



**BODY-WORN  
CAMERA**  
POLICY AND IMPLEMENTATION PROGRAM

# Leveraging Artificial Intelligence and Machine Learning with Body-Worn Cameras

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# Background



- Bergen County, NJ, covers 246 square miles and has 1 million residents.
- There are more than 70 police agencies.
- Borders NYC, Paterson, and Newark.
- Bergen County has a regionalized SWAT team (RST) and Rapid Deployment Team that pulls from every agency in the county.

# Digital Evidence Management



- Every municipality that has an indictable crime must share its body-worn camera (BWC) footage with the prosecutor's office.
- What do we do in cases where we have 300GB of video footage? (In this example, that is approximately 75 hours of BWC recording.)
- Current Stats:
  - Internal usage: 10.3TB
  - External usage: 30.5TB

# Our Project



- We are currently partnered with the New Jersey Innovation Institute (NJII) on a grant dedicated to using Artificial Intelligence/Machine Learning (AI/ML).
- Key Research Questions:
  - How can machine learning mitigate the burden of reviewing enormous datasets of BWC footage?
  - Can ML be used to identify an escalating or de-escalating situation?
  - Will ML supplement training/compliance as a tool to provide more accountability?

# Why ML/AI?



- Example: A critical incident involving a barricaded subject and an RST response involving 30 law enforcement members.
- 8-hour standoff
- 30 active BWCs
- 240 hours of footage

# Traditional vs. ML

## Traditional Review

- Review 240 hours of footage or prioritize which videos to view.
- Non-priority cameras may contain valuable evidence.
- Bandwidth overload: a human will start to miss key items as their bandwidth is exhausted.

## ML

- Analyze the content for key indicators to prioritize critical videos.
- ML may not catch everything.
- ML bandwidth is limited only by its capacity.

# ML



- A larger dataset can better improve the “fitness” of an ML algorithm, but be aware that you’re also more susceptible to having more unwanted “noise” in the data.
- Algorithms must be continuously re-trained; there is no one set solution for all instances or cases.
- Old datasets can introduce bias into ML algorithms. For example, at one point in time, it may have seemed odd to have two cell phones. Now everyone has two cell phones.



## ML—Key Points

- It's important to remember that AI and ML are tools that can aid in the evaluation of large datasets (BWC).
- ML/AI is not a complete solution, but it does make managing large datasets easier.
- Learning data has a huge impact on the “fitness” of the algorithm: Variations in policing, social norms, and geo-cultural changes will impact the models.



## Next Steps

- Connecting our DEM portal via API to super-computing capabilities at NJIT
- Loading 100 randomly selected BWC videos for a wide selection of possible situations
- Testing and refining the algorithms until a high level of accuracy is detected, at which point we will run a new set of BWC videos into the system to verify the model
- Making the system scalable, so that both large and small departments can potentially benefit from these capabilities

# Contact:

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# Harnessing Body Cameras and Artificial Intelligence to Enhance Police Supervision

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# AI-Based Analytic Tools

- AI-based tools for processing BWC footage
  - Systematic review of all recorded interactions
  - Cost-efficient alternative to individual review
- These tools can:
  - Automate supervisor audits
  - Facilitate keyword searching of videos
  - Produce summary metrics of various language/behavior
- Two relevant branches of AI
  - Natural language processing (NLP)
  - Computer vision (CV)

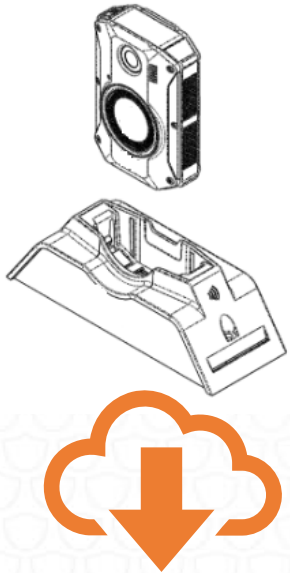
# Natural Language Processing



- Transforms speech into usable data by identifying key features
  - **Linguistic:** Content of words, use of greetings, terms of respect, turn-taking
  - **Paralinguistic:** Pitch, loudness, tone, intensity
- Simple uses:
  - Identifying words and meaning
  - E.g., language translation, speech-to-text conversion, automatic summation of text
- Complex uses:
  - Assesses underlying concepts, thoughts, emotions, and social context
  - E.g., determining emotions or perceptions from text

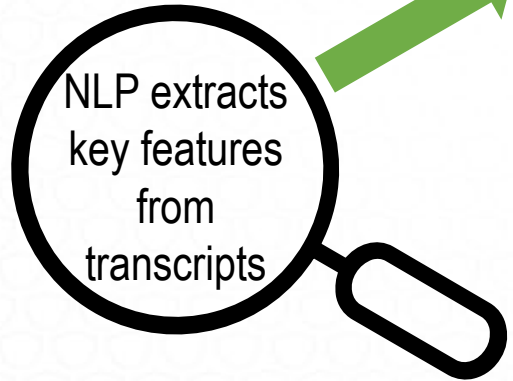
# NLP Analysis of BWC Footage

Officers upload BWC footage to servers



AI-based tool integrated with servers

Videos transcribed using AI-based speech recognition software

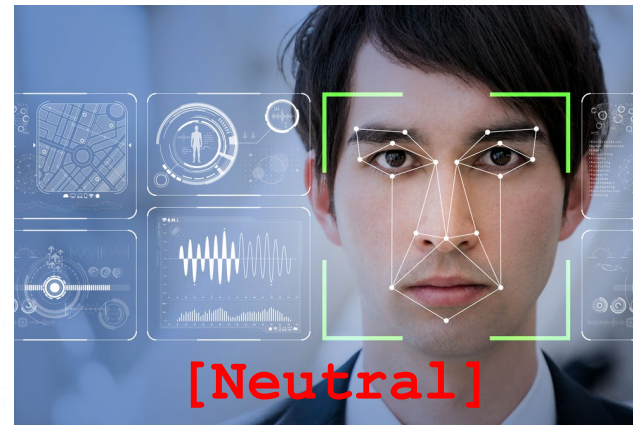


"Positive" Linguistic Features	
Formality	• Good morning sir I am Officer Peterson with...
Explanation	• The reason I pulled you over is that you were...
Politeness	• May I please see your license and registration?
Gratitude	• Thank you sir have a good rest of your day
"Negative" Linguistic Features	
Insult	• Hey dummy, sit on this curb
Threat	• If you stand up again, I will break your legs
	I don't give a sh** • Profanity
Directed profanity	• F*** you

Dashboard, metrics, reports, searchable database

# Computer Vision

- Method for deriving meaningful information from images (and videos)
  - Image classification
  - Object tracking
  - Perimeter detection
  - Facial recognition
  - Content-based image retrieval
- BWC applications
  - Automatic redaction
  - Weapon identification
  - Aggression detection (physical spacing, facial expressions, etc.)



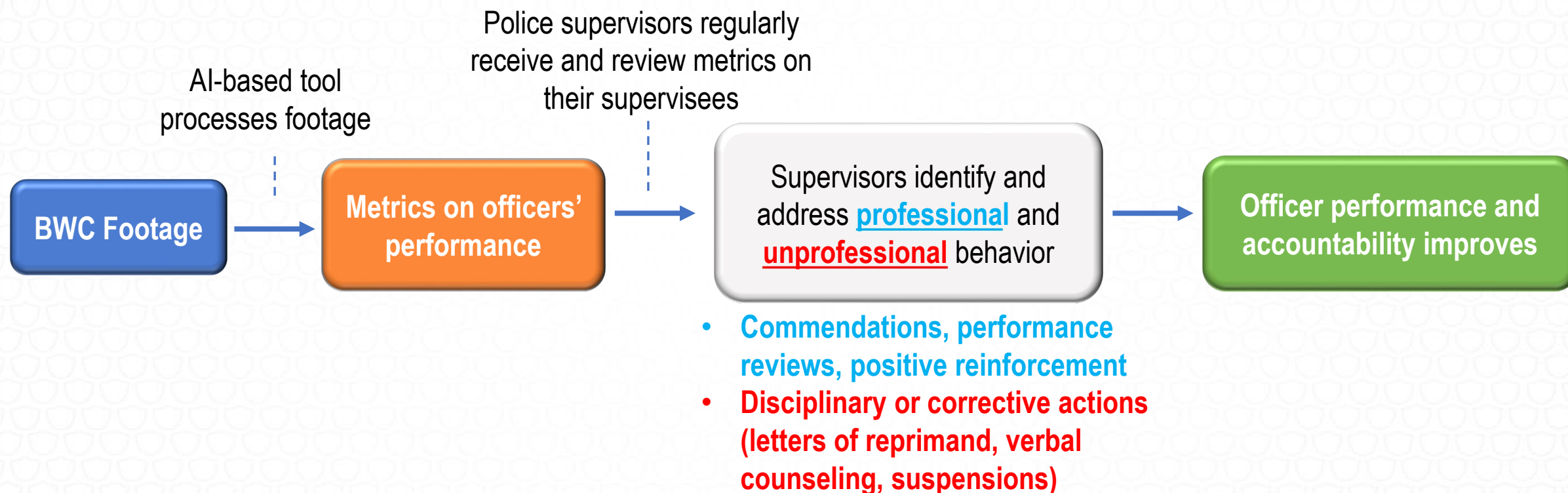


## Uses of these tools

- Researchers have used AI to identify several acts from BWC footage:
  - Giving introductions, offering explanations, asking questions, engaging in proper use-of-force decision-making (Lande et al., 2020; Prabhakaran et al., 2018; Voigt et al., 2017).
- Immediate applications
  - Automated tagging, auditing, redacting
- Forthcoming application
  - Ongoing supervisory review of officer performance



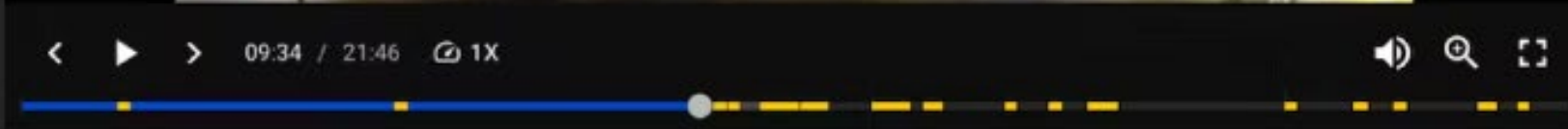
# Using AI Tools for Supervisory Review



Axon Body 4 Video 2022-07-24 1035

Recorded by Effinger, Dan (4254) • [Open evidence details](#)

Example 1:  
Axon



Autoplay flagged moments ⓘ

A flagged moment starts 5 seconds before and ends 5 second after a marker.

FLAGGED MOMENT(S) (50)

RESPONSE

ⓘ To complete this review, watch the video in its entirety and add response(s).

FAST EVIDENCE REVIEW

Click to search transcript... 🔍

- kill (13) yank (6) bullshit (4) weapons (4) grab (3)
- gun (3) out of the car (3) +4

Did nothing wrong. So you said we can't search the car? No. Okay.

09:33

I didn't do nothing wrong

09:28

With his sister car. Okay. Well here's the thing. Well my partner was behind you and prior to activating his lights and sirens, he observed **furtive** movements, which is movements into certain areas. So we're gonna check where those movements were and only where those movements were. Okay. Can you step outta the vehicle please?

09:45

What?

09:45

Step outta the vehicle. Please, undo your seatbelt, please.



- My Calls
- Officer ID
- My Officers
- Verify Risk
- Usage Summary

### My Officers

Compare Department

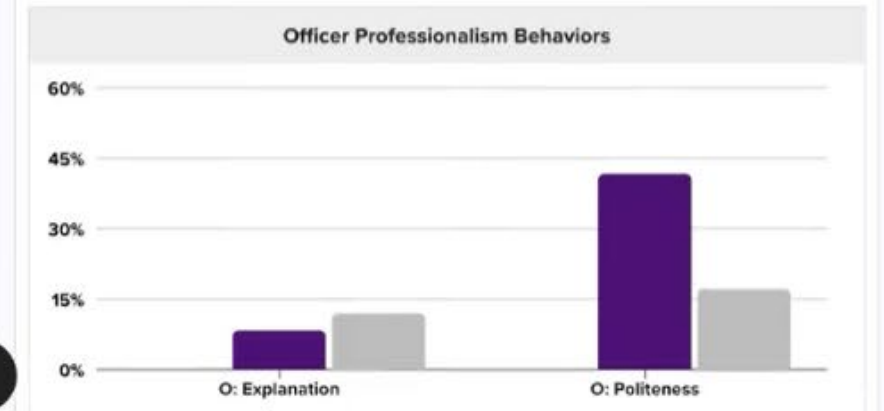
View last 30 60 90 180 365 days



## Stephen Reed

- DEPARTMENT
- GROUPS
  - 3 years or less
  - A Watch
- Bernier, Ferne
- Bogisich, Ben
- Bogisich, Eddie
- Breitenberg, Carley

### PROFESSIONALISM — 8%



### RISK



Id: fcb55b03-a092-4967-a2ef-659828c0f58f

Title: #21-0004520-Video#6.mp4

Date: 07/13/2022

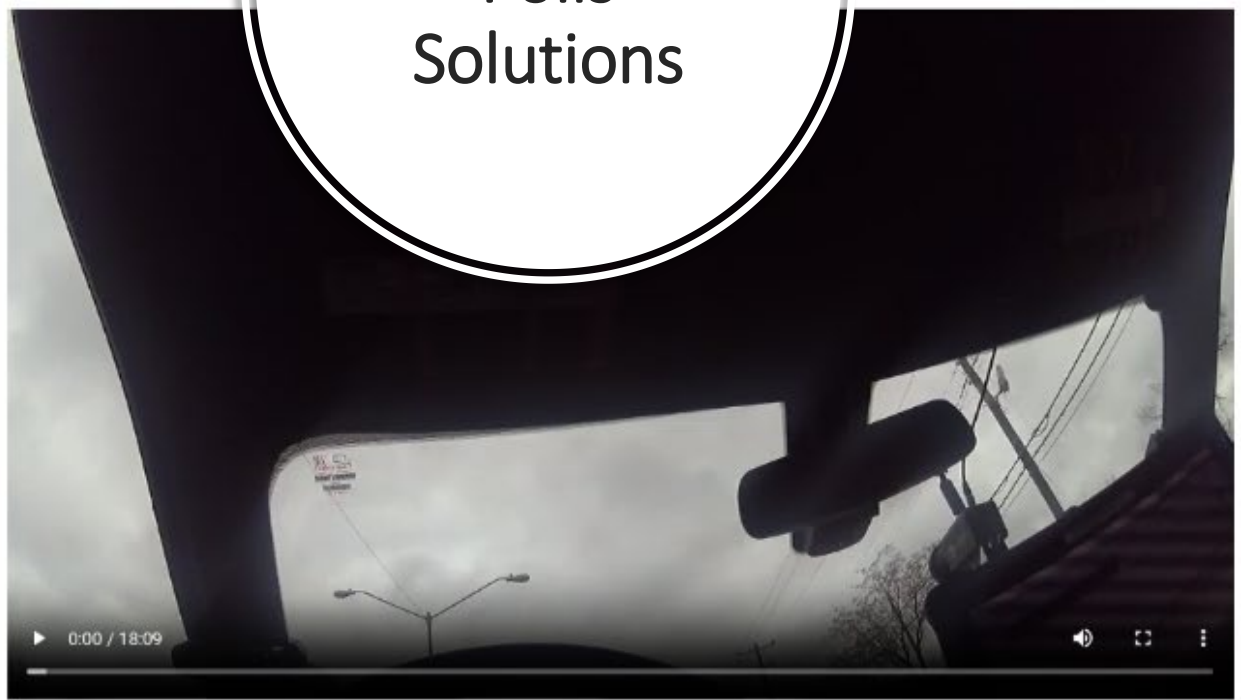
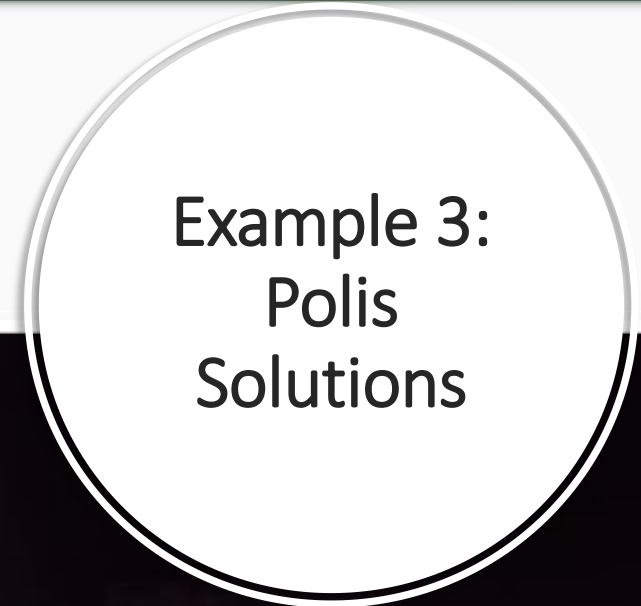
Location: North Central

Notes 

Interactions

- CAMERA WEARING OFFICER
- OTHER OFFICERS
- COMMUNITY MEMBERS
- POLICE ACTIONS
- SITUATION

Scores	Search	X
Quality ↑	Did the person exemplify this category?	How often did the person exemplify this category well?
Accept Power Of Other Person	[- 1 2 3 4 5]	[- 1 2 3 4 5]
Adaptability	[- 1 2 3 4 5]	[- 1 2 3 4 5]
Block Influence	[- 1 2 3 4 5]	[- 1 2 3 4 5]
Calming	[- 1 2 3 4 5]	[- 1 2 3 4 5]
Challenge Power Of Another	[- 1 2 3 4 5]	[- 1 2 3 4 5]
Communicate Clearly	[- 1 2 3 4 5]	[- 1 2 3 4 5]
Listening	[- 1 2 3 4 5]	[- 1 2 3 4 5]
Open To Influence	[- 1 2 3 4 5]	[- 1 2 3 4 5]
Show Humanity Or Empathy	[- 1 2 3 4 5]	[- 1 2 3 4 5]



Auto-scroll to transcript

Create new block

# Challenges and Considerations

- Public dissemination
  - Reports on performance metrics
  - Impact on transparency
- Pushback from departments
  - Unions
  - Fishing expeditions
- Technology limitations
  - Especially CV
- Research limitations
  - Limited validation studies
  - No evidence on efficacy
  - No best practices