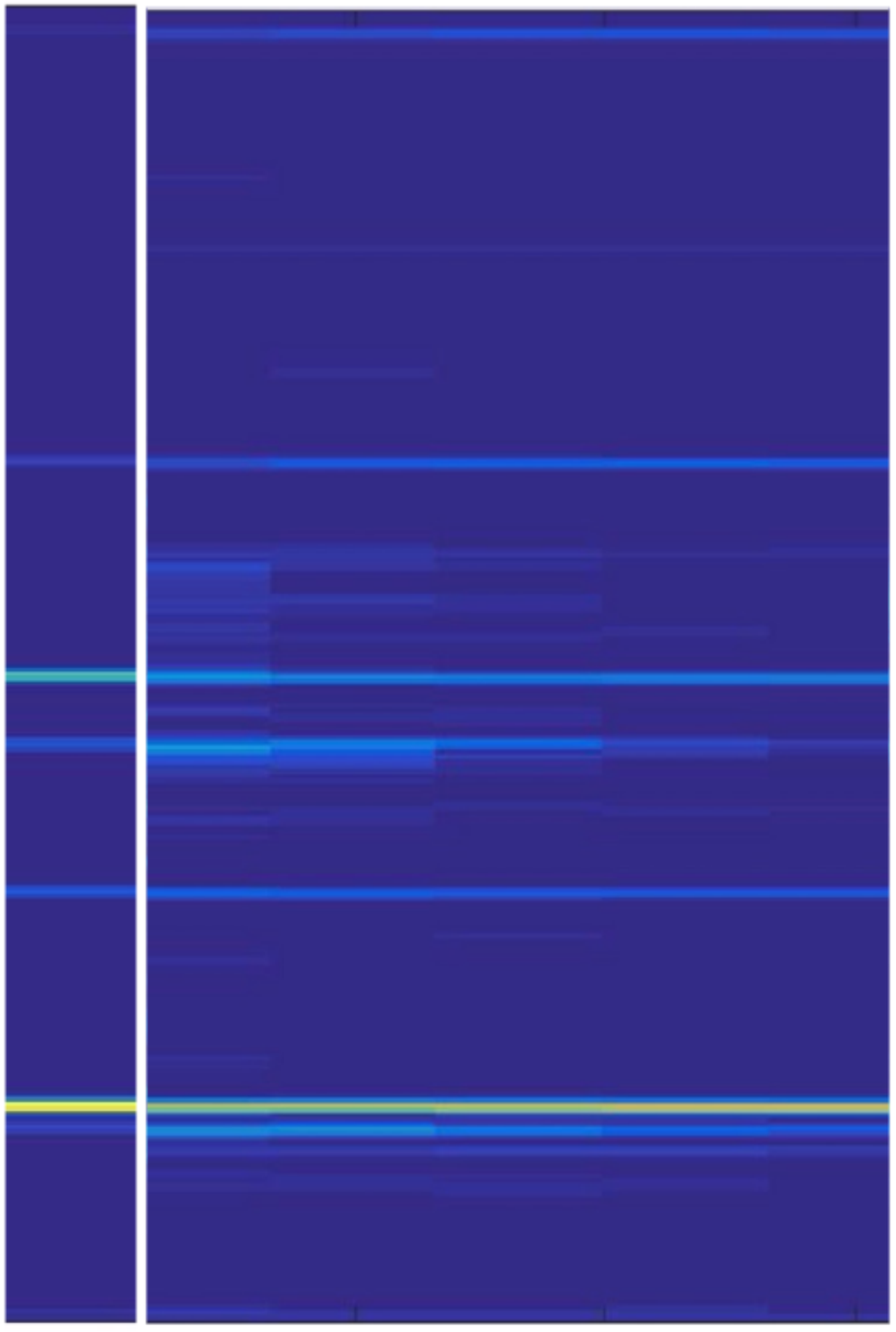
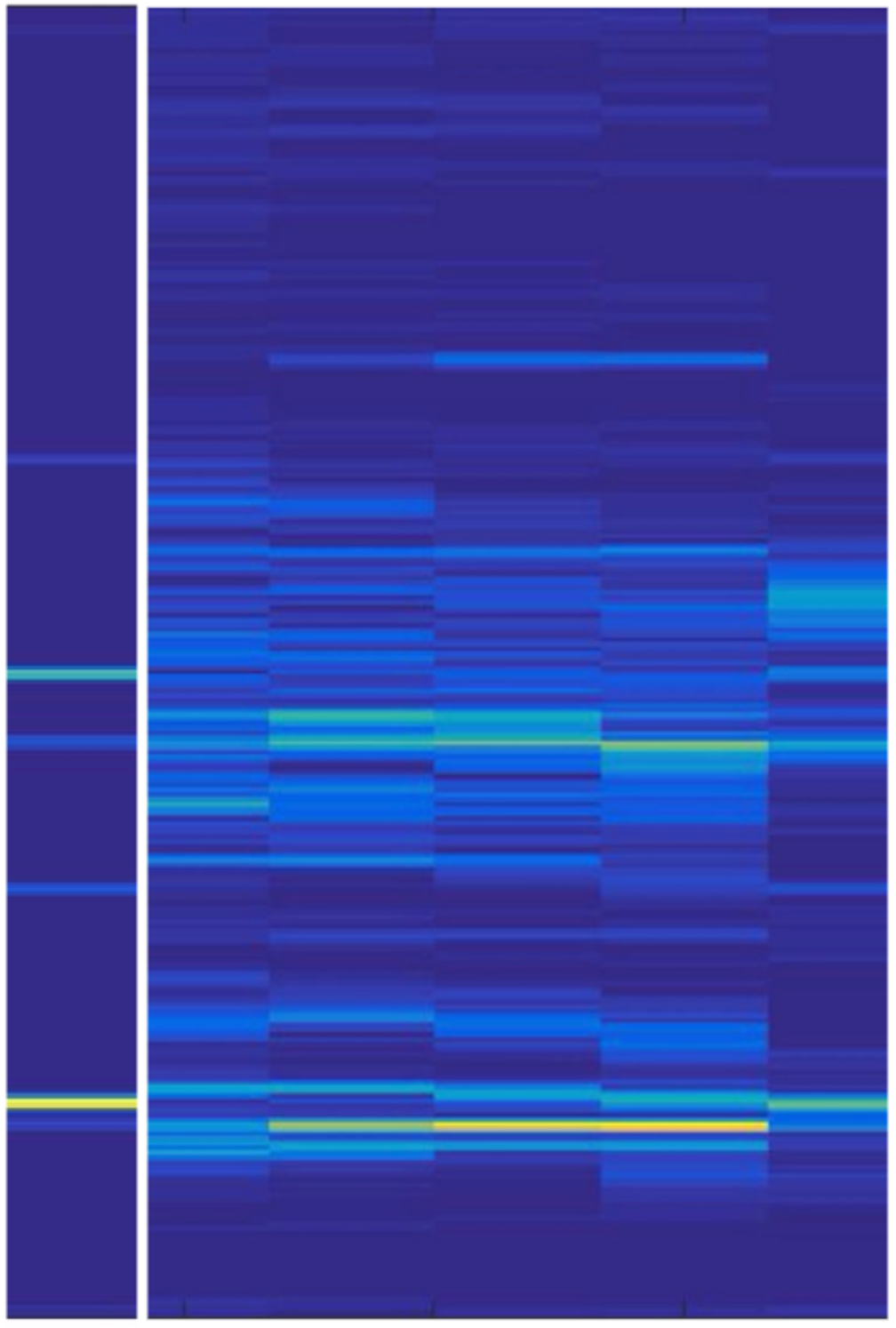
0.2
0.1



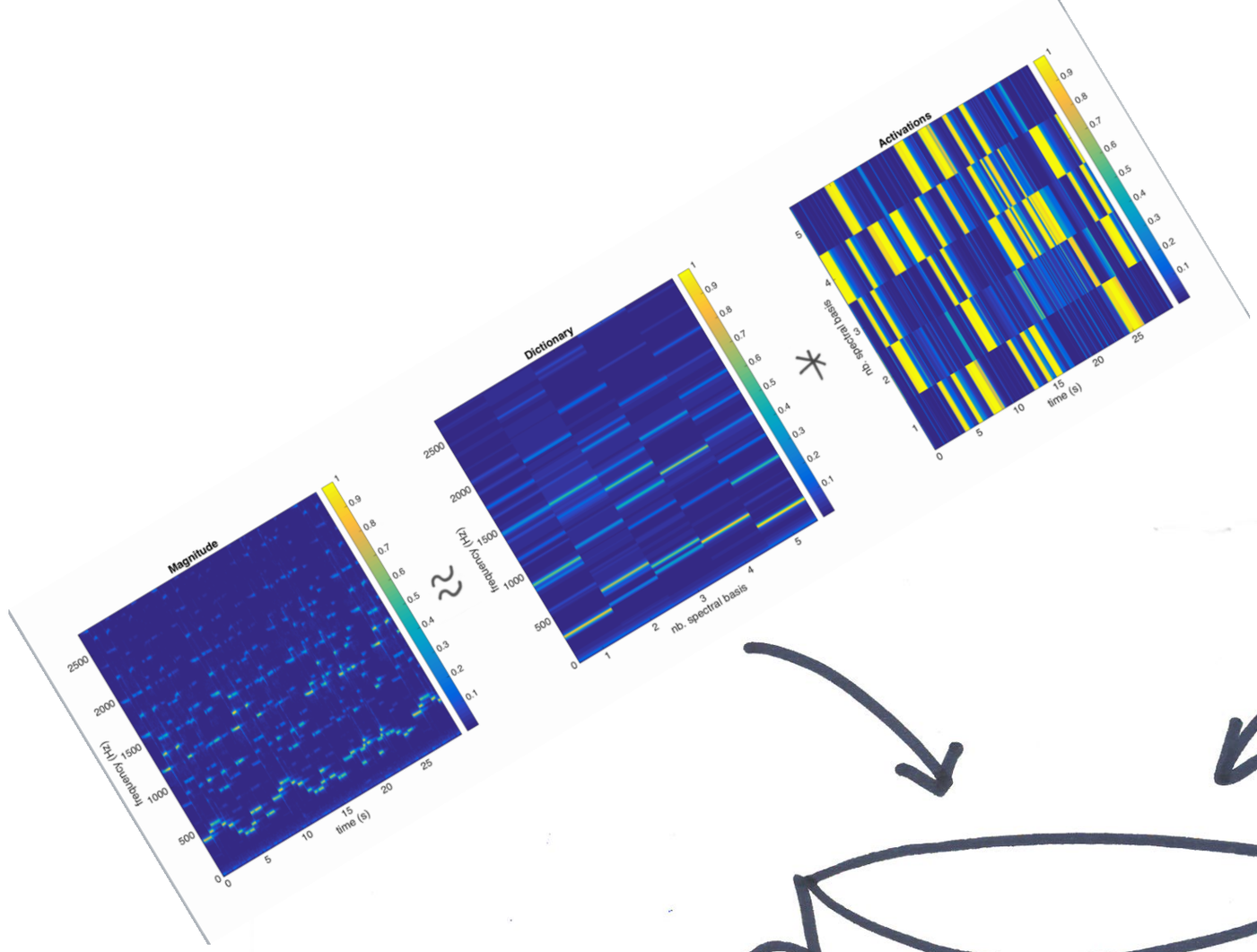
ORIGINAL CLEAN FRAME

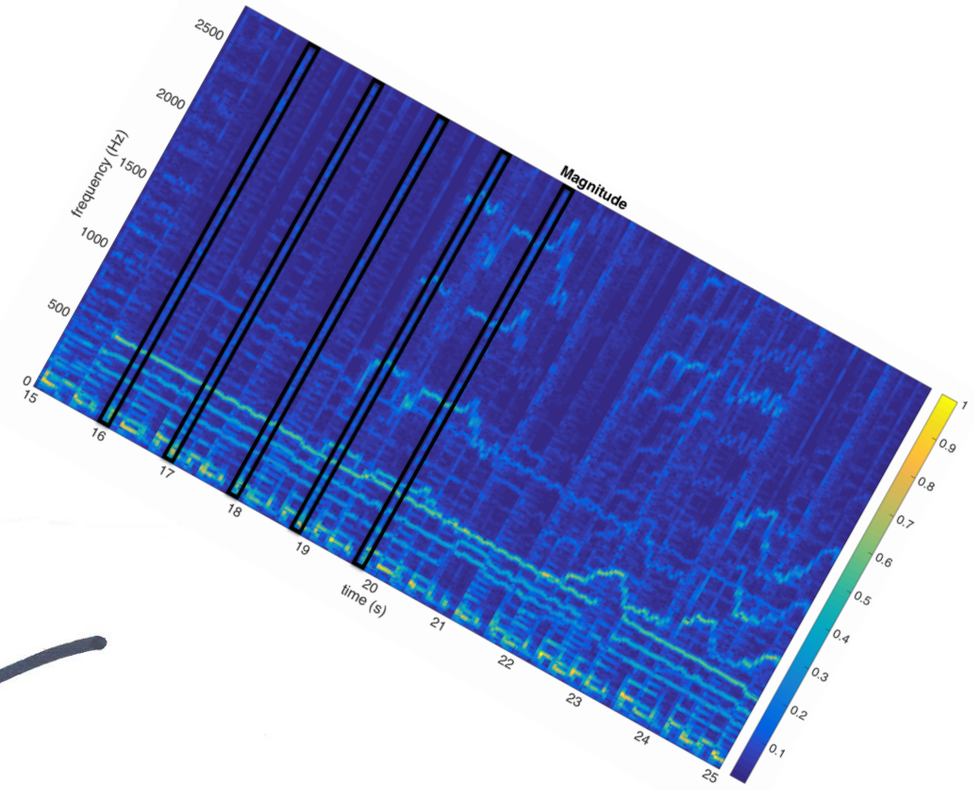
CLOSE FRAMES

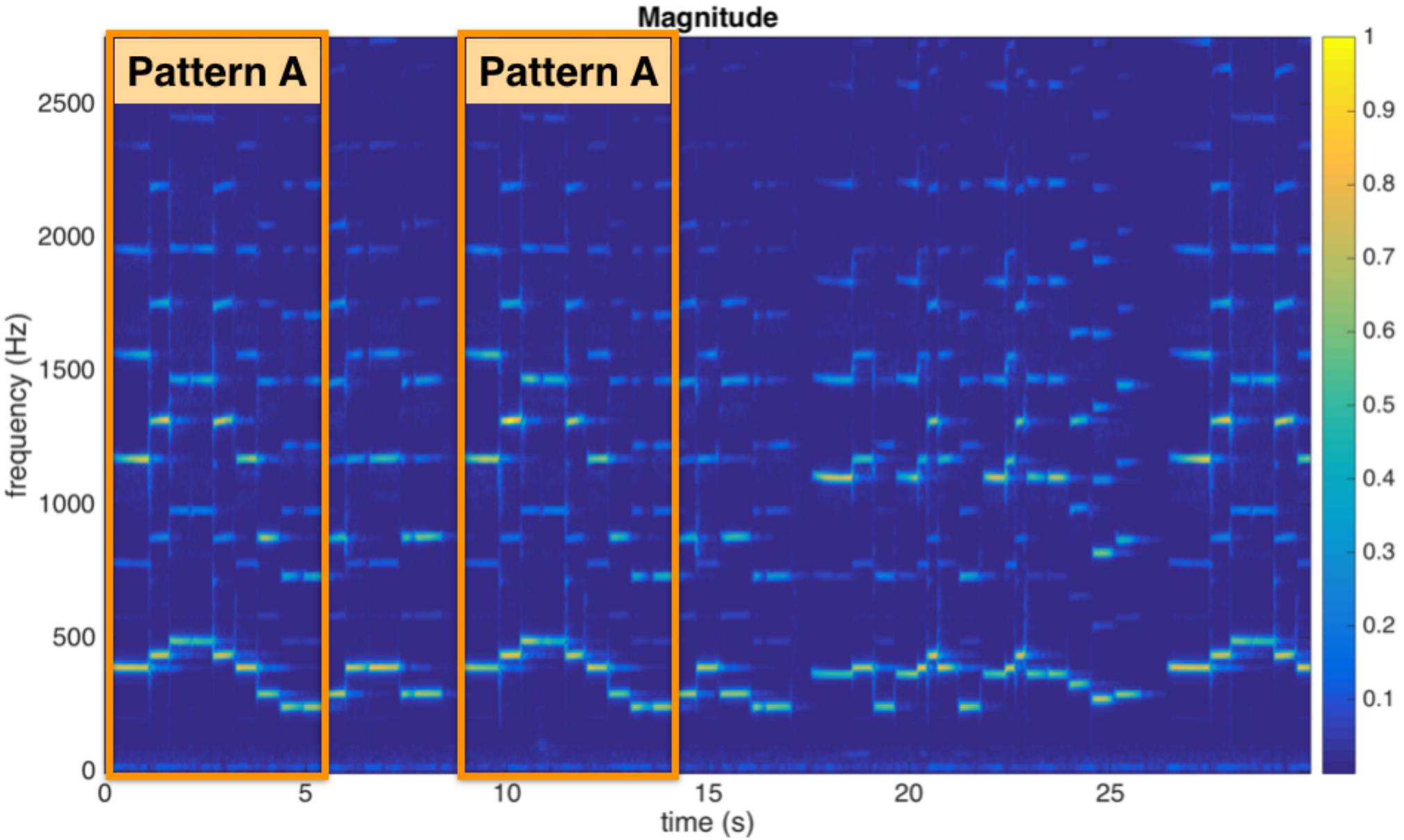


ORIGINAL CLEAN FRAME

CLOSE FRAMES


Magnitude
frequency (Hz)
time (s)
Dictionary
frequency (Hz)
nb. spectral basis
Activations
nb. spectral basis
time (s)


Magnitude
frequency (Hz)
time (s)


Magnitude
Pattern A
Pattern A
frequency (Hz)
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10
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time (s)
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0.4
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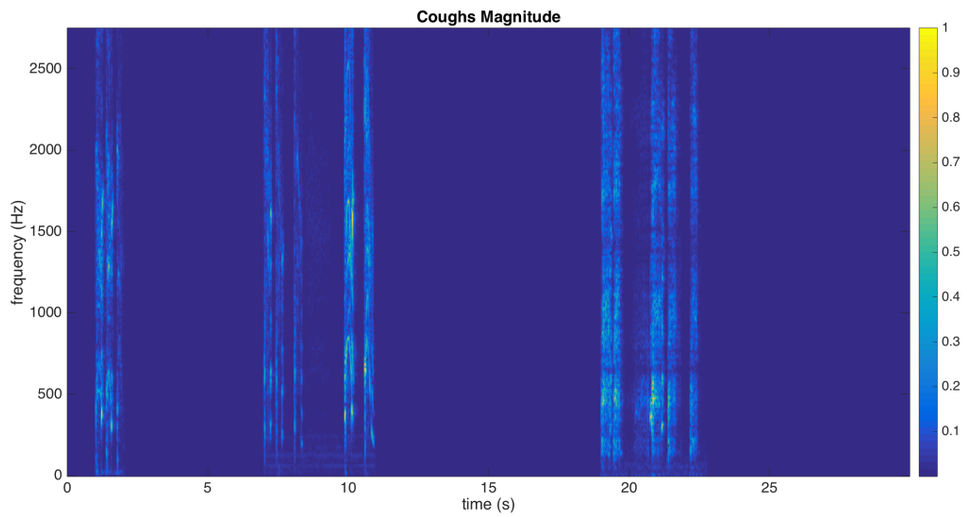
Coughs Magnitude
frequency (Hz)
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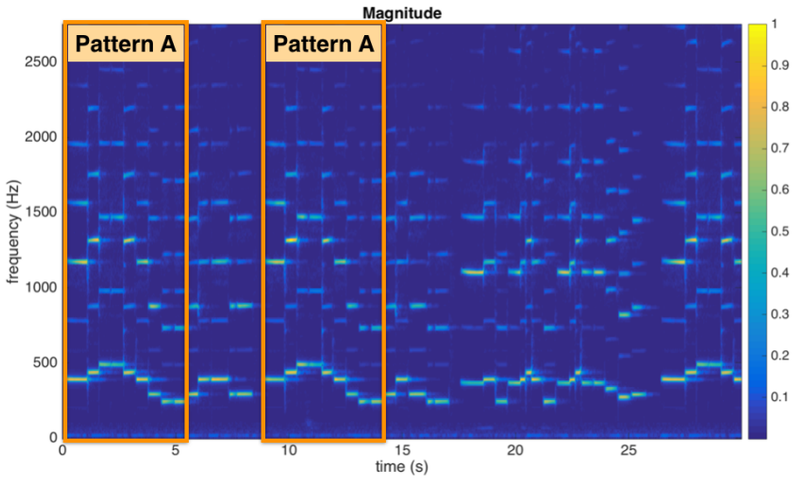
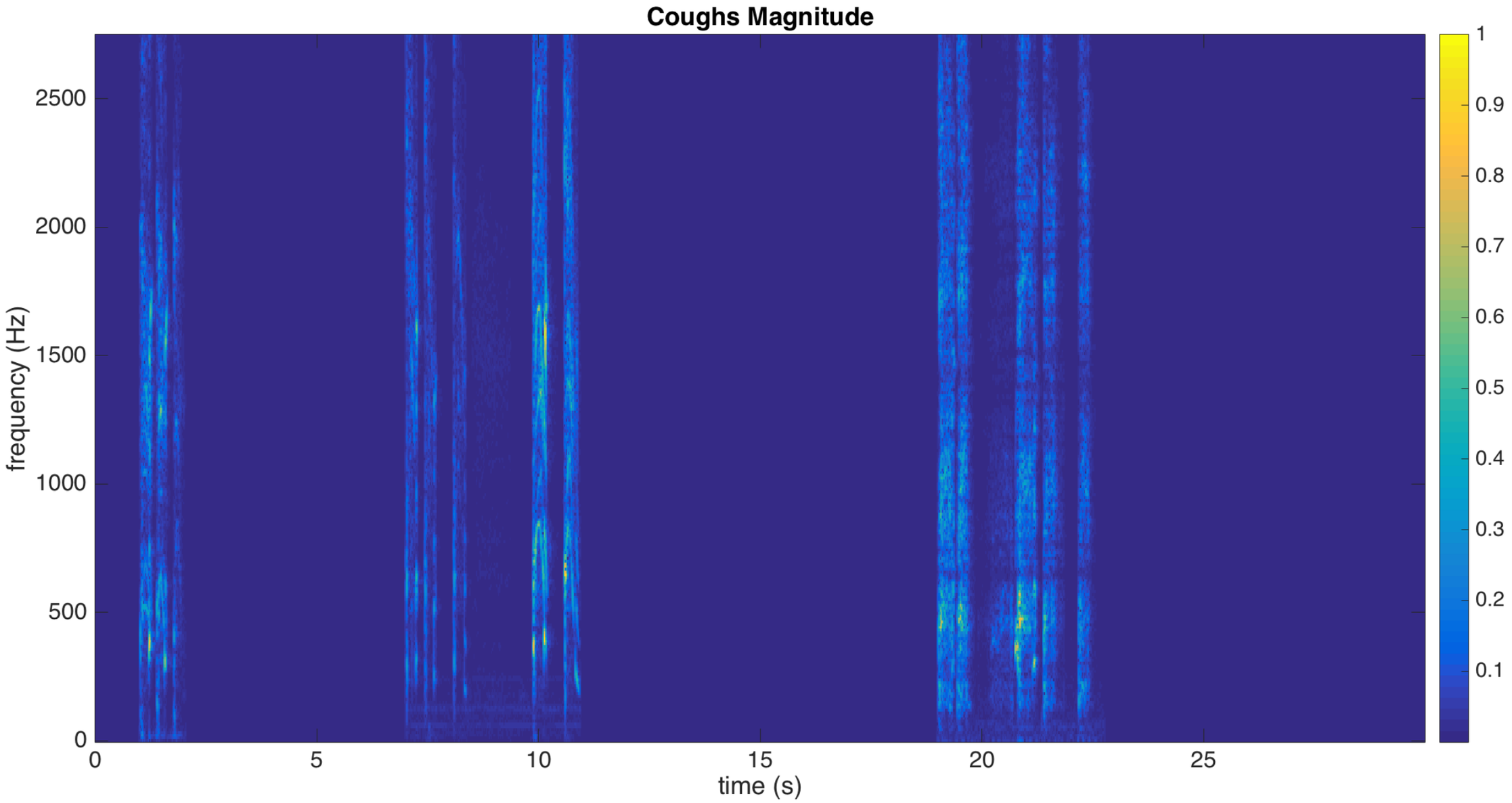

Magnitude
Pattern A
Pattern A
frequency (Hz)
time (s)


Coughs Magnitude
frequency (Hz)
time (s)

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freesound

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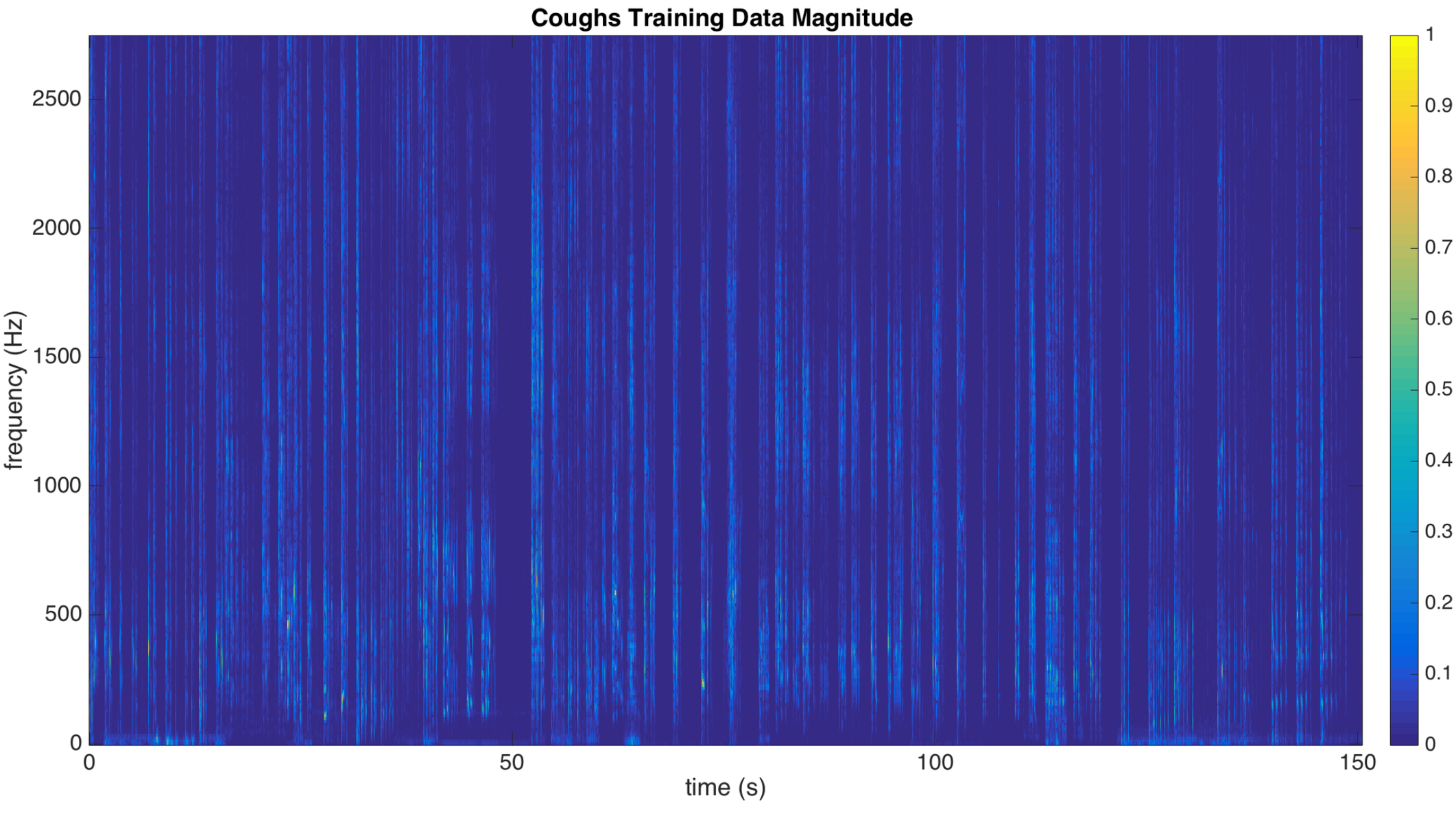
coughs

Sounds Forums People Help

Random sound of the day



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Search

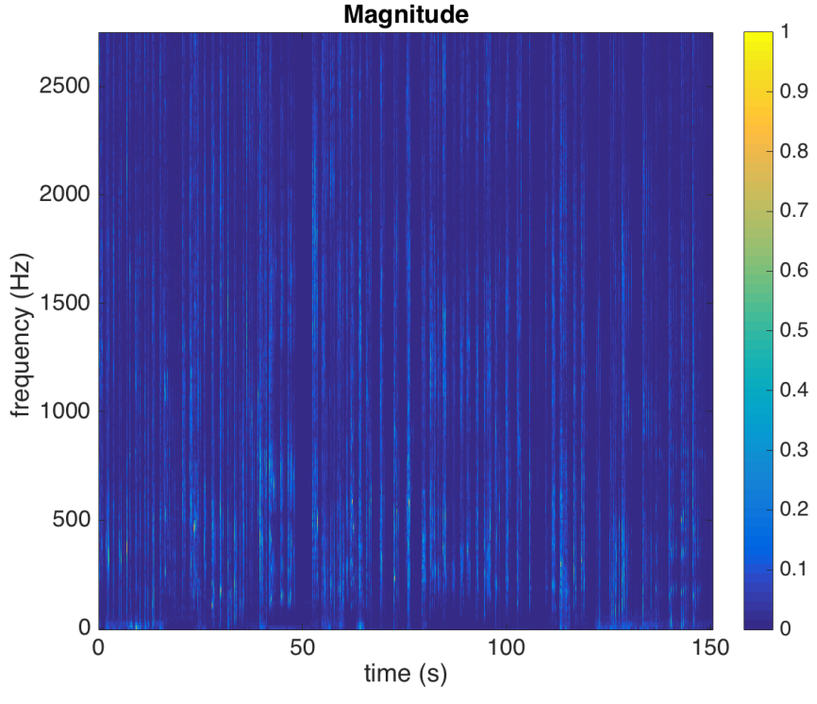
freesound

Register Log In Upload Sounds

coughs

Sounds Forums People Help

Random sound of the day



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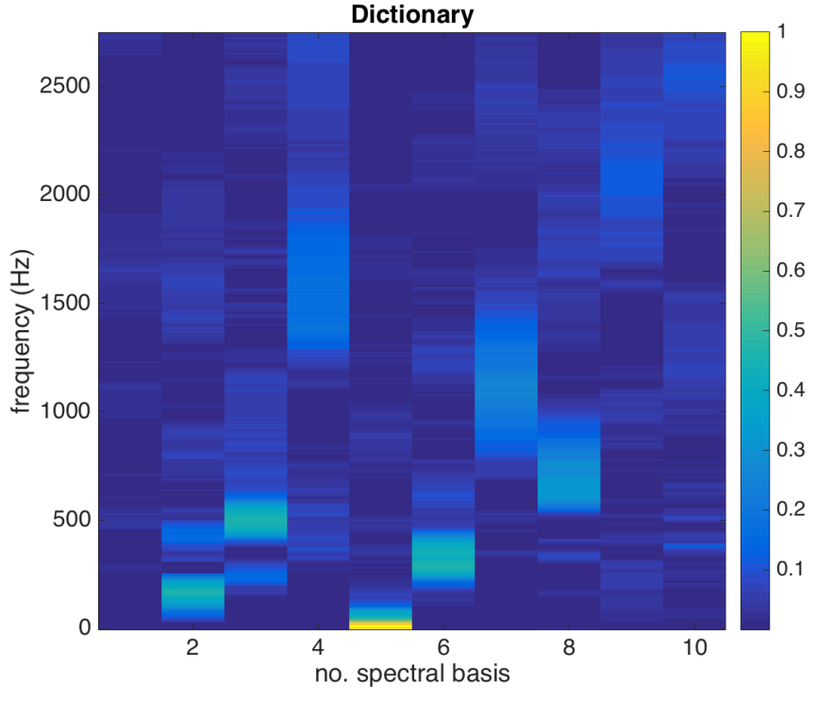

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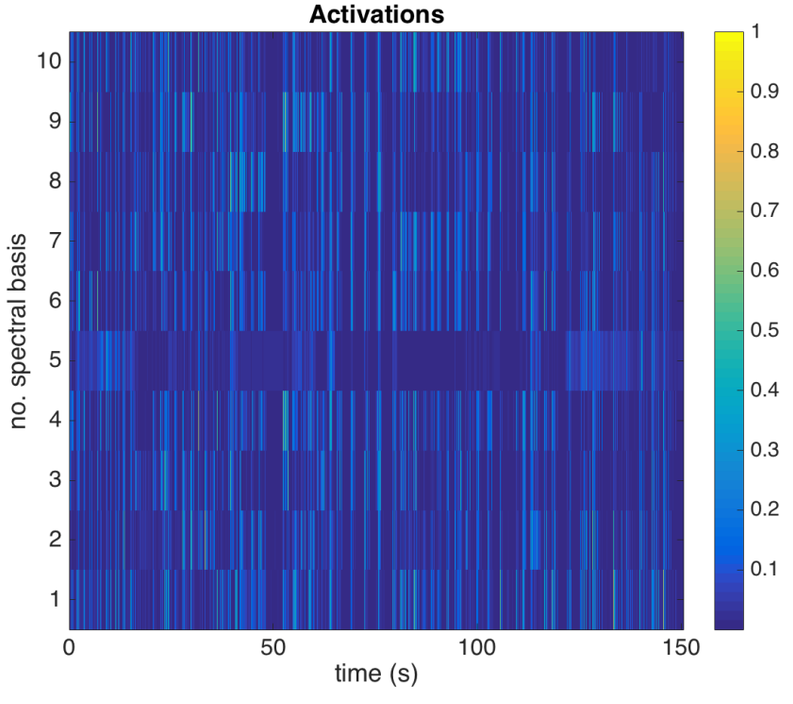
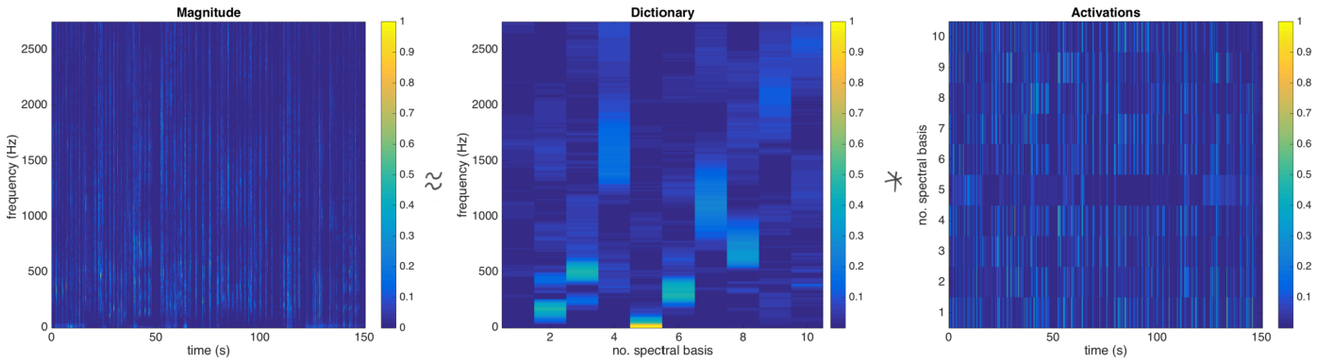
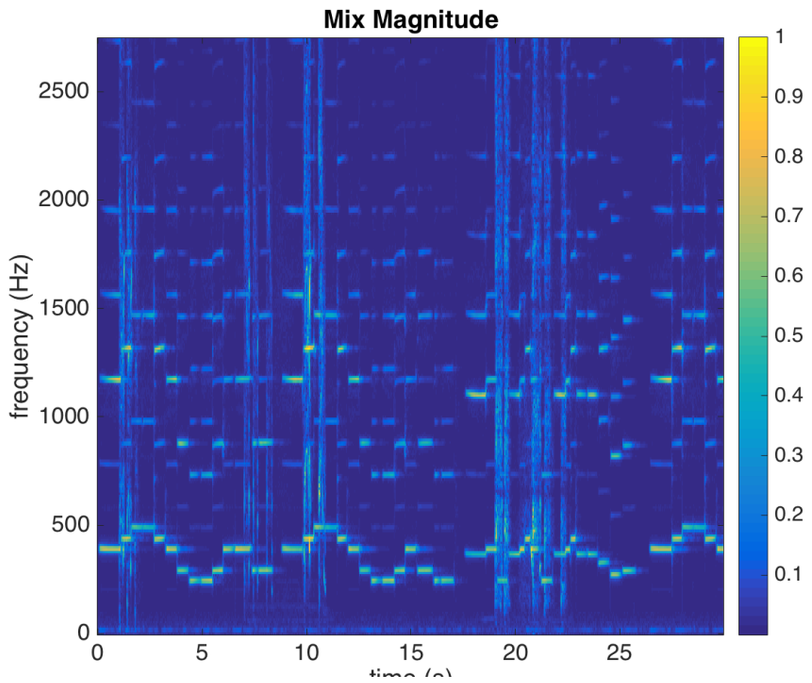




SEMI-SUPERVISED NMF



Mix

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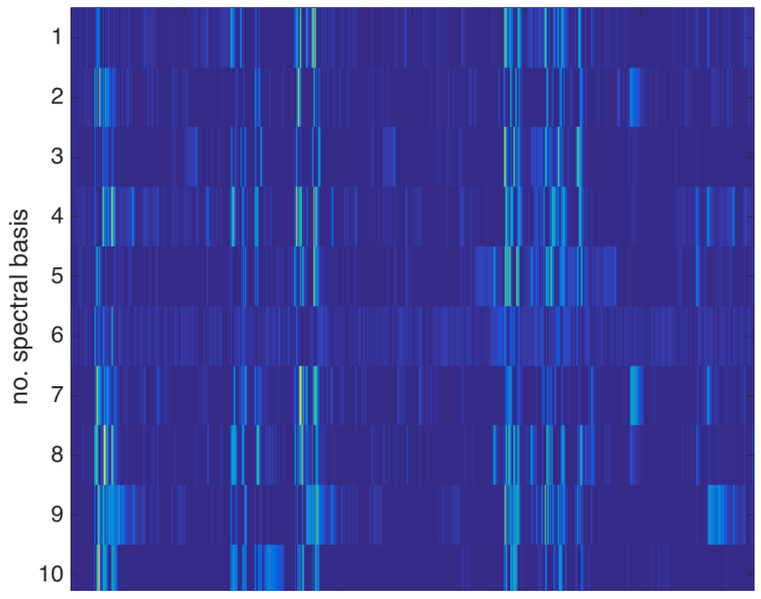
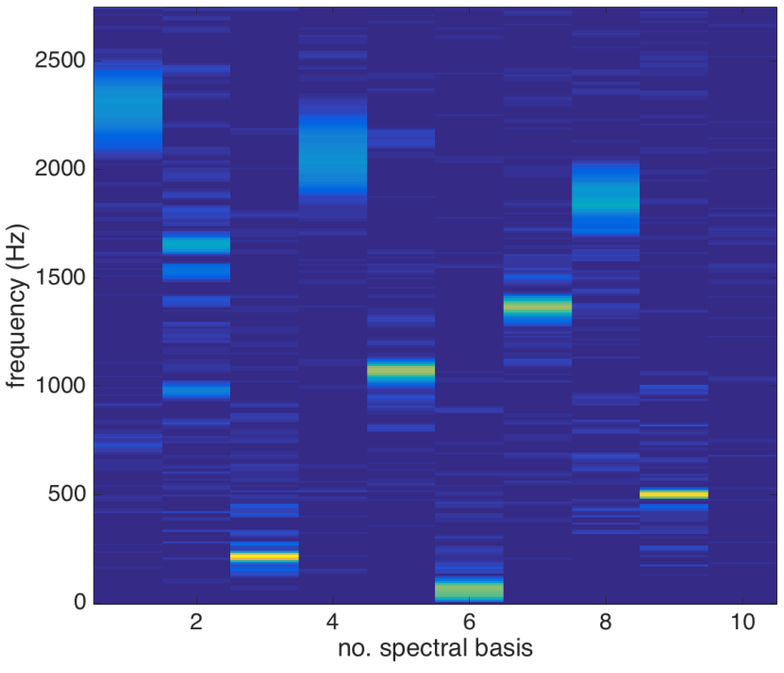
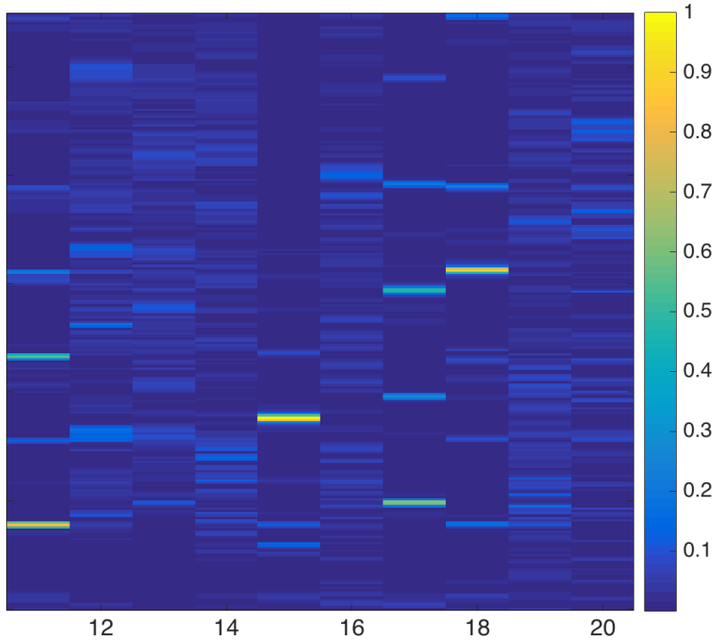


H1

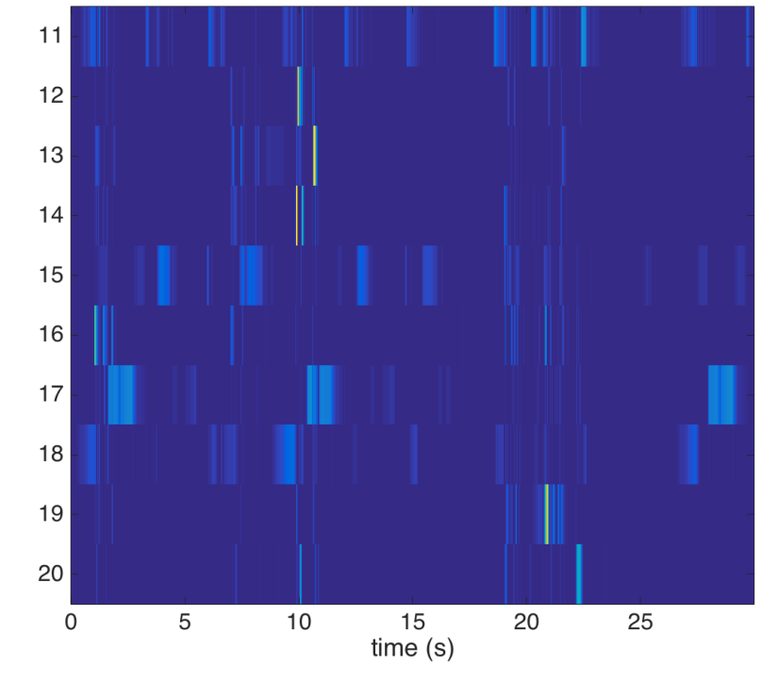


W1

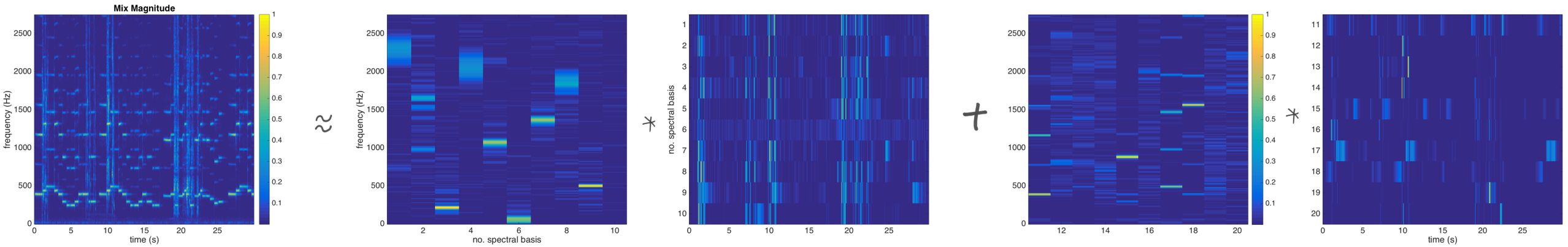


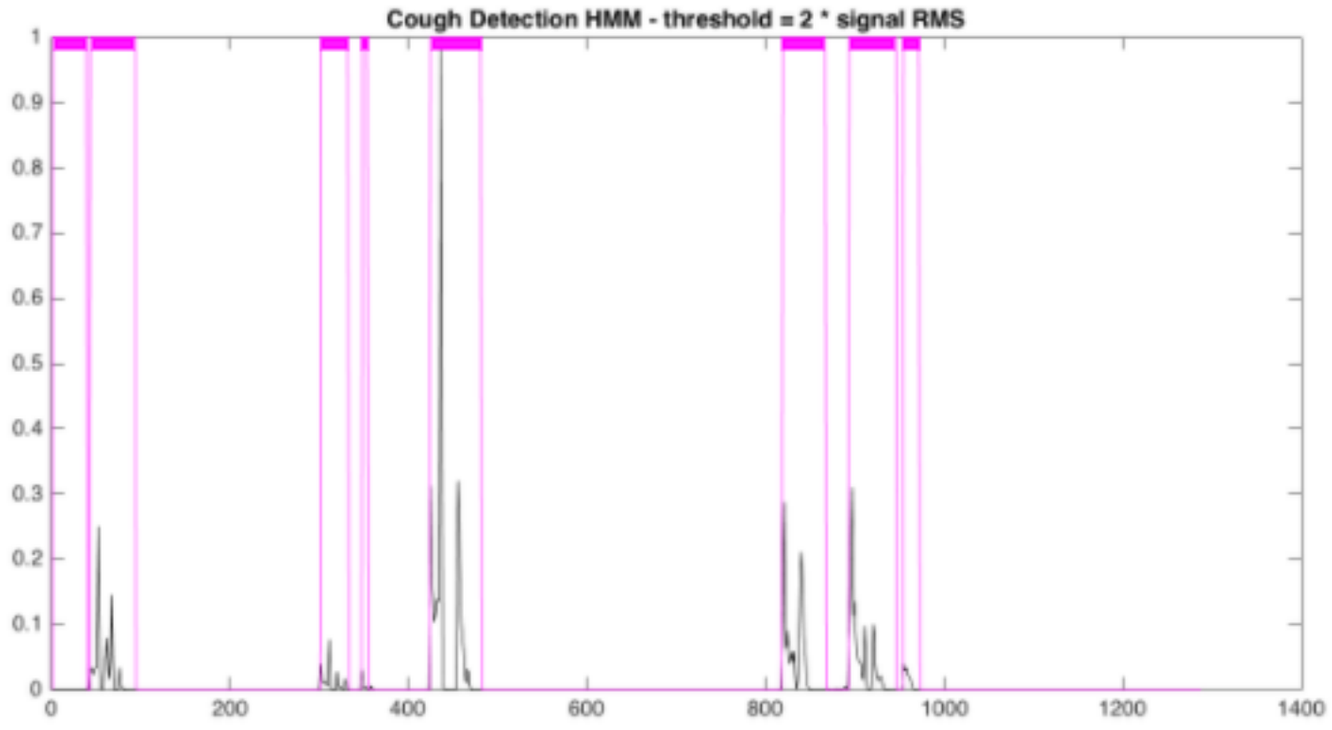
W2

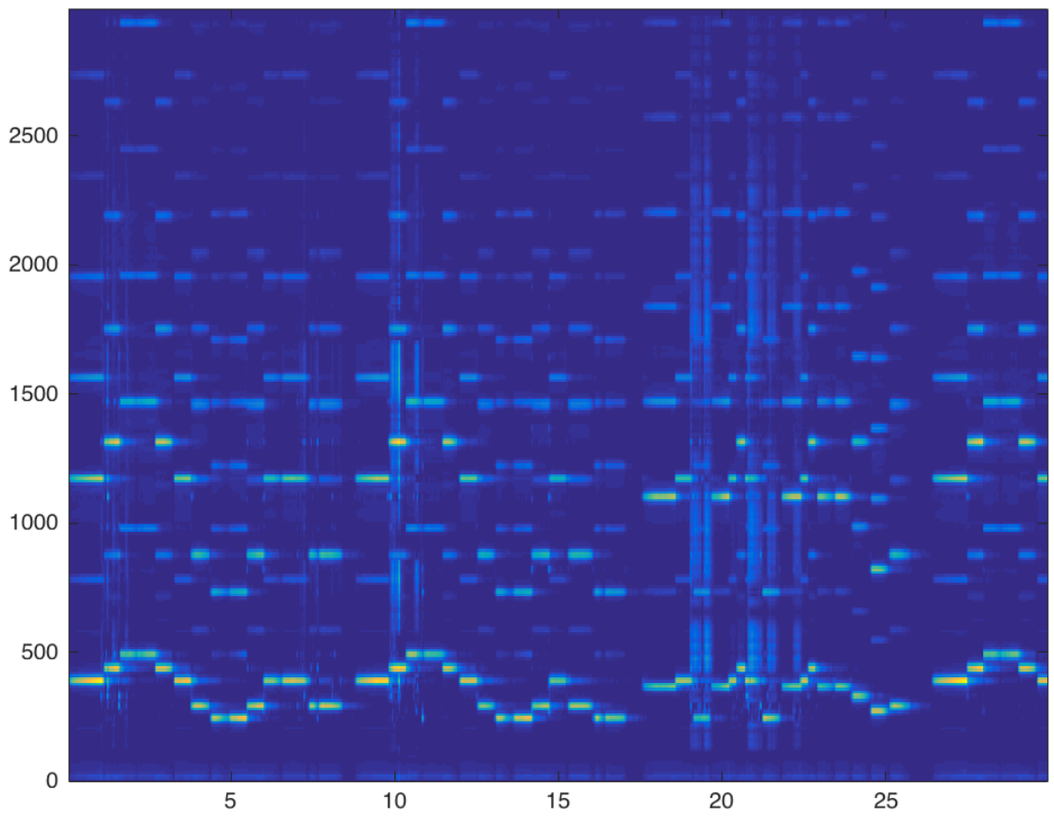
*



H2


Mix Magnitude
frequency (Hz)
time (s)
no. spectral basis
Mix ≈ W1 * H1 + W2 * H2


Cough Detection HMM - threshold = 2 * signal RMS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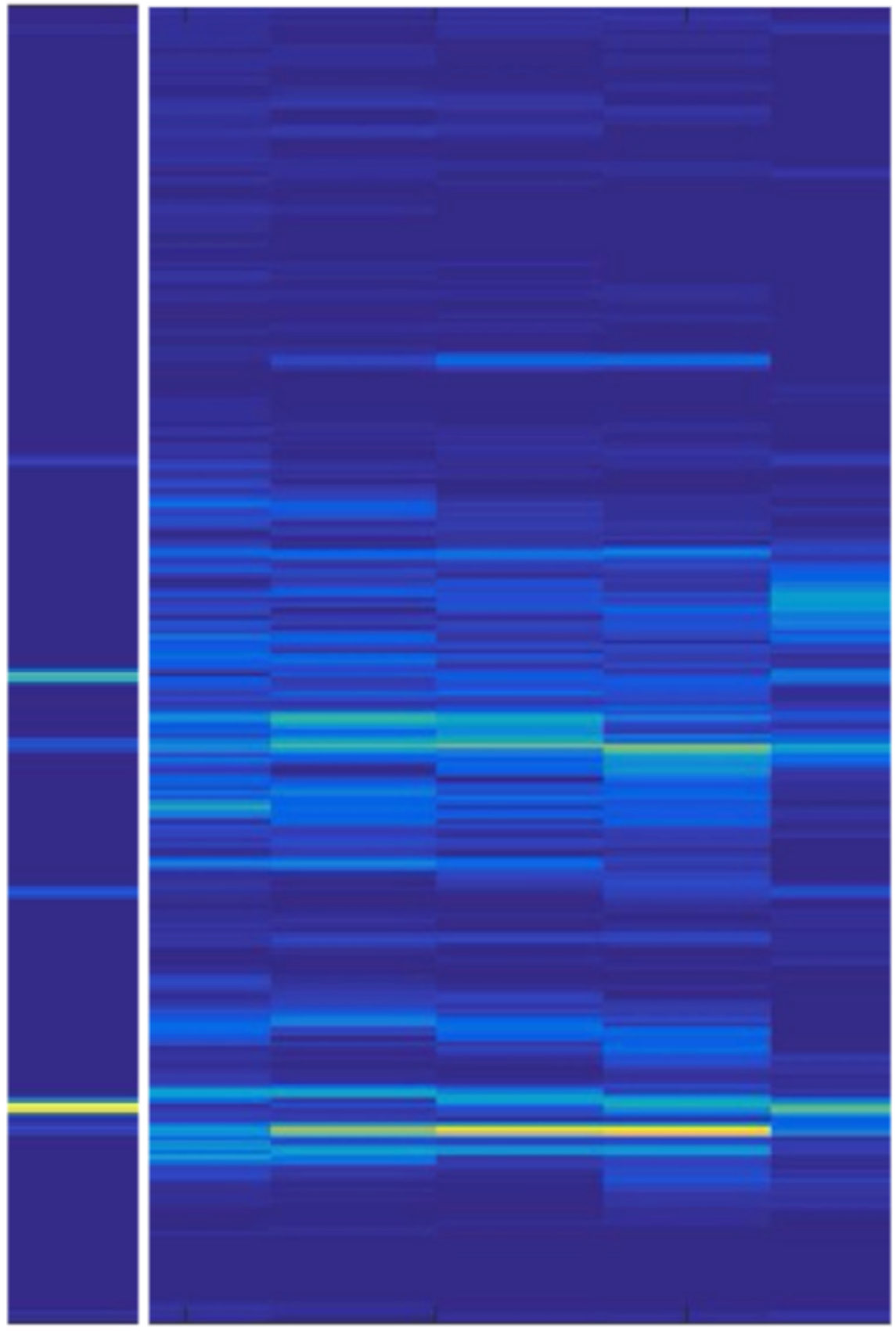
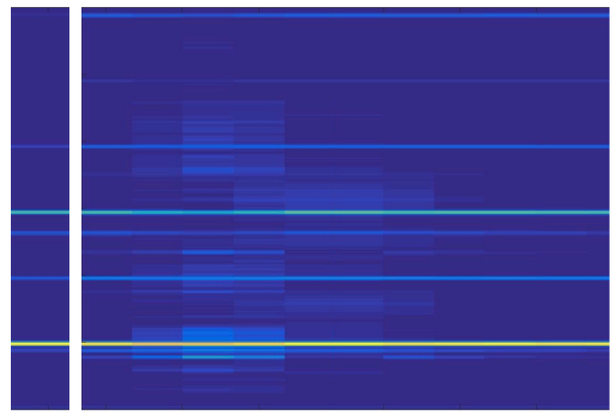
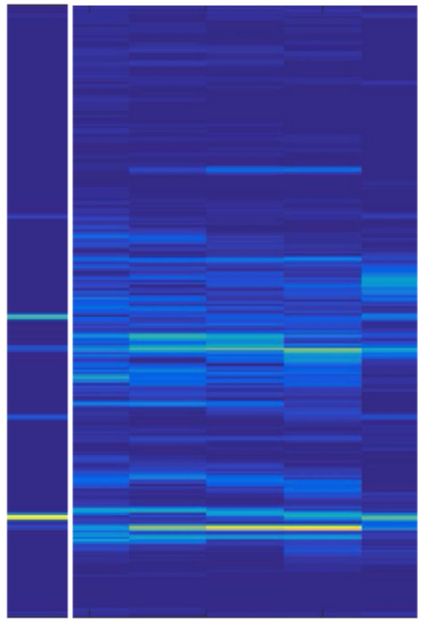
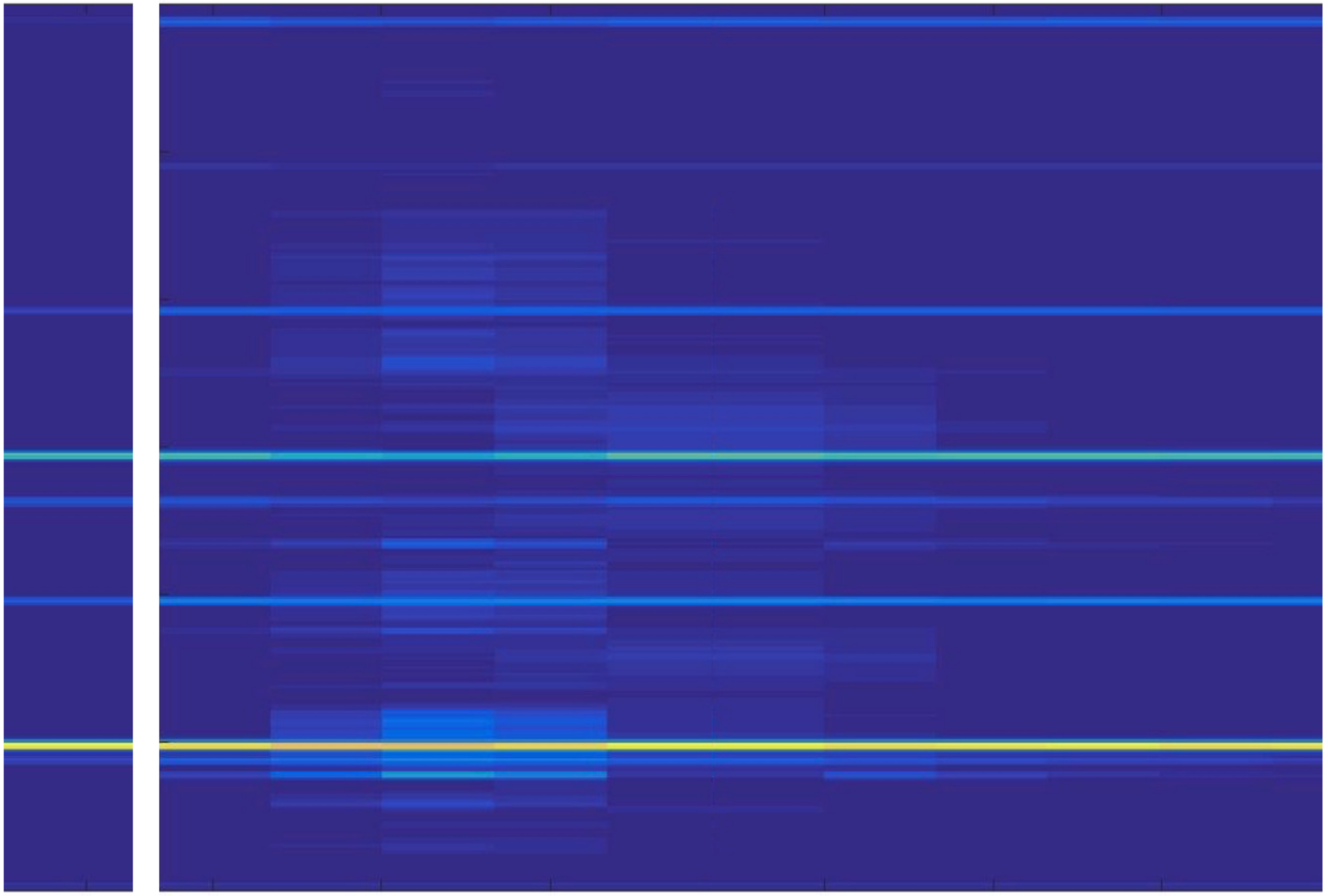
20
25


ORIGINAL
CLEAN
FRAME
CLOSE FRAMES


ORIGINAL
CLEAN
FRAME
CLOSE FRAMES


ORIGINAL CLEAN FRAME
CLOSE FRAMES


ORIGINAL CLEAN FRAME
CLOSE FRAMES

58
STEMS

+

COUGHS

DOOR
SLAM

CHAIR
SOUNDS

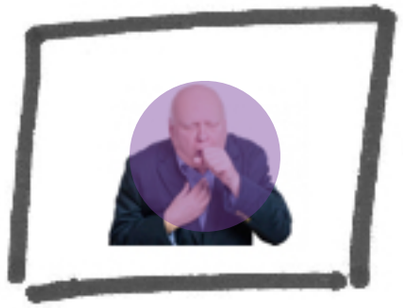
SCREAM

OBJECT
DROP

23 INSTRUMENTS

58
STEMS

+



COUGHS

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DROP

23 INSTRUMENTS

	NSDR			NSIR		
	0dB	−3dB	−6dB	0dB	−3dB	−6dB
Prop.	6.78	4.76	2.52	16.79	15.30	13.69
NMF	4.76	3.16	1.13	13.15	14.40	15.62

REAL LIFE...

CONCLUSION

NMF ❤ KAM

ANY

QUESTIONS?

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