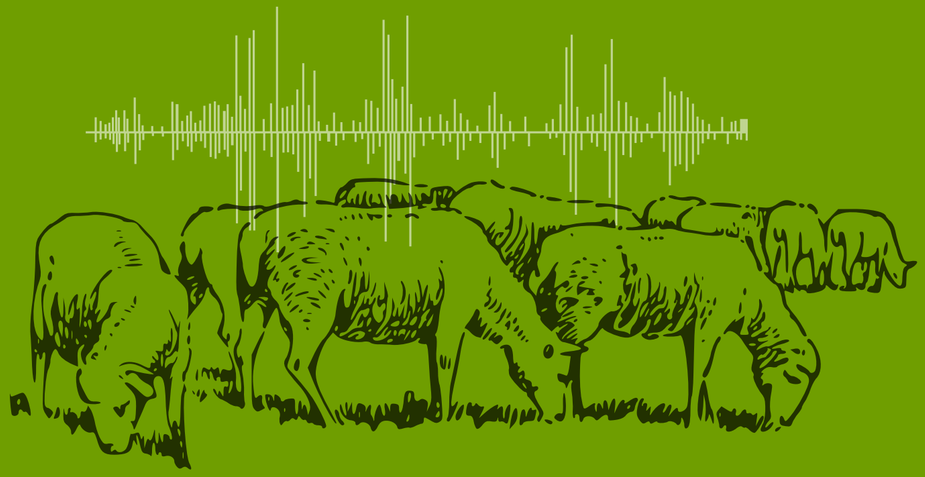


AUTOMATIC RECOGNITION OF HERBAGE PREHENSIONS IN GRAZING EWES

S. Bognanno, R. Avanzato, L. Beritelli, F. Beritelli, F. Gimmillaro, M. Avondo

PROBLEMATIC

Monitoring of feeding behaviour on pasture rappresents one of the fundamental challenges for PLF, especially in extensive sistems.

1

DIRECT OBSERVATIONS

Traditional method.
Expensive and subject to interobserver variability.

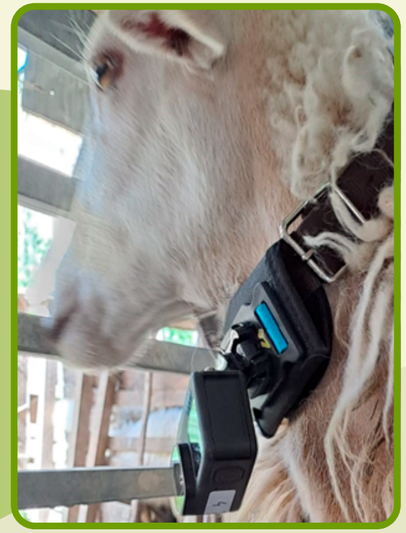
2

ACCELEROMETERS

Inertial sensors (X, Y, Z) that record posture and dynamic movement intensity to automatically classify grazing, rumination and resting.

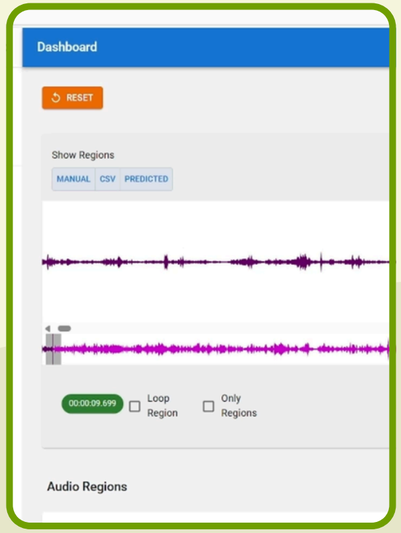
ACOUSTIC TECHNOLOGIES

Exploit distinctive bite and prehension patterns allowing events to be classified.



Acoustic data acquisition

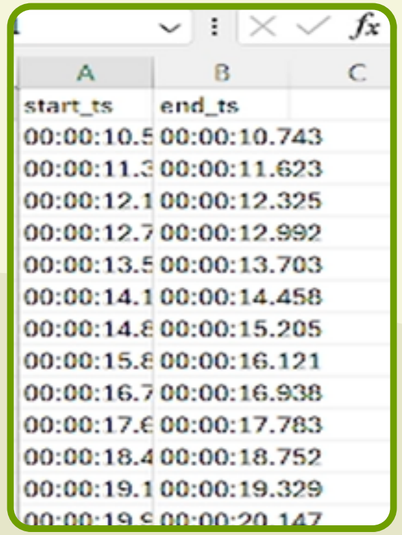
Collar-mounted microphone and POV camera



File upload

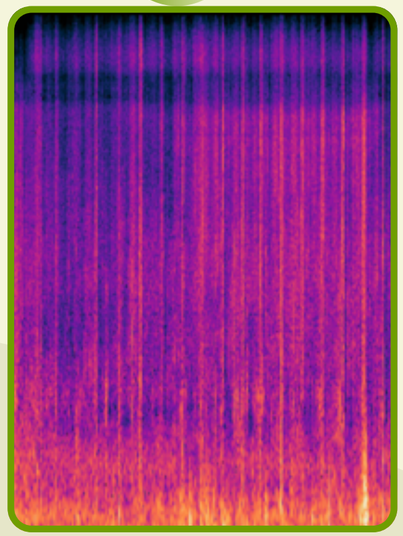
Deep learning classification

Pattern recognition of prehension events



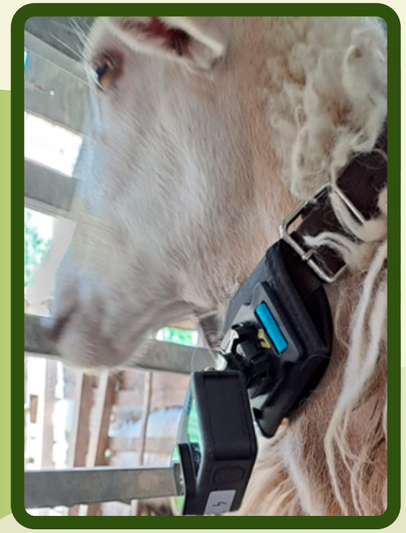
Prehension events output

Timing and number of bites



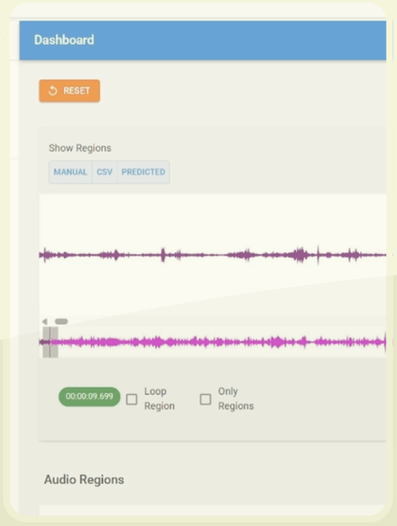
Spectrogram generation

Time-frequency representation



Acoustic data acquisition

Collar-mounted microphone and POV camera



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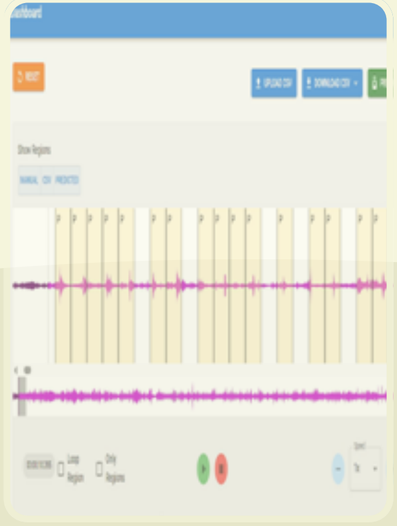
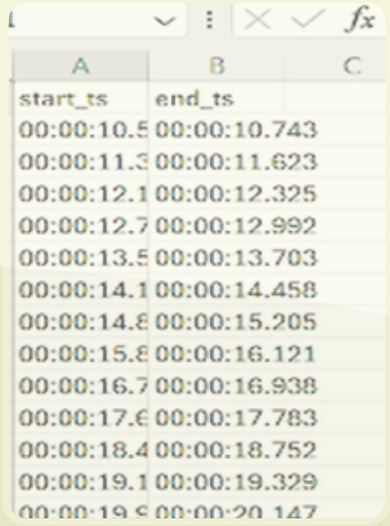


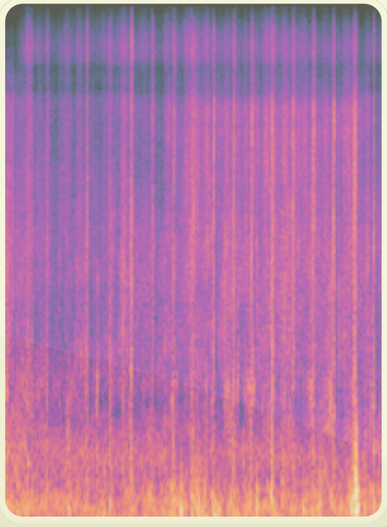
Deep learning classification

Pattern recognition of prehension events



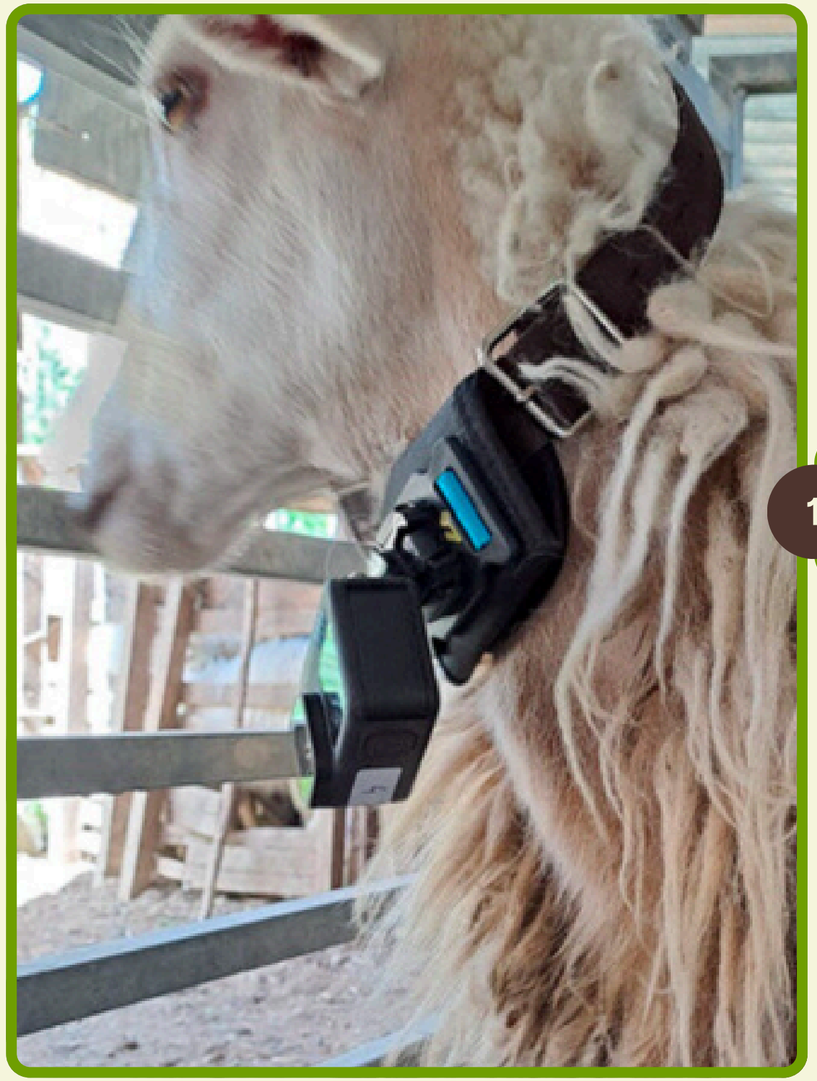
Prehension events output

Timing and number of bites



Spectrogram generation

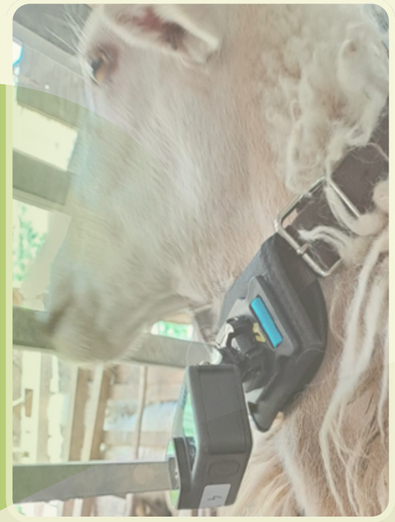
Time-frequency representation



ACOUSTIC DATA ACQUISITION

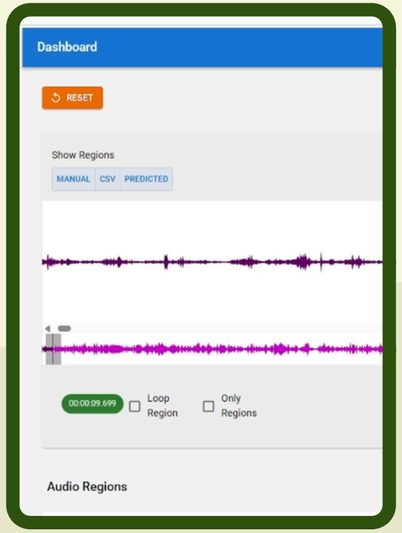
1 Microphone collars

2 Audio file in WAV format



Acoustic data acquisition

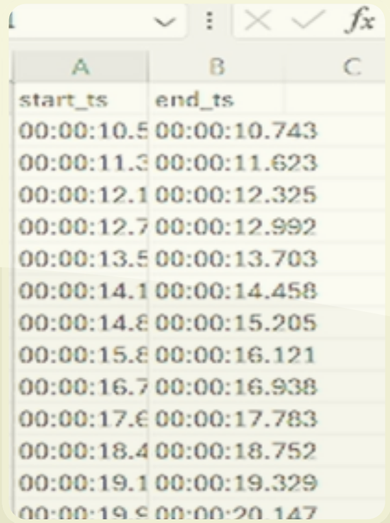
Collar-mounted microphone and POV camera



File upload

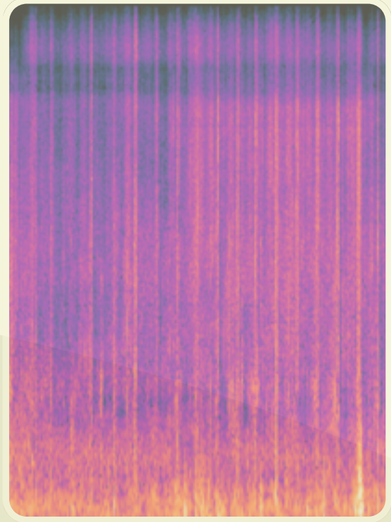
Deep learning classification

Pattern recognition of prehension events



Prehension events output

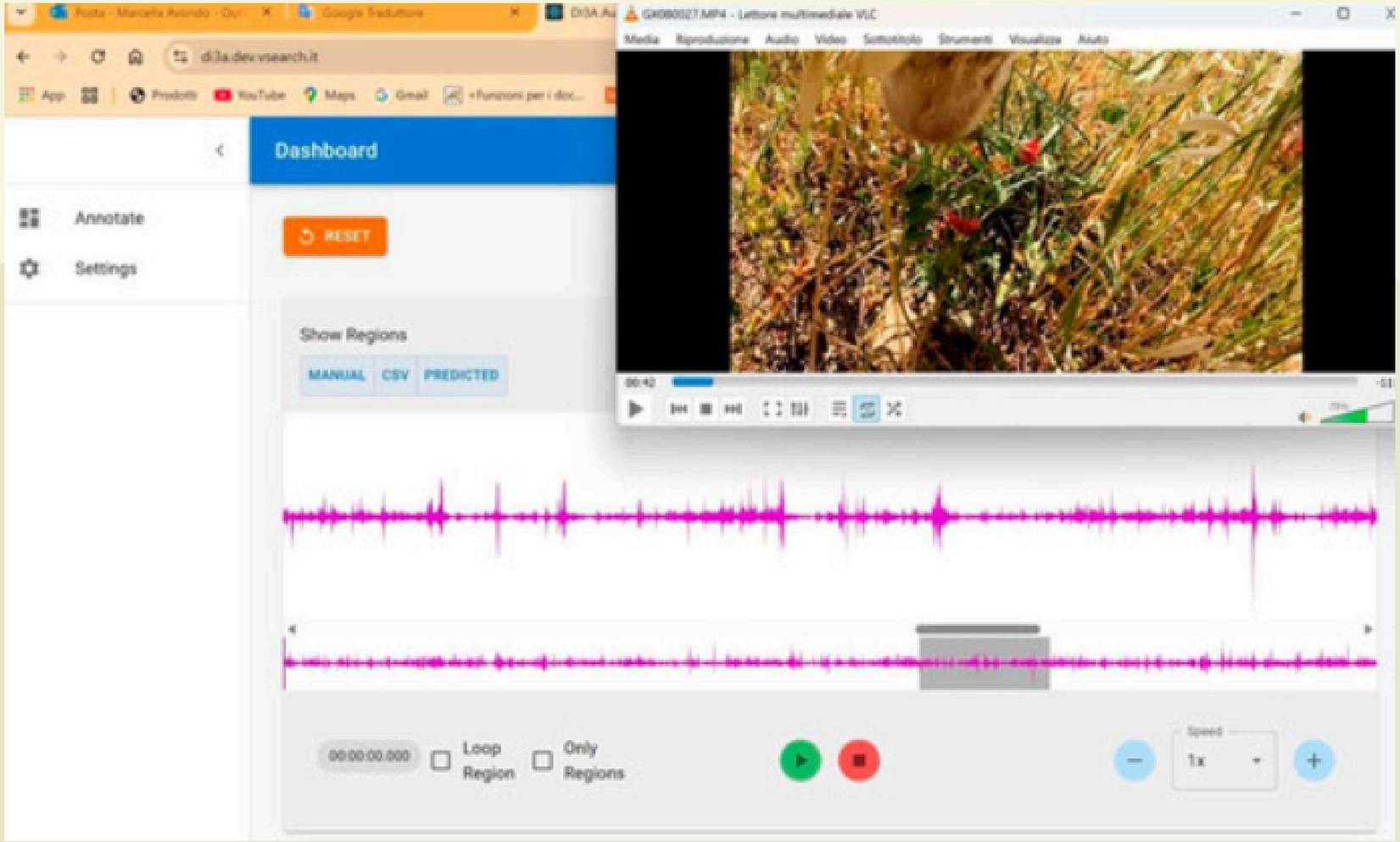
Timing and number of bites

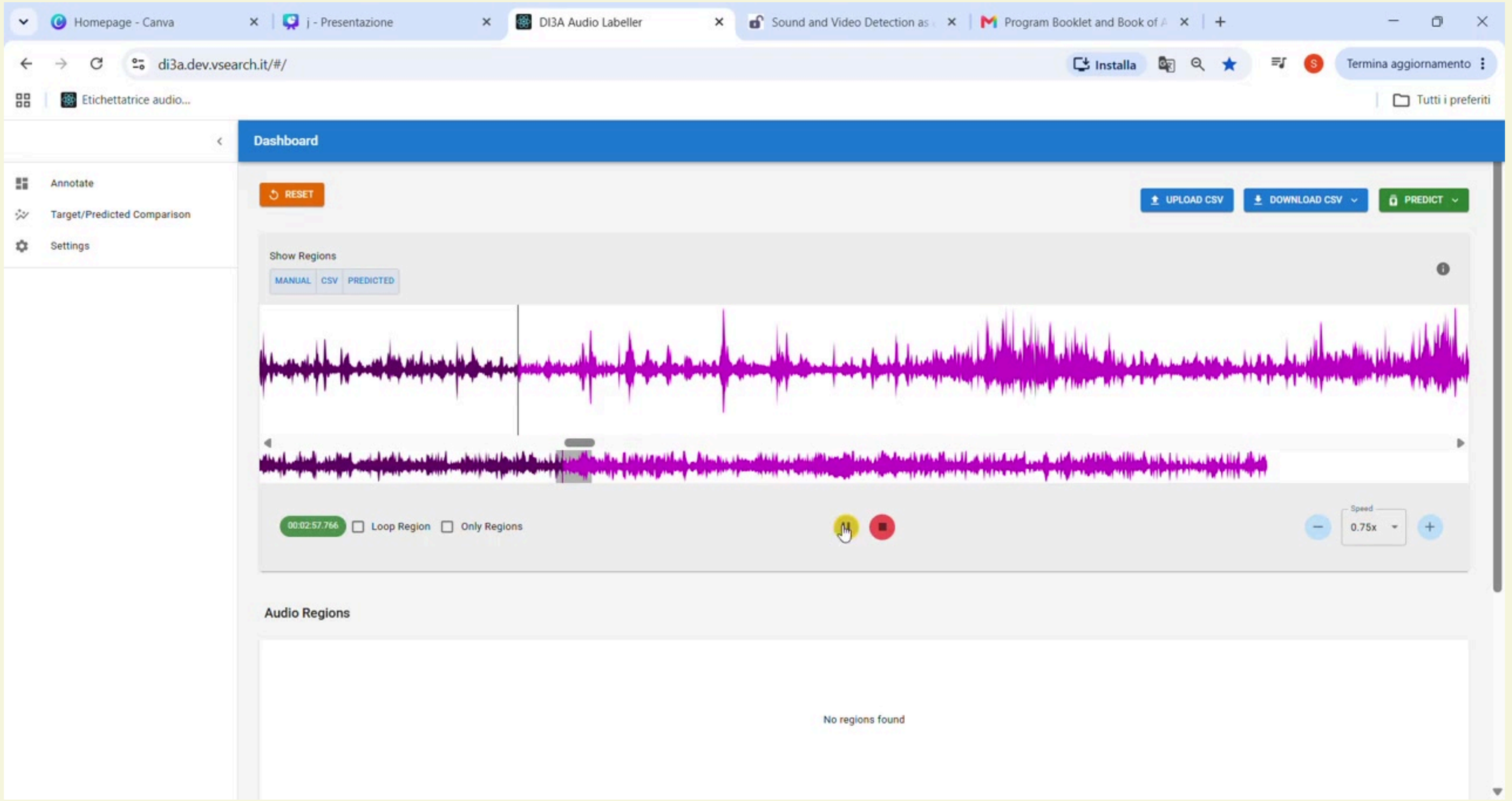


Spectrogram generation

Time-frequency representation

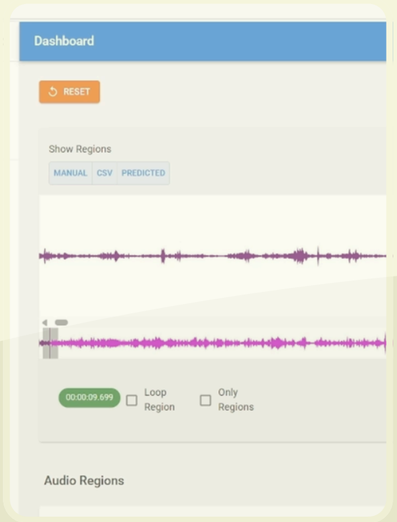
FILE UPLOAD


Dashboard
Annotate
Settings
RESET
Show Regions
MANUAL
CSV
PREDICTED
00:00:00.000
Loop Region
Only Regions
Speed
1x

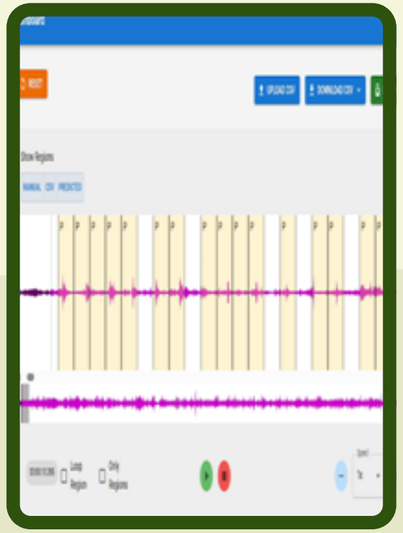

Homepage - Canva
j - Presentazione
DI3A Audio Labeller
Sound and Video Detection as
Program Booklet and Book of
di3a.dev.vsearch.it/#/
Installa
Termina aggiornamento
Etichettatrice audio...
Tutti i preferiti
Dashboard
Annotate
Target/Predicted Comparison
Settings
RESET
UPLOAD CSV
DOWNLOAD CSV
PREDICT
Show Regions
MANUAL
CSV
PREDICTED
00:02:57.766
Loop Region
Only Regions
Speed
0.75x
Audio Regions
No regions found

Acoustic data acquisition

Collar-mounted microphone and POV camera

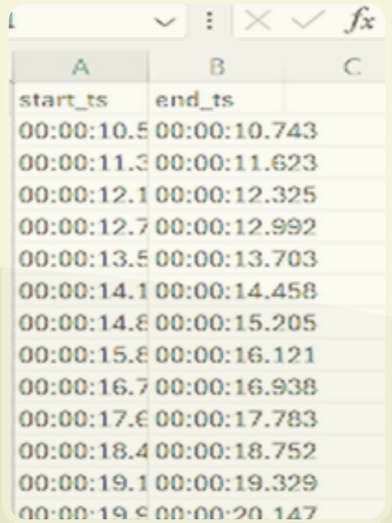


File upload



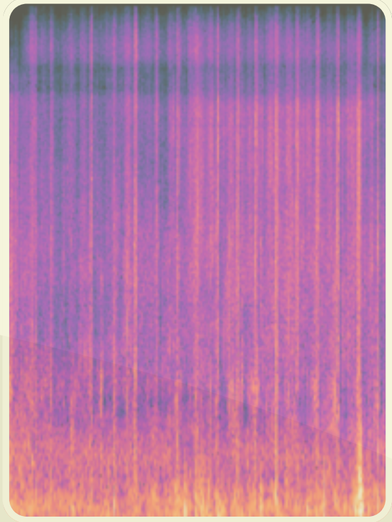
Deep learning classification

Pattern recognition of prehension events



Prehension events output

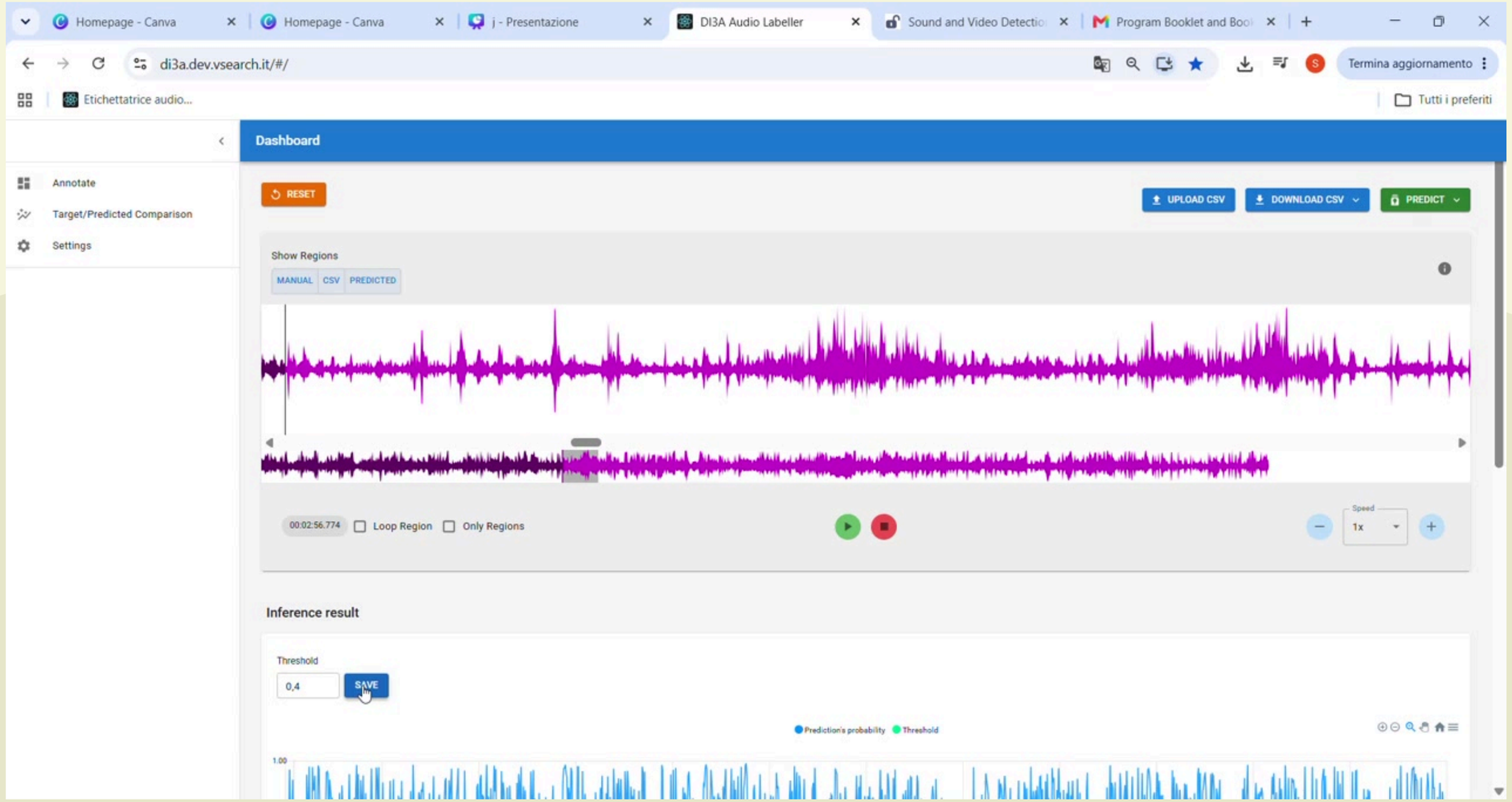
Timing and number of bites

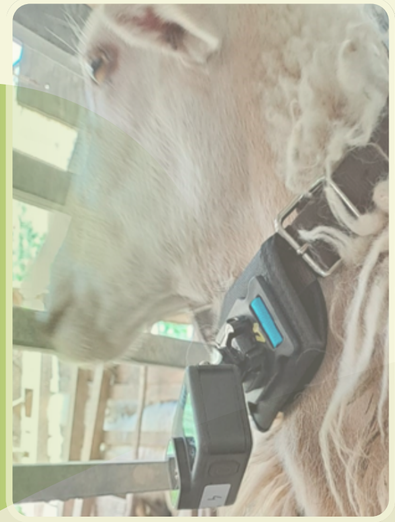


Spectrogram generation

Time-frequency representation

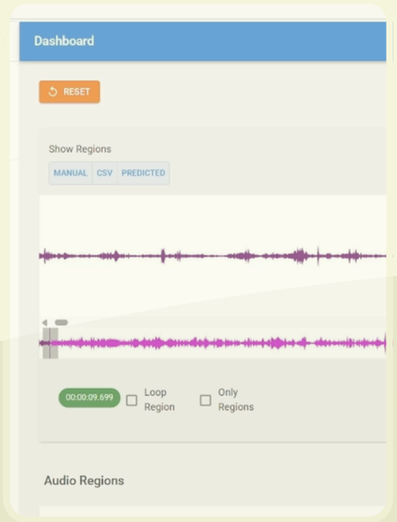
DEEP LEARNING CLASSIFICATION





Acoustic data acquisition

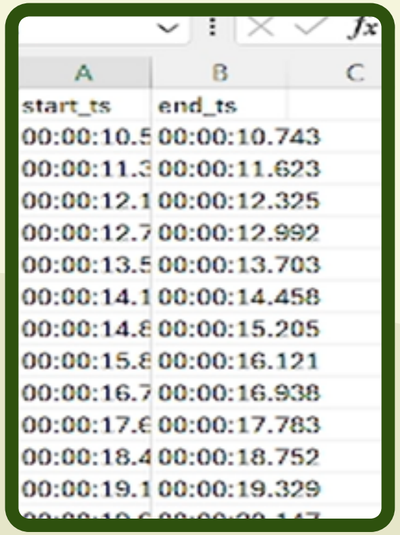
Collar-mounted microphone and POV camera



File upload

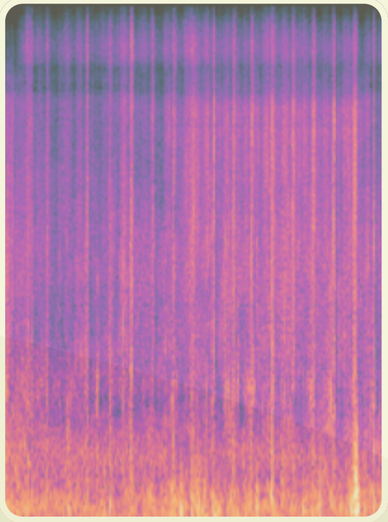
Deep learning classification

Pattern recognition of prehension events



Prehension events output

Timing and number of bites



Spectrogram generation

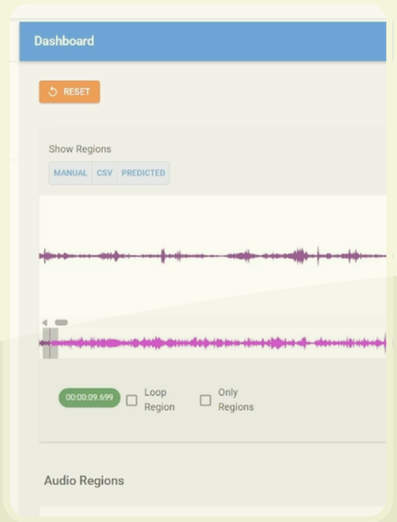
Time-frequency representation

PREHENSION EVENTS OUTPUT

5	00:00:06.3	00:00:06.750
6	00:00:07.7	00:00:08.058
7	00:00:08.5	00:00:09.000
8	00:00:09.6	00:00:09.846
9	00:00:10.0	00:00:10.500
10	00:00:10.5	00:00:11.000
11	00:00:13.0	00:00:13.500
12	00:00:13.5	00:00:14.000
13	00:00:15.2	00:00:15.642
14	00:00:16.5	00:00:17.000

Acoustic data acquisition

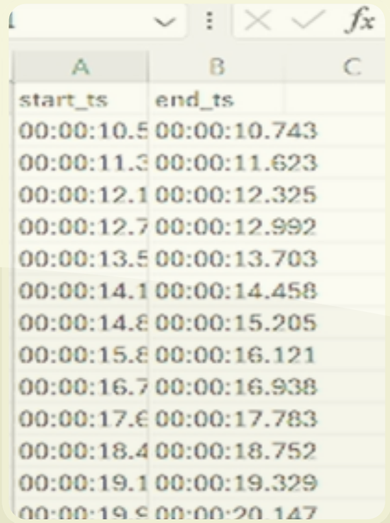
Collar-mounted microphone and POV camera



File upload

Deep learning classification

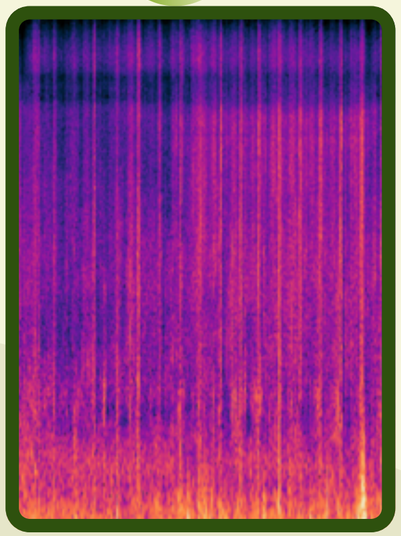
Pattern recognition of prehension events



A	B	C
start_ts	end_ts	
00:00:10.5	00:00:10.743	
00:00:11.3	00:00:11.623	
00:00:12.1	00:00:12.325	
00:00:12.7	00:00:12.992	
00:00:13.5	00:00:13.703	
00:00:14.1	00:00:14.458	
00:00:14.8	00:00:15.205	
00:00:15.8	00:00:16.121	
00:00:16.7	00:00:16.938	
00:00:17.6	00:00:17.783	
00:00:18.4	00:00:18.752	
00:00:19.1	00:00:19.329	
00:00:19.9	00:00:20.147	

Prehension events output

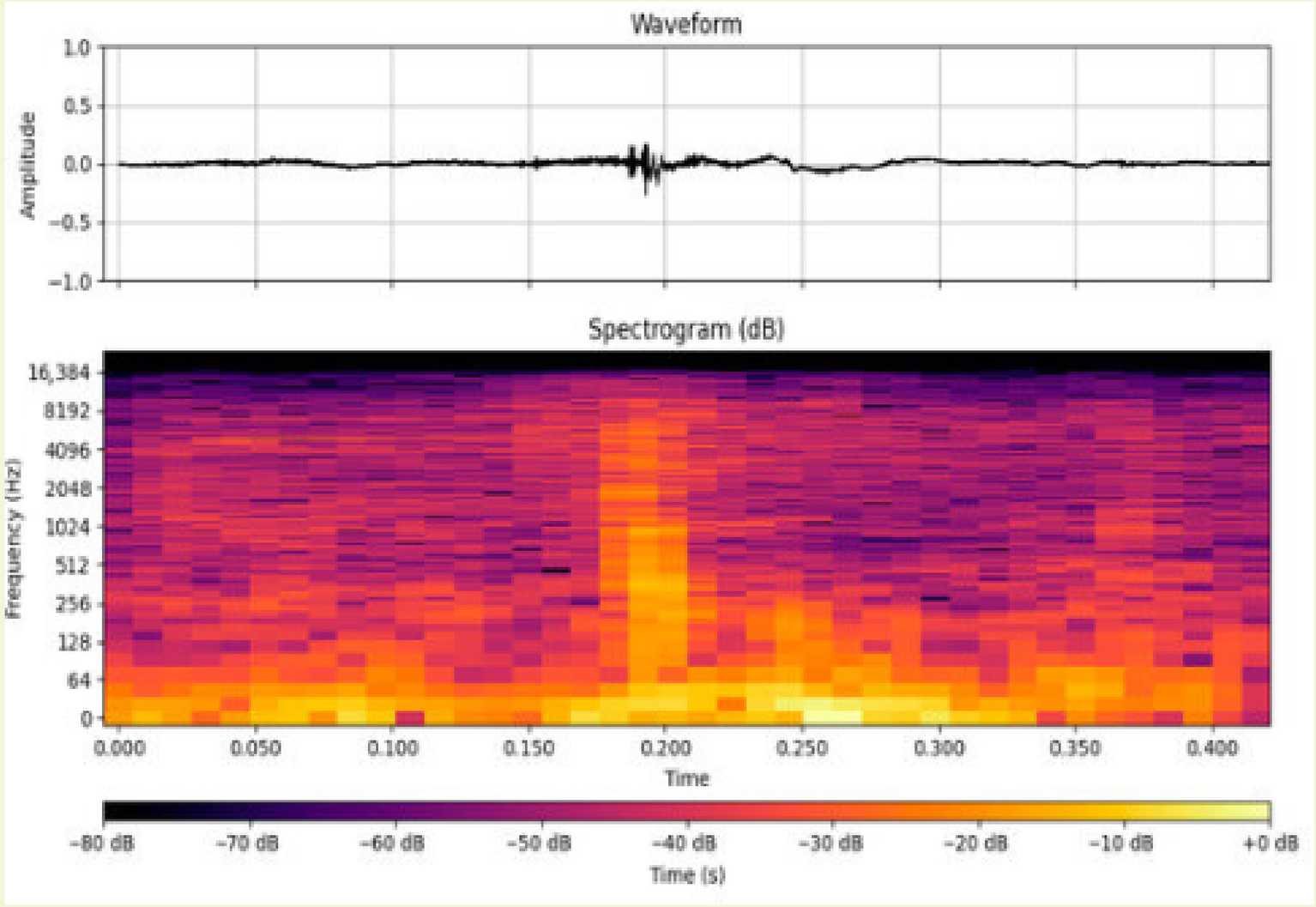
Timing and number of bites



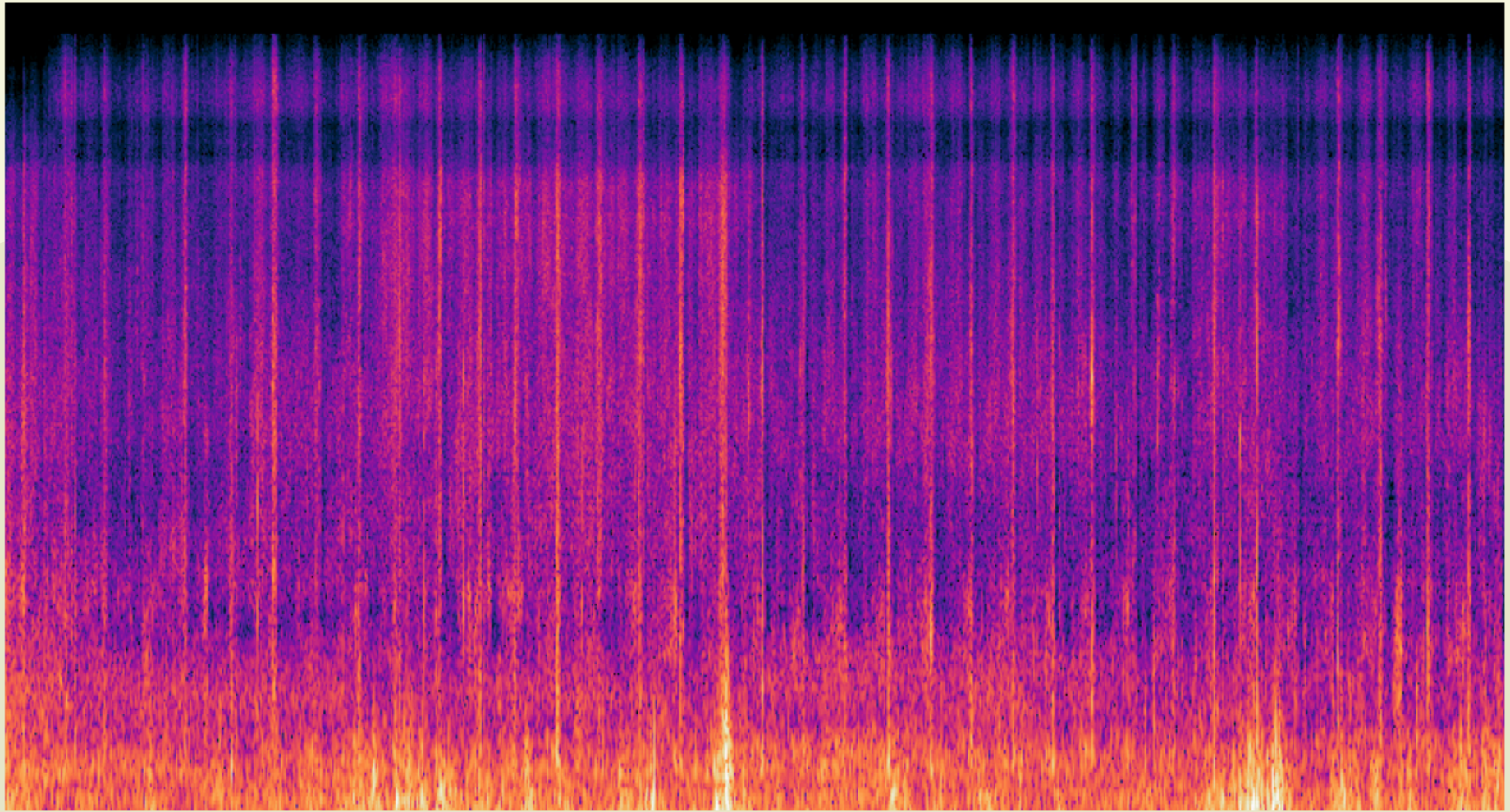
Spectrogram generation

Time-frequency representation

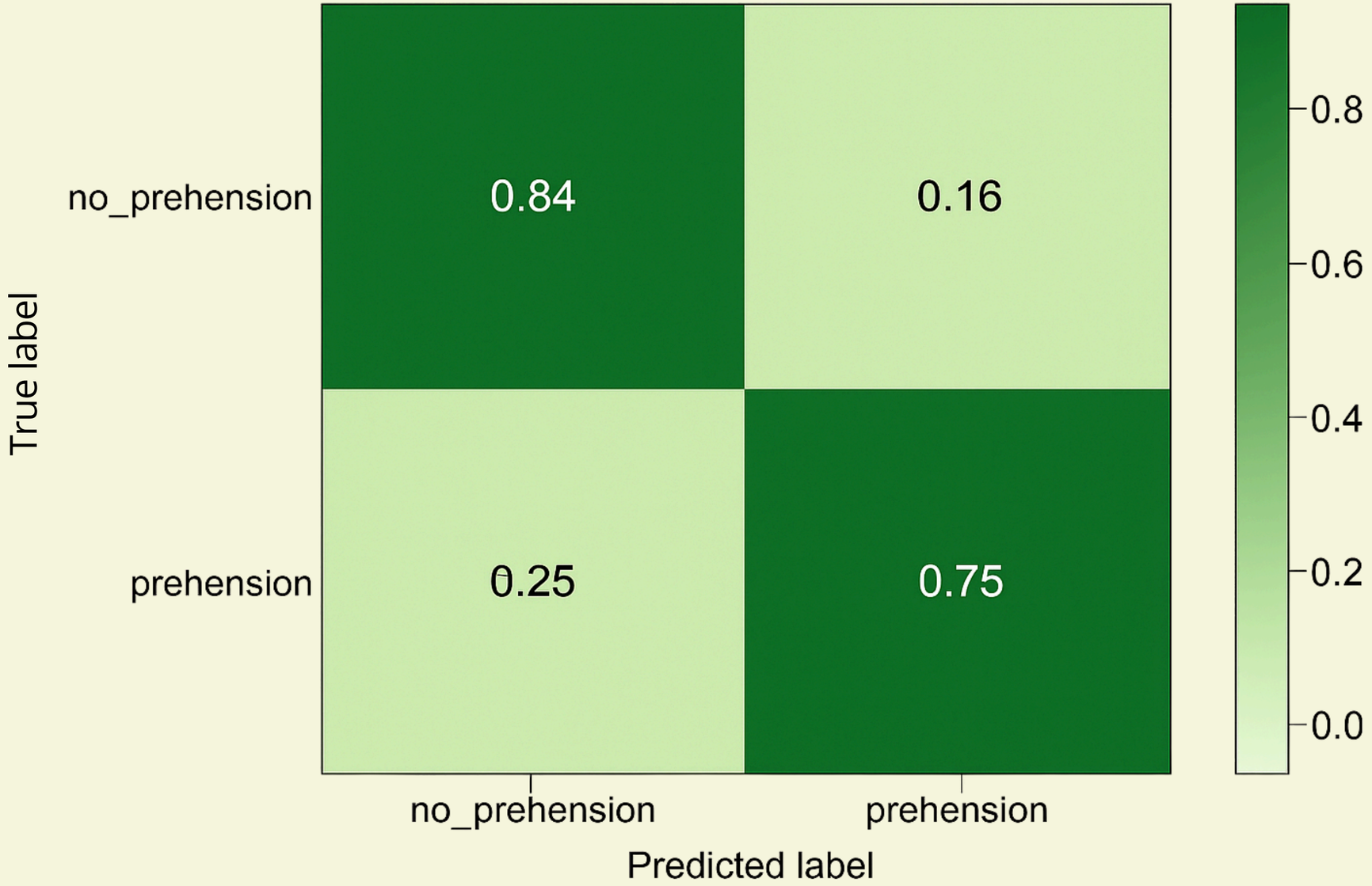
YOLOv11


Waveform
Amplitude
1.0
0.5
0.0
−0.5
−1.0
Spectrogram (dB)
Frequency (Hz)
16,384
8192
4096
2048
1024
512
256
128
64
0
0.000
0.050
0.100
0.150
0.200
0.250
0.300
0.350
0.400
Time
−80 dB
−70 dB
−60 dB
−50 dB
−40 dB
−30 dB
−20 dB
−10 dB
+0 dB
Time (s)

SPECTROGRAM GENERATION



CLASSES	TRAIN_COUNT	TRAIN_MS	TRAIN_TIME	VAL_COUNT	VAL_MS	VAL_TIME	TEST_COUNT	TEST_MS	TEST_TIME
0 (no prehension)	17172	8586000	02:23:06.000	4294	2147000	00:35:47.000	10549	5274500	1:27:54.500
1 (prehension)	14146	7073000	01:57:53.000	3537	1768500	00:29:28.500	6545	3272500	00:54:32.500


no_prehension
prehension
True label
0.84
0.16
0.25
0.75
no_prehension
prehension
Predicted label
0.8
0.6
0.4
0.2
0.0

CONCLUSIONS

The platform allows, in a non-invasive way, to estimate the number of prehensions.

$$I_e = T_i \times N_i \times P_i$$

With positive impacts in terms of:

- animal welfare;
- production efficiency;
- environmental impact.