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Coding Severe Behaviors in Children with Autism Spectrum Disorder to Train Machine Learning Algorithms

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Background

- One in 44 children are diagnosed with autism spectrum disorder (ASD)³, which can result in challenging behaviors that negatively affect both them and their caregivers⁴.
- Function-based treatment (FBT) is effective but rare, due to intense training and time requirements.² This translates to limited access for families.
- At the Munroe-Meyer Institute (MMI), 30-40% of staff time is allocated to collecting observational data alone, limiting potential availability for clinical treatment.
- Machine learning algorithms (MLAs) have been used for automation in a variety of fields; however, data on their efficacy in observing challenging behaviors is limited.

Purpose

The goal of this study is to train MLAs to identify challenging behaviors and to assess their accuracy within- and between-subjects.

Methods

Participants

- Nine male youths, ages 4-18
- Diagnosis of ASD or other intellectual/developmental disability (IDD)
- Participants were patients receiving FBT in the Severe **Behavior Department at MMI**

Data Extraction For Development of MLAs

- Series of 20-minute videos featuring recorded footage of participants during delivery of FBT.
- A custom software , "cometrics", developed to facilitate and streamline video coding/data collection process¹
- Coding performed by two researchers per video
- Coders looked for 21 challenging behaviors from the perspective of MLA

Coding Process in "cometrics"

- Coder fills out "Patient Information" section (Fig. 1)
- Coder loads video and starts session (Fig. 2)
- Coder refers to key bindings listed on left side of screen to tag behaviors as they happen in the video (Fig.3)

Coding Severe Behaviors in Children with Autism Spectrum Disorder to Train Machine Learning Algorithms

This study aims to train machine-learning algorithms to code severe behaviors automatically, giving staff more time to engage with patients directly.

C cometrics v1.1.4 File Export Analyze Help				
cometrics		Key Bindings	Video View	
Patient Information	Session Time	Frequency Binding		
Name	0:00:00	_ (Char Freq	
p001	Break Time	a		h
Medical Record Number	0:00:00	s	, O	ki
а	Session Stopped	c	I 0	pu
Session Location		f	0	gra
a	□ Reminder Beep (Seconds)	g	0	hea
Assessment Name	□ Session Duration (Seconds)	j	0	hai
a	Bession Duration (Seconds)	h		b
Condition Name		k		ch
	Start Session Esc Key	1	0	sib
	Pause Session Left Ctrl	c		sib
Primary Therapist		V		sib
а		e		sib
Case Manager		r	-	sib
а		t		sib sib
Session Therapist		y L	•	sib
a		i	0	sib
Data Recorder				thro
		p	-	kicl
		z	-	flip
Session Number		r	0	
24		ç	0	n
1/3		_		

Figure 1: Initial screen once inside "cometrics"

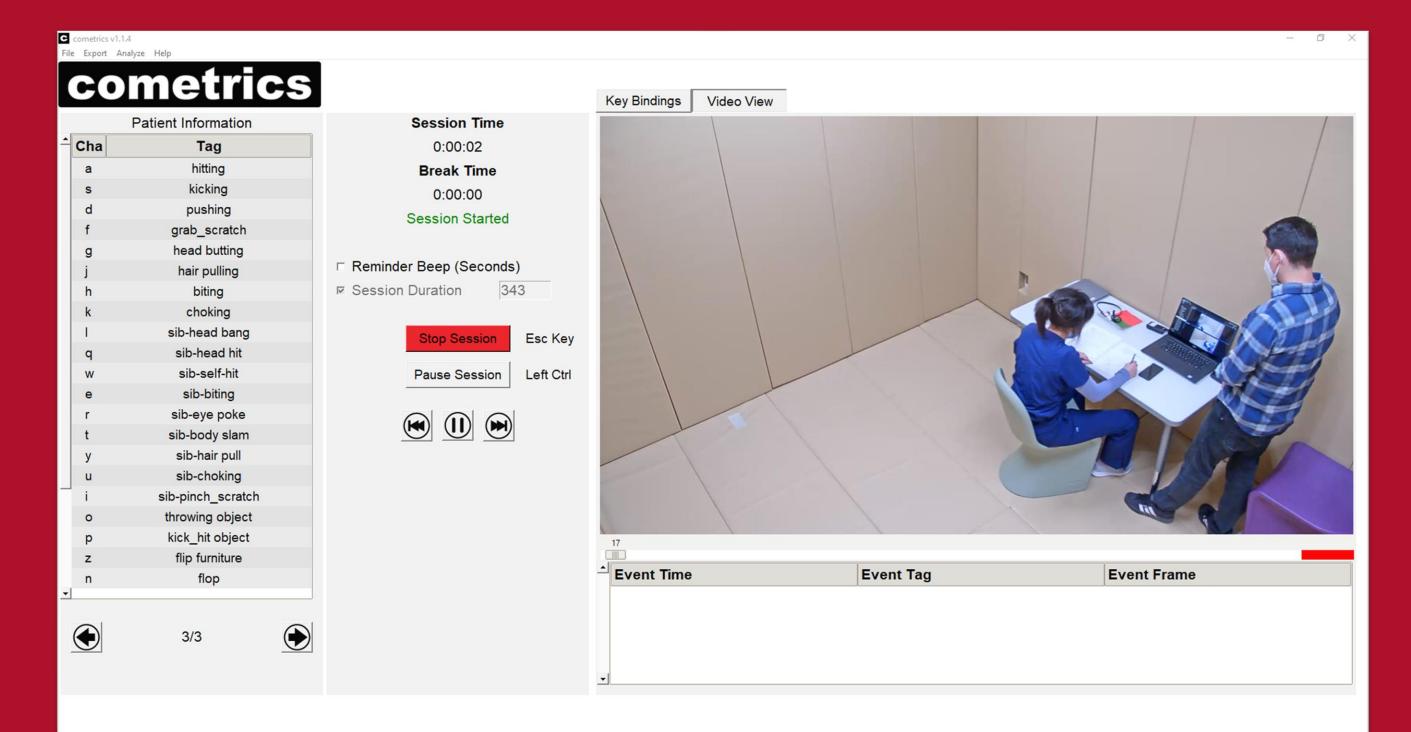


Figure 2: Screen once video for coding is selected

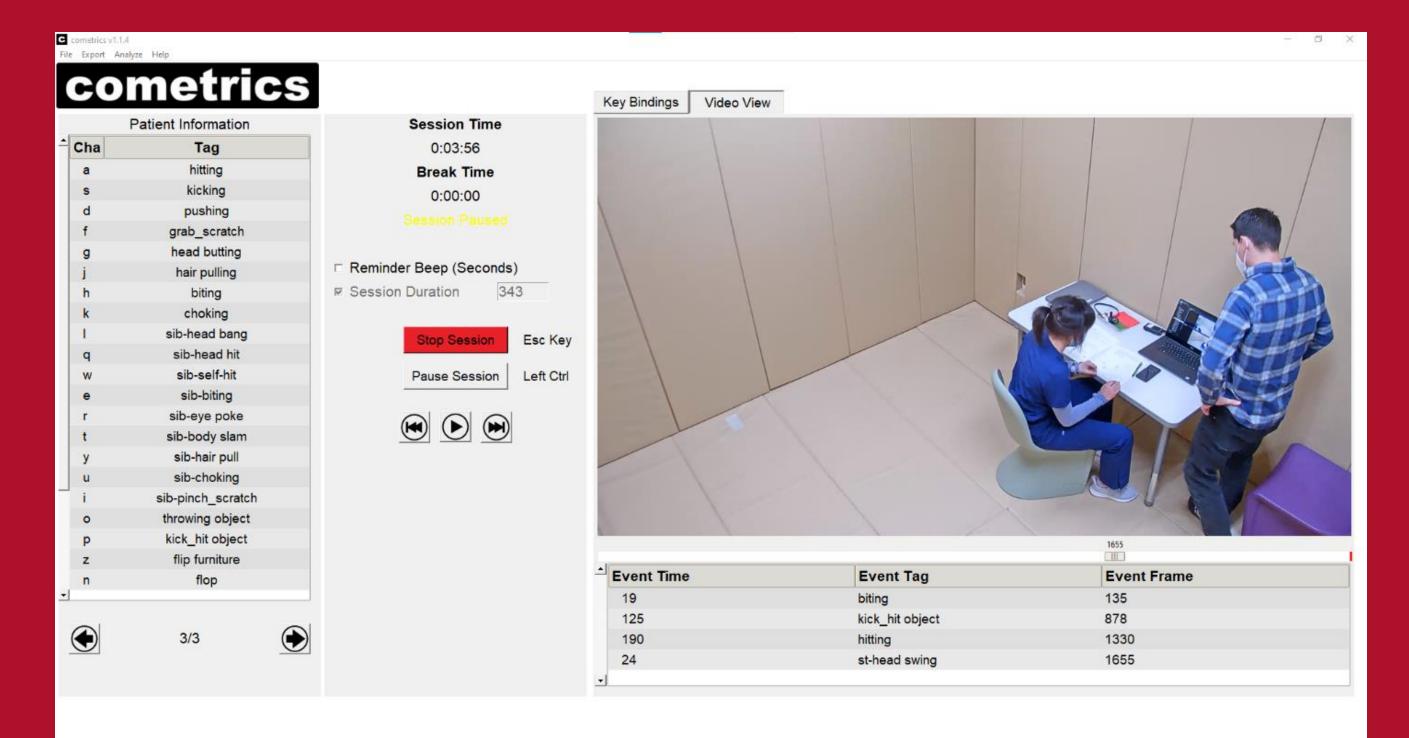
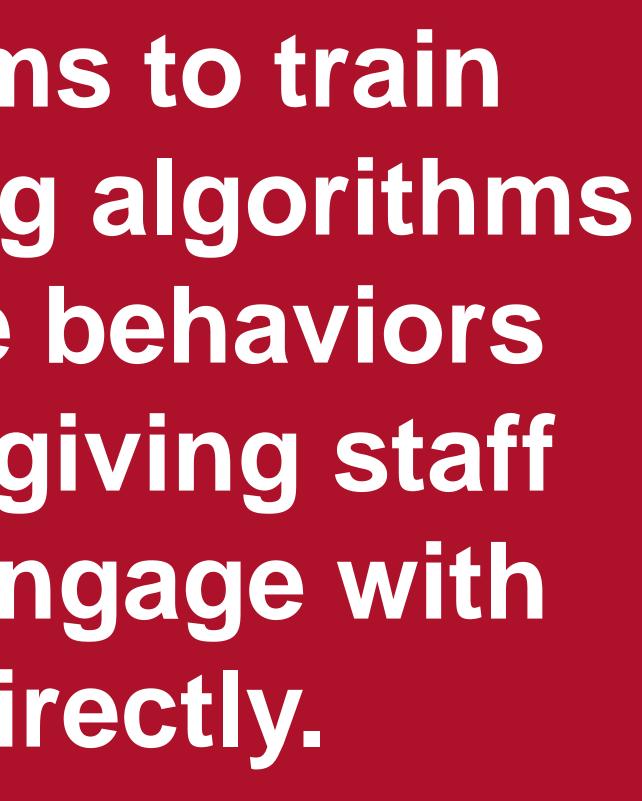
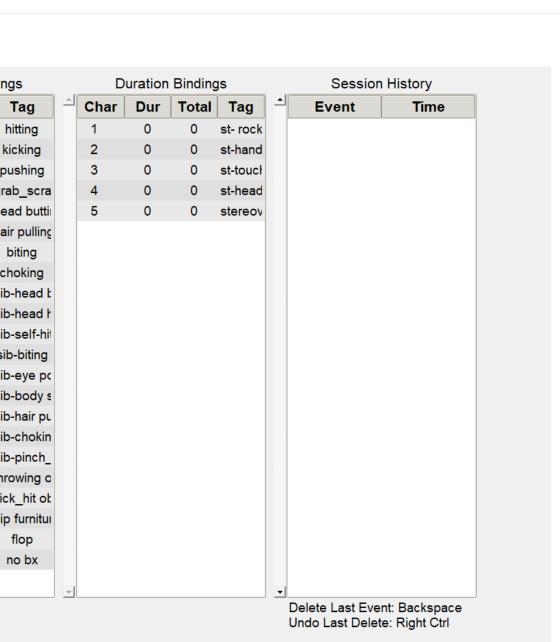
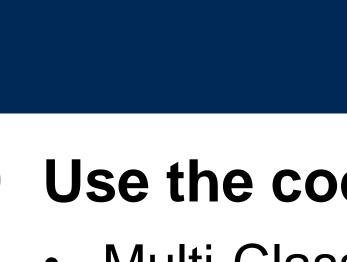


Figure 3: Screen during coding session in "cometrics"







MLA per behavior



(1)

Test MLA performance for accuracy

- seconds.



- to machine.
- dedicate to serving more patients.

- Laboratory/cometrics
- 122-143.
- Review of Psychiatry, 30(1), 96-109.

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Next Steps

Use the coded datasets to train MLAs

• Multi-Class Classification: allows for training of one MLA to detect several behaviors, rather than one

• MLA will analyze short videos featuring novel instances of the behaviors it's been trained for. • MLA will provide binary output on either the presence or absence of those behaviors every two

• Results will be compared to actual number of behaviors predetermined by human analysis.

Expected Results and Conclusion

• If MLAs can identify severe behaviors at a level close to that of humans, the task can be reassigned from human

• By automating the behavioral coding process, applied behavioral analyst staff will be have more time they can

• The more data we process through "cometrics", the more successful the MLA training process will be.

Eventually, we plan to apply these technologies to realtime monitoring during FBT sessions as well.

Benefits include increased safety for staff, as well as reducing the number of staff needed on standby during sessions (automatic alerting system).

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