Analyzing horse facial expressions of pain with EquiFACS

Maheen Rashid[1], Alina Silventoinen[2], Karina B. Gleerup[3], Pia Haubro Andersen[2]

[1]University of California, Davis.
Computer Science Department. USA.

[2]Swedish University of Agricultural Sciences.
Department of Clinical Studies. Sweden.

[3] Roskilde, Denmark.

Background:

Horses' facial expression of pain is now well recognized through, e.g. Pain Face [1], or the Horse Grimace Scale [2]. However, comparison of results is difficult.

Equine Facial Action Coding System (EquiFACS) [3] exhaustively describes equine facial activity in terms of Action Units (AU) and Descriptors (ADs), based on underlying horse face musculature.

EquiFACS presents an objective and common language for describing horse facial expressions.

This study describes the pain face in terms of EquiFACS with a data driven approach.

Dataset:

6 horses were filmed stress free before and after pain was induced with a pneumatic blood pressure cuff [1].

30 second clips from each film were EquiFACS annotated. Coders have >70% rater agreement.

Start and end time of all AUs and ADs was noted.
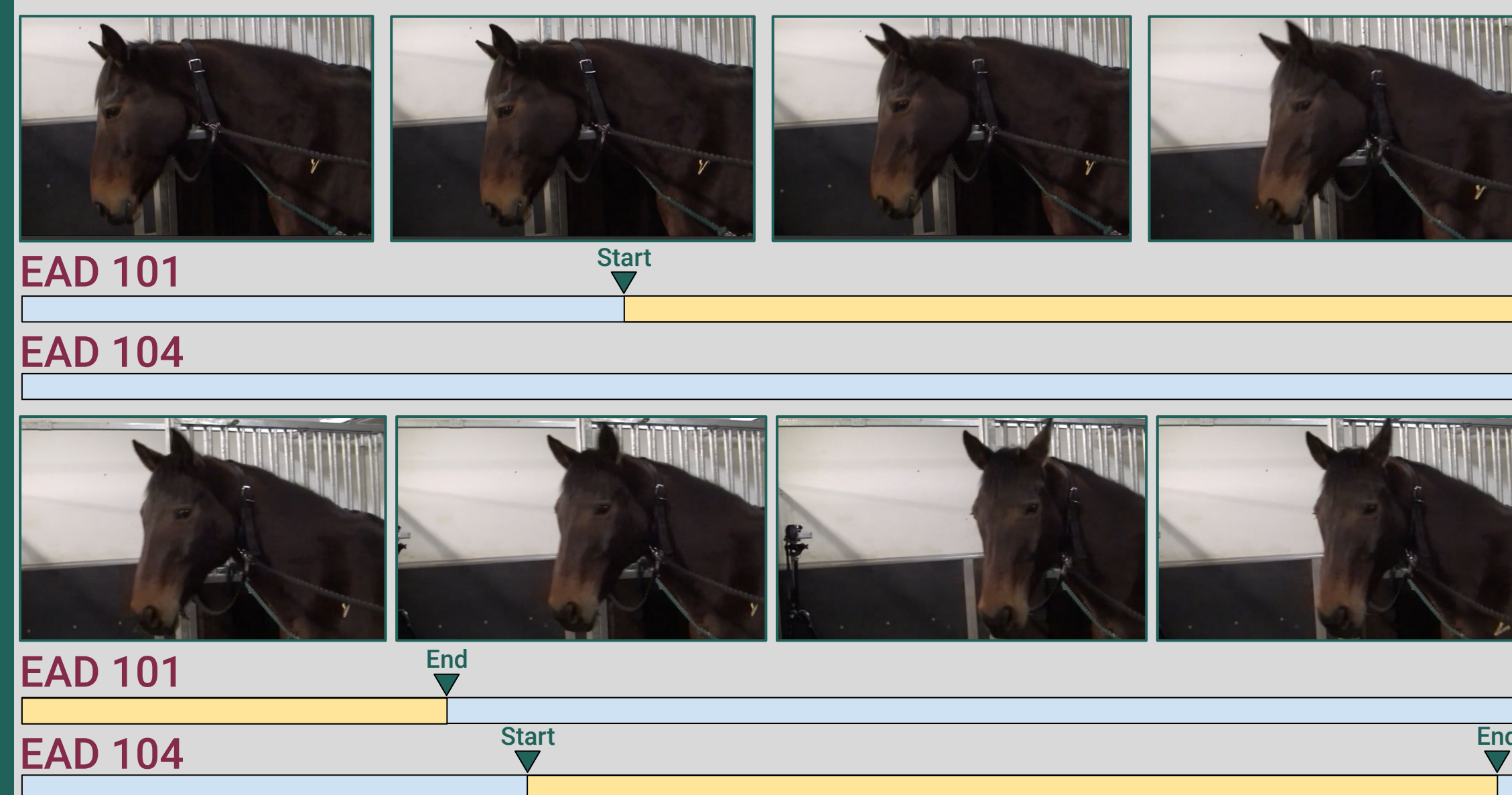
Pain Action Units:

We use the method of Kunz et al [4] to identify pain action units. Originally developed to identify pain AUs in humans, it follows a two step selection process:

1. AUs that represent more than 5% of total AU occurrences in pain videos are identified.
2. Of these, AUs that occur more frequently in pain videos than no-pain videos are selected.

Pain AUs are therefore both frequent and distinct.

EquiFACS Code	EAD 104 Ear Rotator	AU 101 Brow Raiser	AU 47 Half Blink	AD 38 Nostril Dilator	EAD 101 Ears Forward	AU 145 Blink	AU 17 Chin Raiser
Percent of total Pain Video AUs	11.85%	11.34%	10.56%	9.27%	7.47%	6.7%	6.18%
More Frequent in Pain Videos	Yes	Yes	Yes	Yes	No	No	Yes

AU Frequency vs Duration:

We inspected how often an AU occurred (Frequency), and the maximum of length of time it remained active (Maximum Duration) for each video. Differences in AU frequency between pain and no pain were not reflected in differences in maximum AU duration across all subjects.
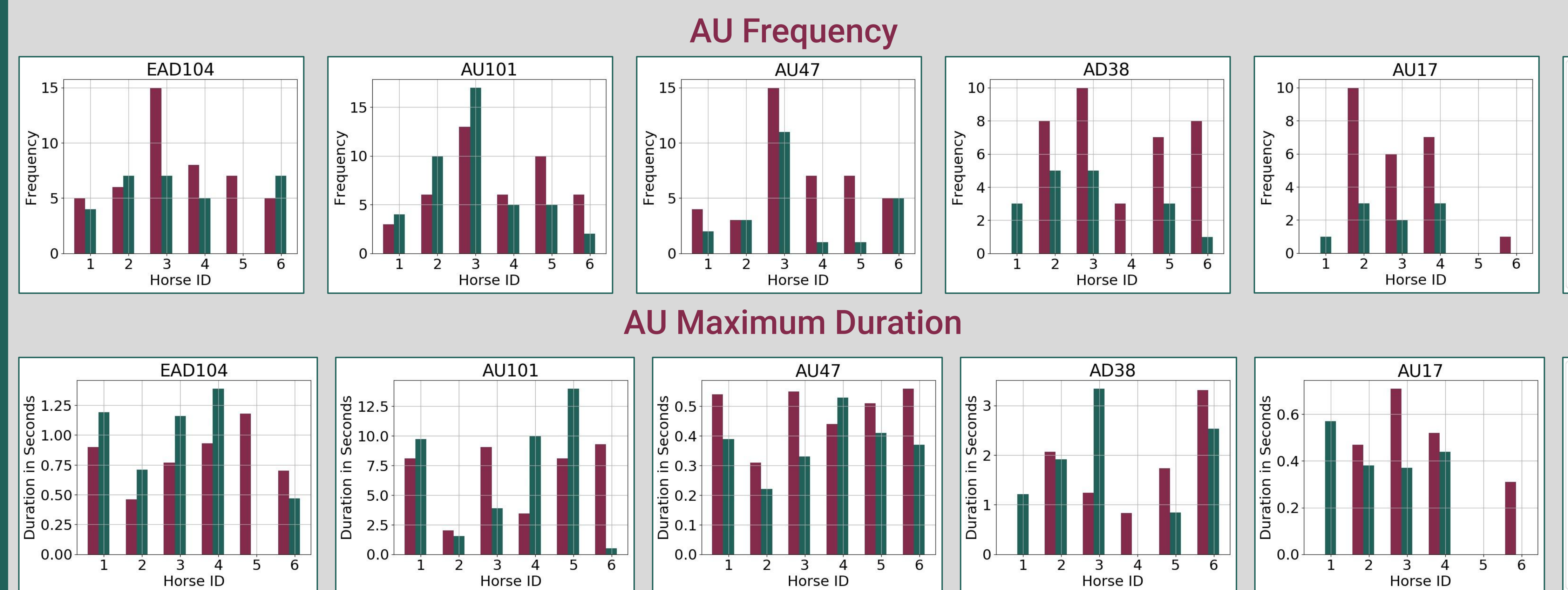
Discussion:

Inner brow raiser, half blink, chin raiser, ear rotator and nostril dilator were significantly associated to pain, while, of the 5% most frequent action units, blink and ears forward were not.

Frequency statistics are a promising route to further inspect pain behavior.

Comparison with Horse Grimace Scale [2]:

EquiFACS Code	Horse Grimace Scale
EAD 104. Ear Rotator	X . Not identified in HGS.
AU 101. Brow Raiser	✓ . "Tension above the eye"
AU 47. Half Blink	X . Not visible in still frames.
AD 38. Nostril Dilator	✓ . "Strained Nostrils"
AU 17. Chin Raiser	✓ . "Pronounced Chin"
X . EAD 103. Ear Flattener.	"Ears Stiffly Backwards"
X . AU 143. Eye Closure.	"Orbital Tightening"

Comparison with Pain Face [1]:

EquiFACS Code	Pain Face
EAD 104. Ear Rotator	✓ . Asymmetrical/low ears
AU 101. Brow Raiser	✓ . "Angled Eye"
AU 47. Half Blink	X . Not identified in Pain Face
AD 38. Nostril Dilator	✓ . "Nostrils - Square-like"
AU 17. Chin Raiser	✓ . "Tension of the muzzle/mimic muscles"
X . No parallel in EquiFACS	"Withdrawn and tense stare"

Limitations: Only six horses were studied, using one type of pain induction. Before conclusions can be drawn on the presence of a prototypical pain face in horses, more horses with different pain types should be included. Co-occurrence patterns of AUs was not assessed, which may be important for recognition of the pain face.

References
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