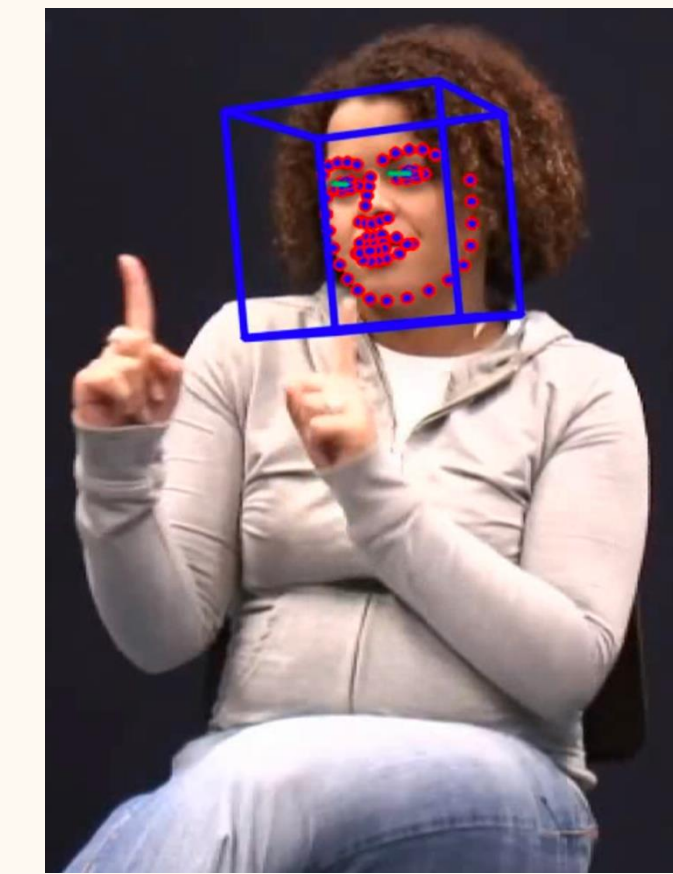


## Kinematics of sign languages

- Both manual and nonmanual markers can be measured
- Also with Computer Vision tools: OpenPose, OpenFace, MediaPipe, 3DDFA, etc.

## Methodological challenges:

1. Dealing with noisy measurements: all measurements are imprecise
2. Peak detection: e.g. finding turns in headshakes, detecting nods
3. Calculating kinematic measures: range of motion, velocity, frequency, etc.



Head pose and face tracking with OpenFace

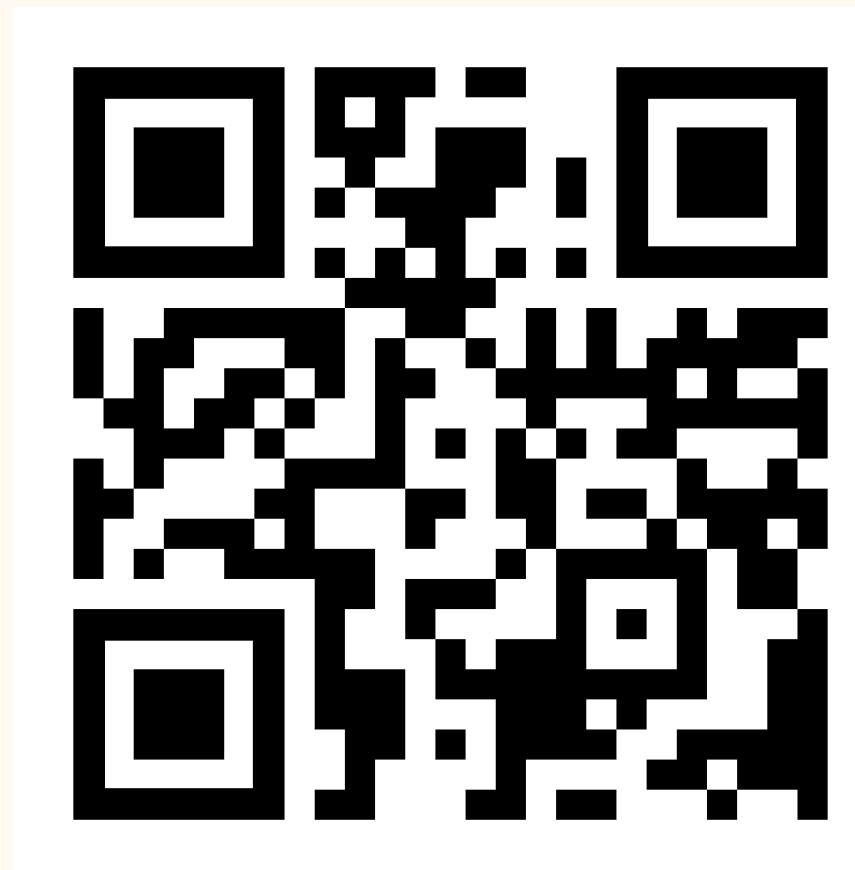


Head pose and face tracking with 3DDFA\_v2

## Solution: we developed a small set of R scripts

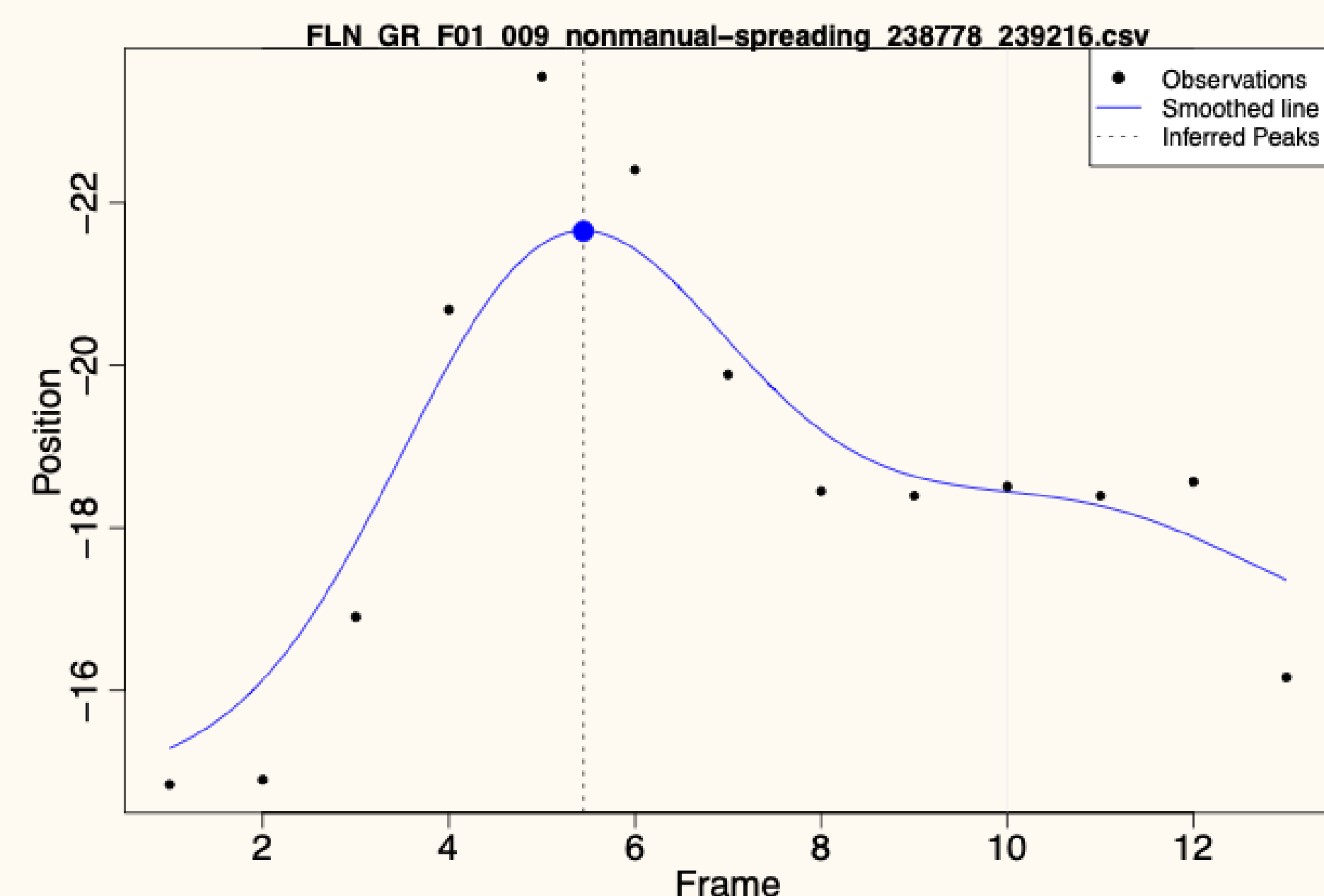
+ demo and documentation

- **Input:** raw measurements (per frame)
- **Processing:** smoothing (two methods: splines and kernel regression), peak detection
- **Output:** smoothed smoothed measurements and summary measures

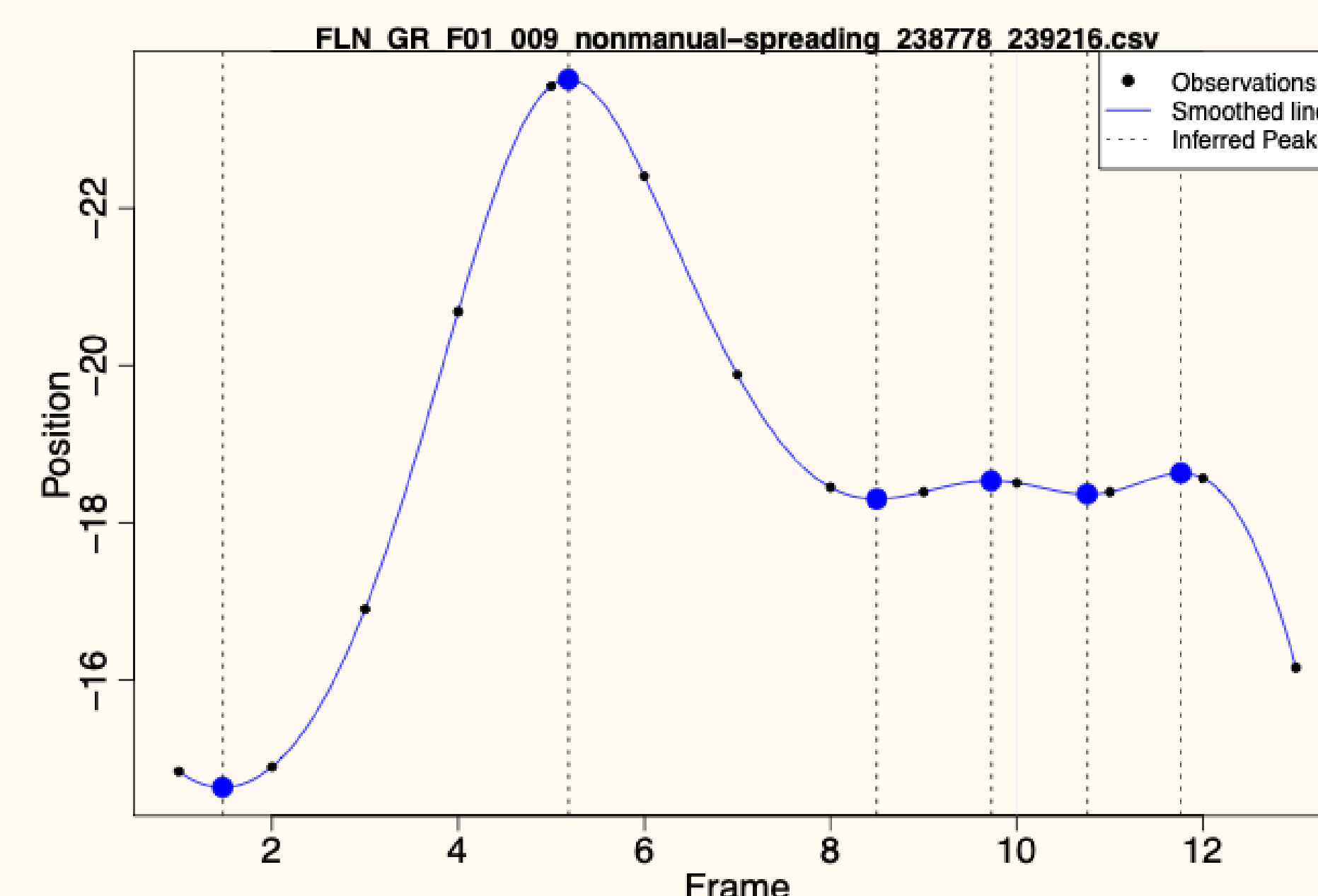


## Example: one headshake in Brazilian Sign Language

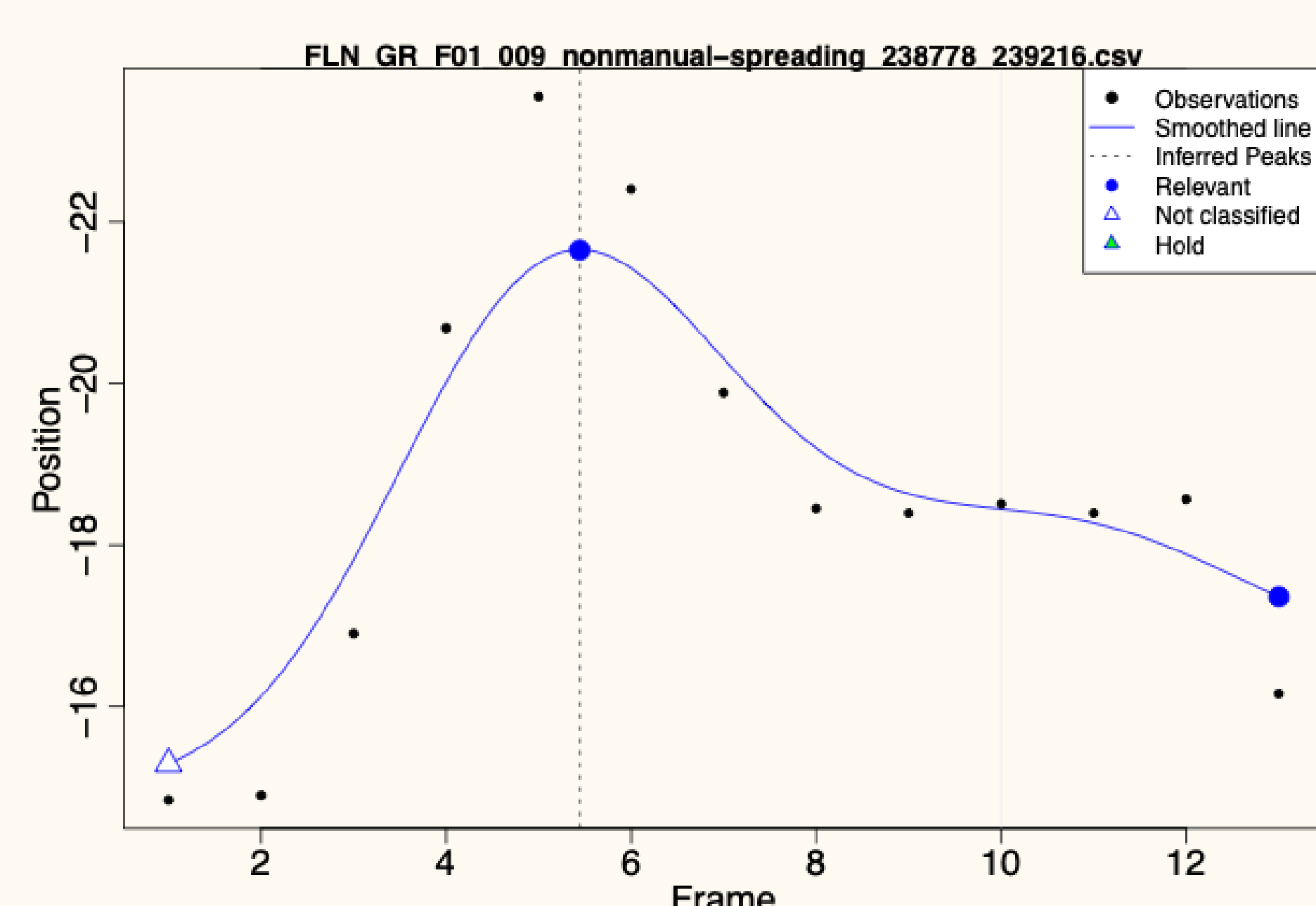
### Raw data and smoothed line with kernel regression



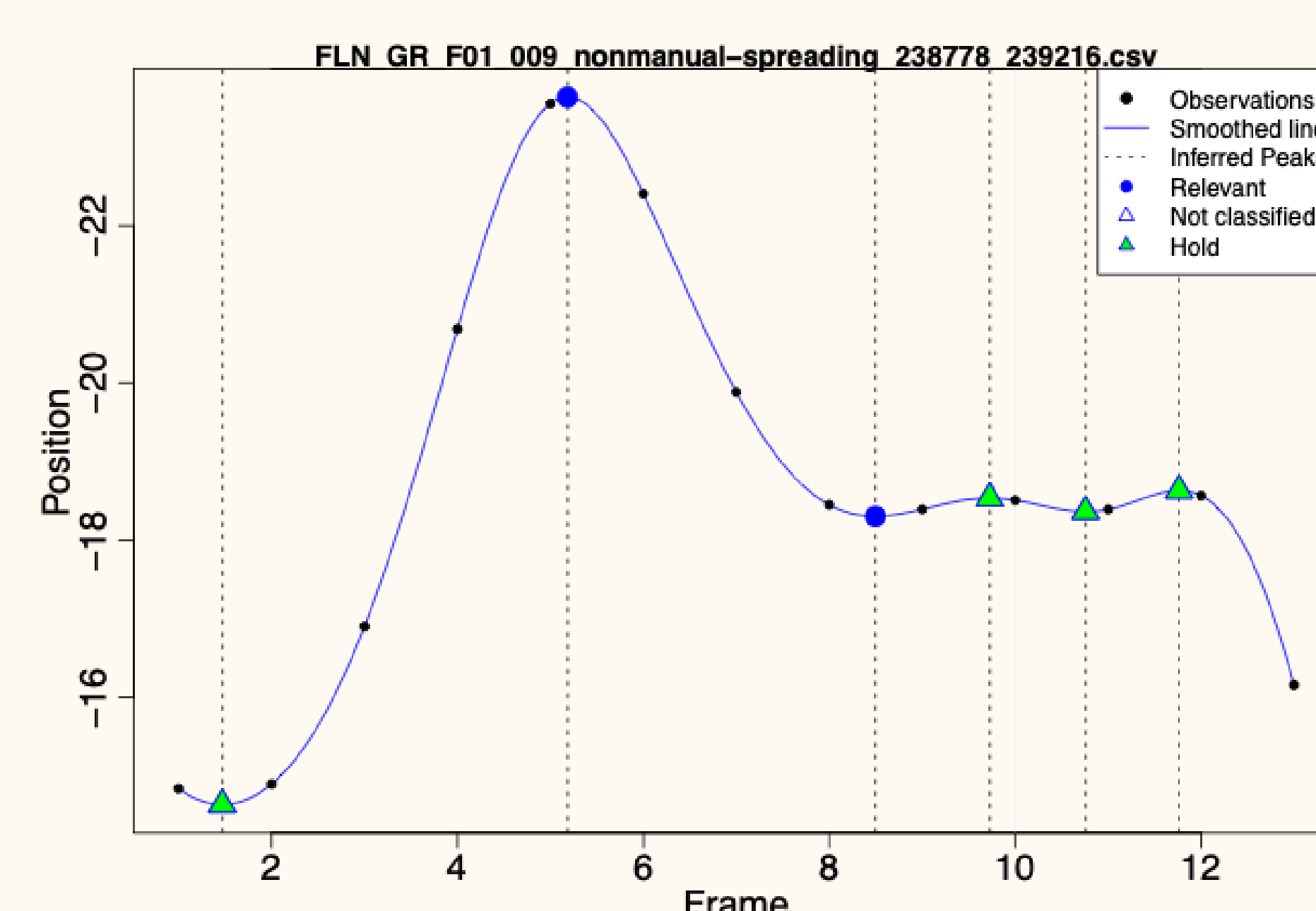
### Raw data and smoothed line with splines



### Peak classification after kernel regression



### Peak classification after splines



## Limitations

- Manual calibration required
- Not tested on many types of movements/many sign languages/many computer vision instruments
- Not tested on very long time series

## Outlook

- Experimenting with automatic peak classification
- Further testing with other data sets and instruments