



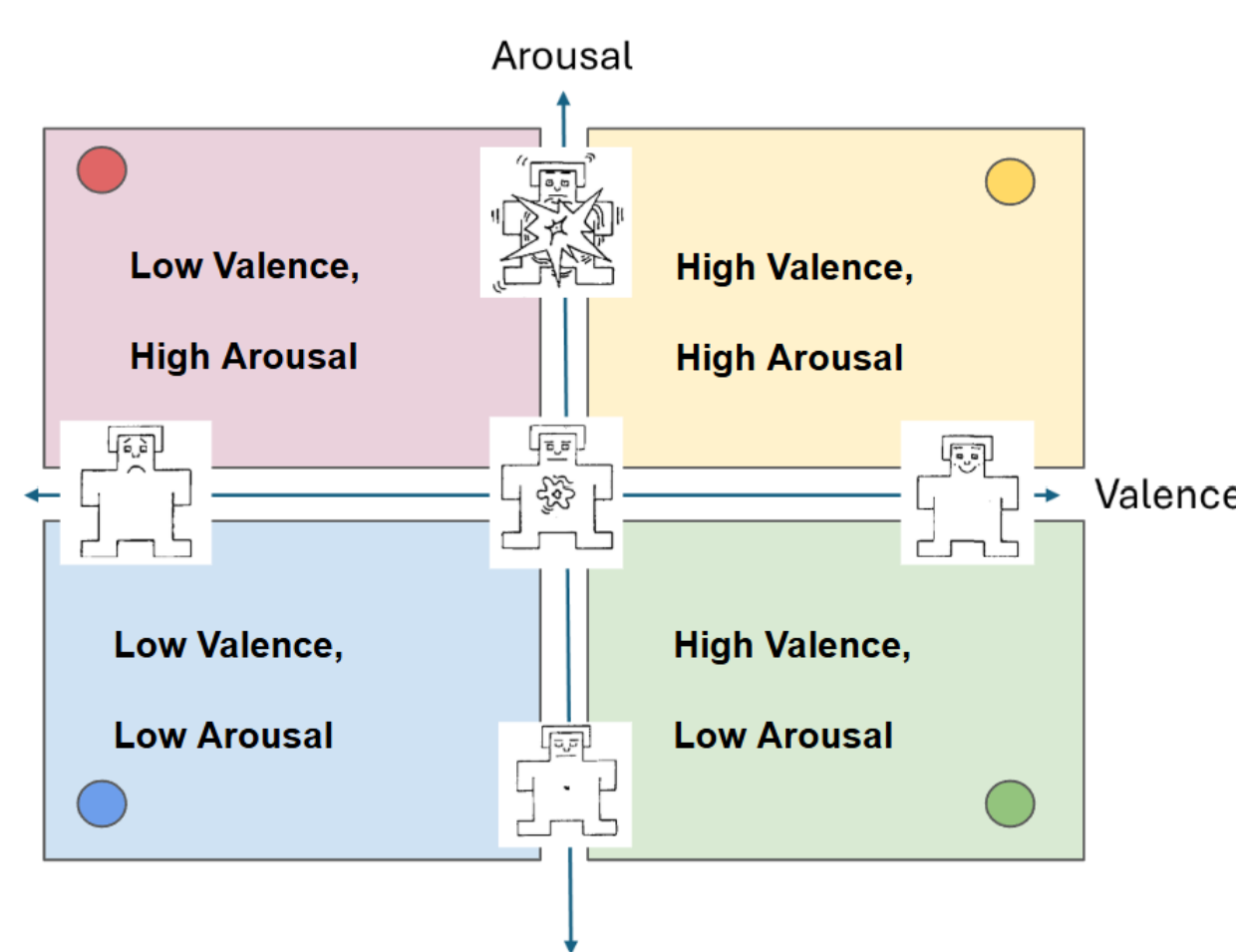
Abstract

- **Gap:** Emotion Recognition research in Sign Languages is still in its infancy. There exists a lack of knowledge about **appropriate annotation guidelines and the impact that facial expressions** have in recognizing emotions while signing.
- **Our Contributions:** 1) Initial acquisition protocol to record acted emotions in German Sign Language (DGS) under four emotion scenarios. 2) **Baseline assessment of the role of facial expressions in recognizing emotions while signing** in this scenario. The best random forest with accuracy of 68.84% and a F1 of 67.96% trained with from Action Units.

Related Works

Emotion Recognition:

- There are several psychological theories to explain Emotions
 - E.g. Valence-Arousal Circumplex Model of Emotion (Posner et al., 2005).
- **Datasets on Emotion Recognition** have different levels of naturalness:
 - 1) acted emotions,
 - 2) elicited emotions with stimuli,
 - 3) spontaneous emotions.



Facial Expressions in Sign Language:

- **In Irish sign language**, participants used the **doubled-wh signs** in the context of **anger, surprise, and excitement**. (Kulshreshtha (2024))
- Three **meta-strategies to cope with the communication of emotions + message** (Kirst (2024)):
 - 1) **separation**, by **sequencing** the emotion expression before or after the grammatical information;
 - 2) **addition**, by introducing, for example, rapid blinking and jaw drops;
 - 3) **competition**, by **increasing muscle activation** when, for example, both a question modifier and expression of anger require brows furrowing.
- (Schwarzenberg et al. (2024)) investigated the **interaction between lexemes and non-manuals**, showing **inconsistency in the use of facial expressions** accompanying a sign for an emotional concept (e.g., sadness).

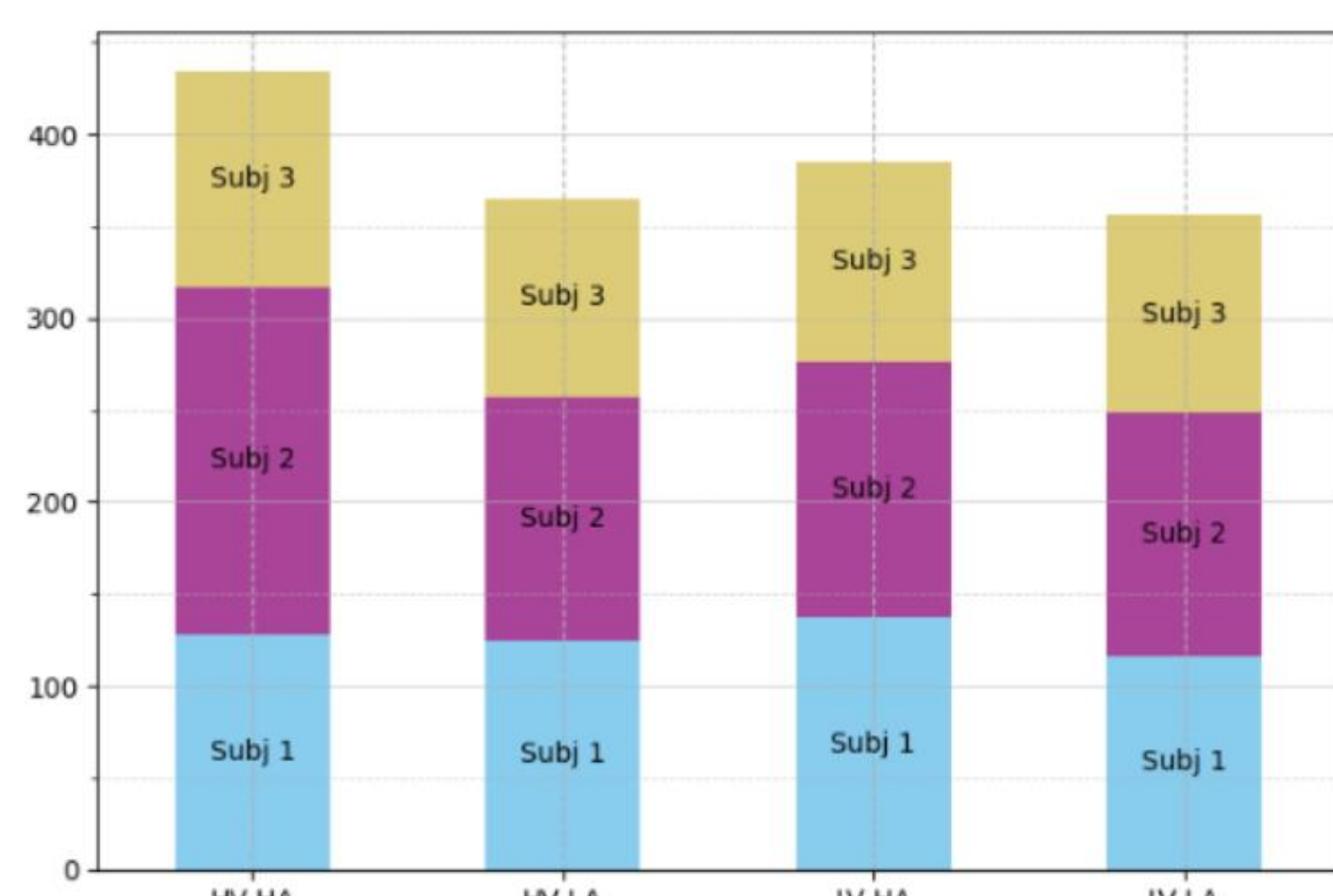
Dataset Acquisition Protocol

1. Introduction to **Valence/Arousal** & Description of the experiment.
2. Eliciting emotions in each of the 4 scenarios.
3. Display of **neutral video sign**.
4. Repeat the sign while expressing the **emotion** of the scenario (acting set-up).

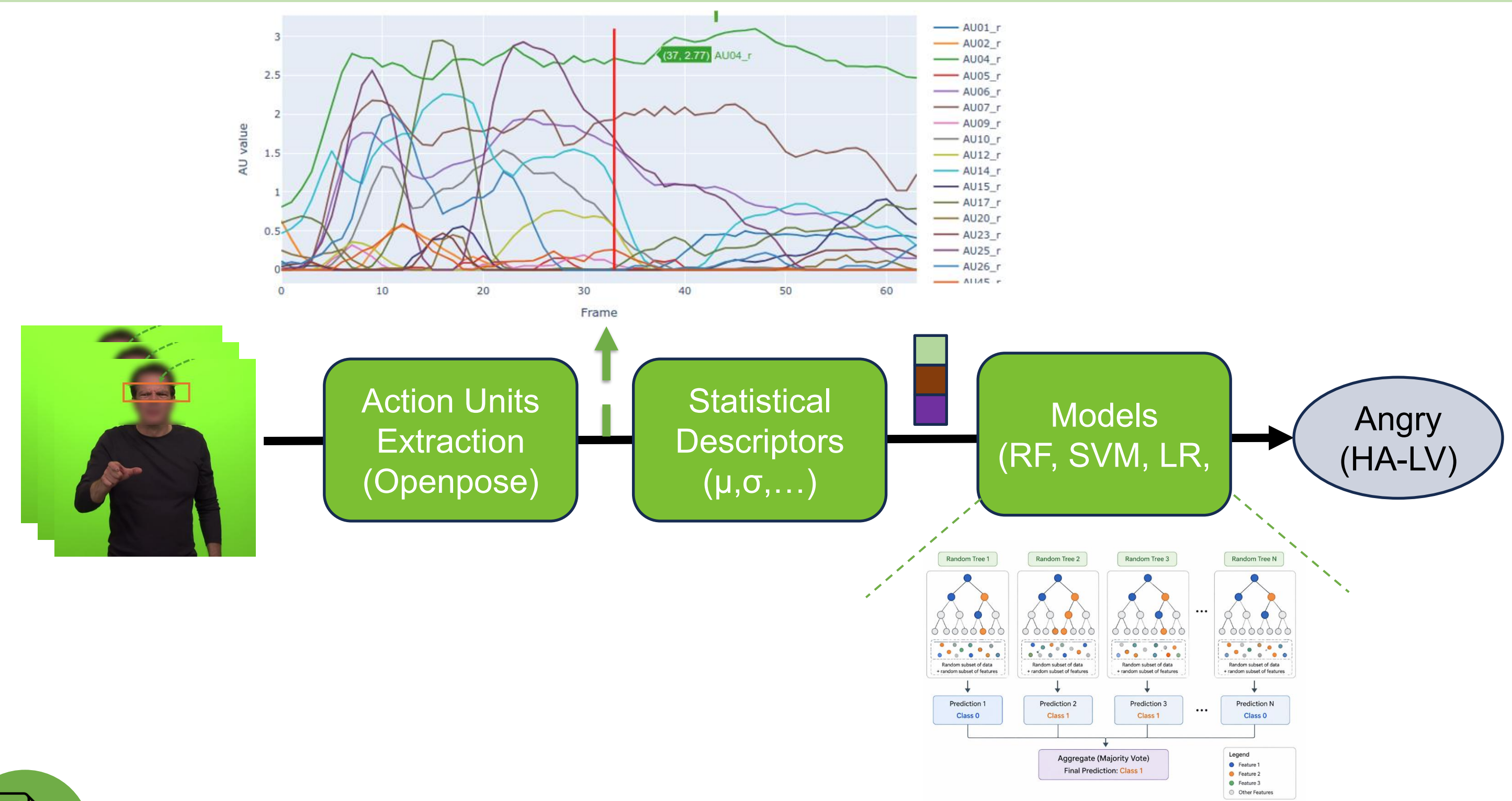
Methodology: First Dataset Evaluation

DGS-Emotions Dataset:

- **1,540 short-videos at Full HD** resolution (1920x1080) at 50 fps, with frontal cameras.
- **4 acted (balanced) emotions** in elicited scenarios.
- 10 signs in DGS recorded by **3 deaf interpreters**. Evaluation: **3-fold subject-wise Leave-One-Out (LOO)**.

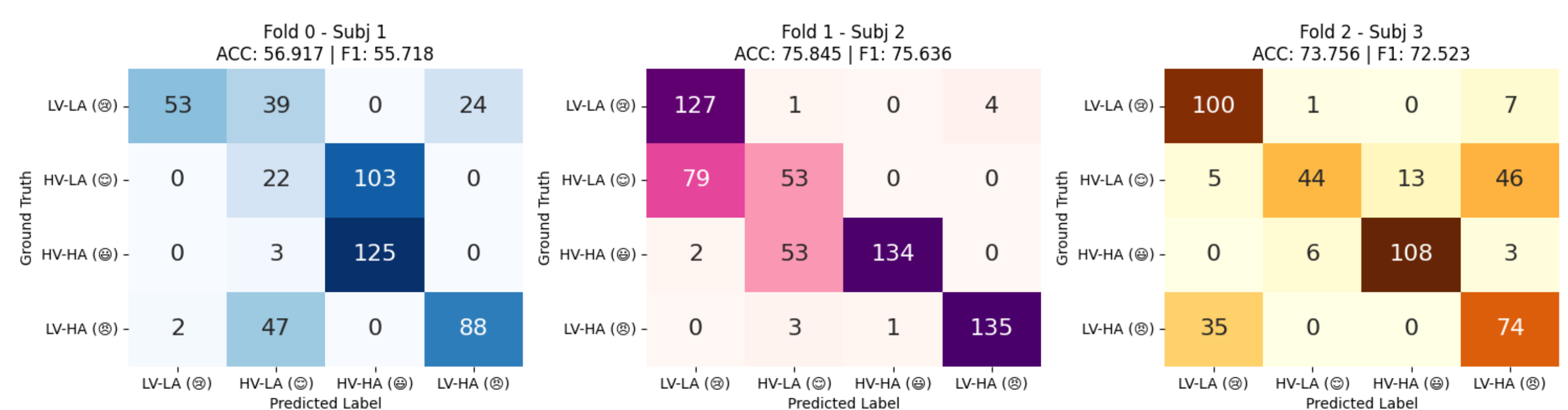


Pipeline



Results

Model	Hyperparam.	ACC	F1
Zero-Rule	-	25.08	10.07
Linear Regressor	C=0.1	66.89	65.06
SVM	C = 0.001	67.32	65.38
Random Forest	N. estim.=300	68.84	67.96



Confusion Matrices of the RF model for facial emotion recognition per subject for the test set of each fold of the LOO. Colors indicate the results of each subject.

Conclusions & Future Work

Key Takeaways

- ✓ Following previous **recording scenario on emotion recognition** datasets for spoken languages (e.g. RAVDESS (Livingstone et al., 2018)), we successfully recorded four emotional scenarios with professional deaf interpreters.
- ✓ First evaluations points out that **AUs seems good emotional markers for emotion recognition in Sign Language**.
- ✓ Different **subjects present variability on their facial expressions when expressing emotions** → other channels may play a key role too.

Future Work

- Evaluate whether the **expressed emotions are perceived** in a similar way for deaf and non-deaf individuals.
- **Extend study to multimodality and sentences** → Expect to see the same effect?

References

- [Posner et al., 2005] Jonathan Posner, James A. Russell, and Bradley S. Peterson. 2005. The circumplex model of affect: An integrative approach to affective neuroscience, cognitive development, and psychopathology. *Development and Psychopathology*, 17(03).
- [Kulshreshtha (2024)]. Neha Kulshreshtha. 2024 The Effect of Emotional State on the Position of Wh-signs in Indian Sign Language. In First Workshop on Expressing Emotions in Sign Languages (ExEmSiL-2024). Universität Hamburg.
- [Kirst (2024)] Desirée Kirst. 2024. Eyebrow Competition: Layering Emotion & Grammar in ASL. In First Workshop on Expressing Emotions in Sign Languages (ExEmSiL-2024), Universität Hamburg.
- [Schwarzenberg et al. (2024)] Sarah Schwarzenberg, Jenne Mertens, Alexander Eisenzimmer, Simon Kollien, and Annika Herrmann. 2024. Expressing Emotions in the DGS Corpus: The Interaction of Lexemes and Non manual. In First Workshop on Expressing Emotions in Sign Languages (ExEmSiL-2024), Universität Hamburg..
- [Livingstone et al., 2018] Steven Livingstone and Frank Russo, "The Ryerson audio-visual database of emotional speech and song (RAVDESS): A dynamic, multimodal set of facial and vocal expressions in north American English," *PLoS one*, vol.13, pp. e0196391, 05 2018

Acknowledgements

This work was funded by the **BIGEKO** project (BMBF, German Ministry for Education and Research, grant number 16SV9094), and **FORSocialRobots** project (BFS, Bavarian Research Foundation, grant number AZ1594-23).

