Detecting Bids for Eye Contact Using a Wearable Camera

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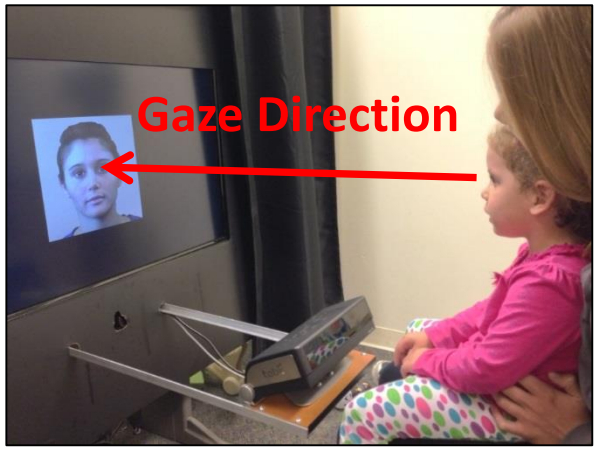
Limitations of Gaze Measurement Technologies

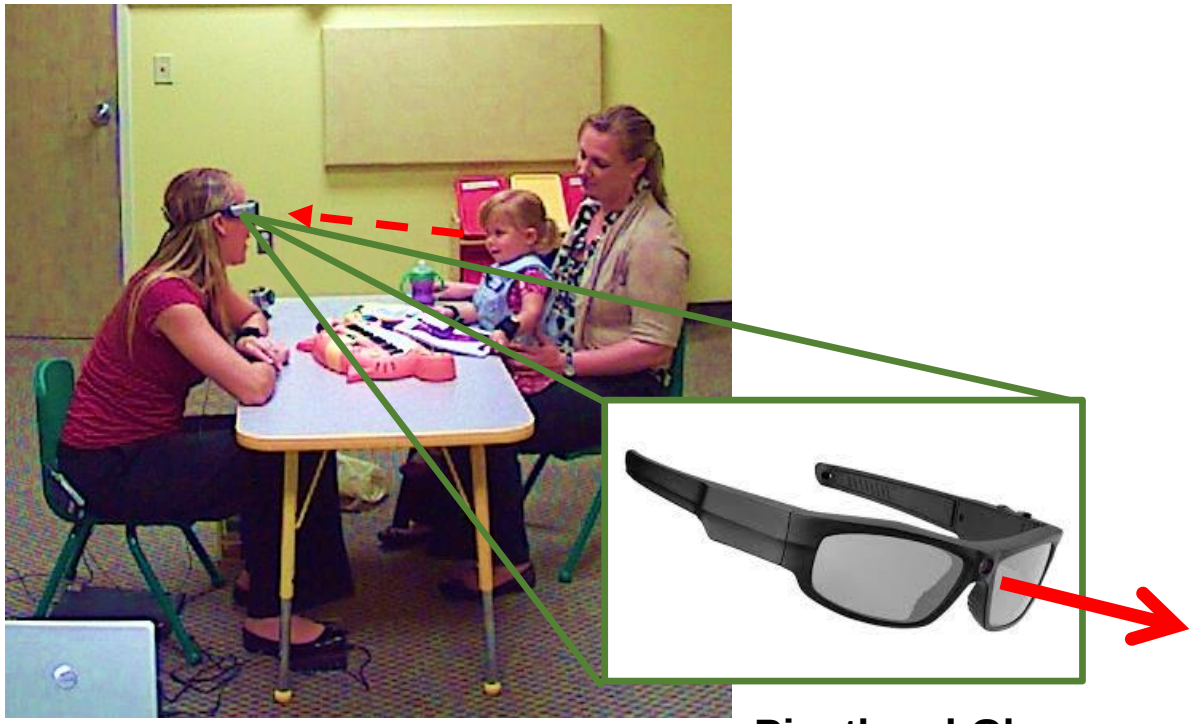
- ***Table-mounted eye tracker***
  - Need to map measured Gaze Direction to Point of Regard (PoR)
  - Good for monitors, bad for people

PoR



- ***Wearable eye tracker***
  - Challenges with calibration
  - Poor tolerance by children

First-Person View of Eye Contact



Pivothead Glasses

First-Person View of the Child

Multimodal Dyadic Behavior Dataset (MMDB)

- ***160 sessions***
  - Adult-child
  - Semi-constructed
  - 3-5 minutes
  - 15-30 months

- ***Multimodal***
  - Video
  - Audio
  - Physiological

cbi.gatech.edu/mmdb/

Contributions

- *Demonstrate feasibility of eye contact detection based on first-person video*
- *Collect the first dataset of first-person videos from adult-child social interactions*
- *Evaluate accuracy of first-person approach at both frame and event levels*

Agenda

Frame-level Detection

Event-level Detection

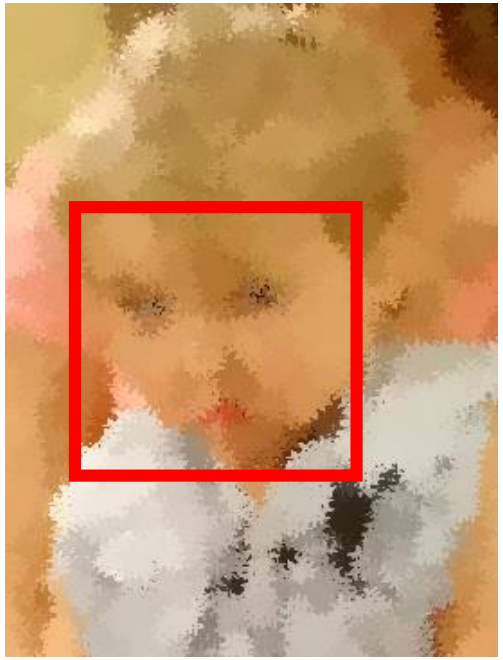
Experiments and Results

Conclusion

Detect and Localize Face

- ***Face Detection***
  - OMRON OKAO Vision

- ***Facial Landmarks & Head Pose***
  - IntraFace (De la Torre et al., CMU)



OMRON OKAO Vision

IntraFace

Ambiguity in Gaze Estimation

Pose-dependent **E**gocentric **E**ye **C**ontact Approach (**PEEC**)

Head Pose and Eye Regions

Head Pose

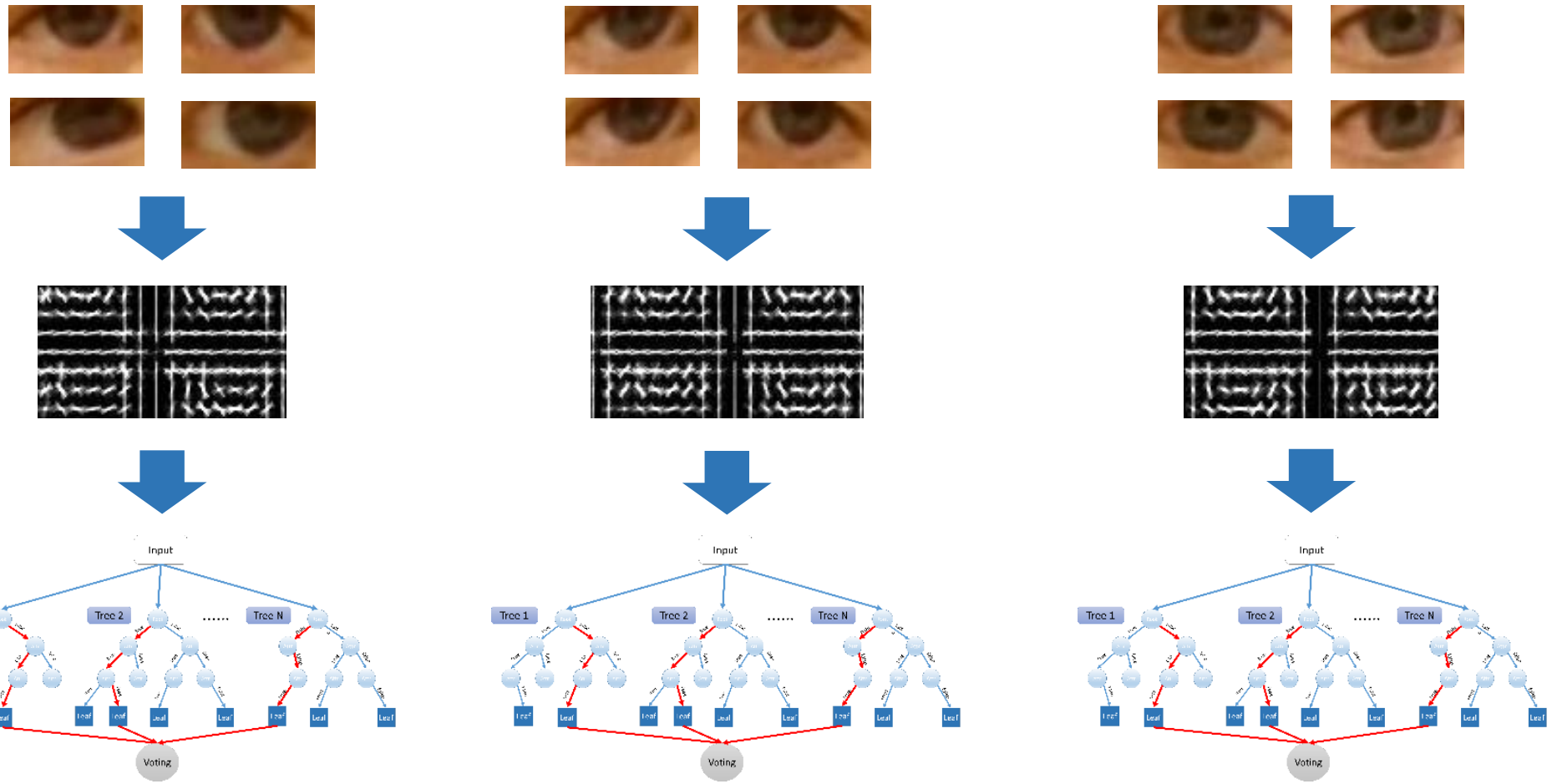
Eye Regions

Pose-Dependent Classifier

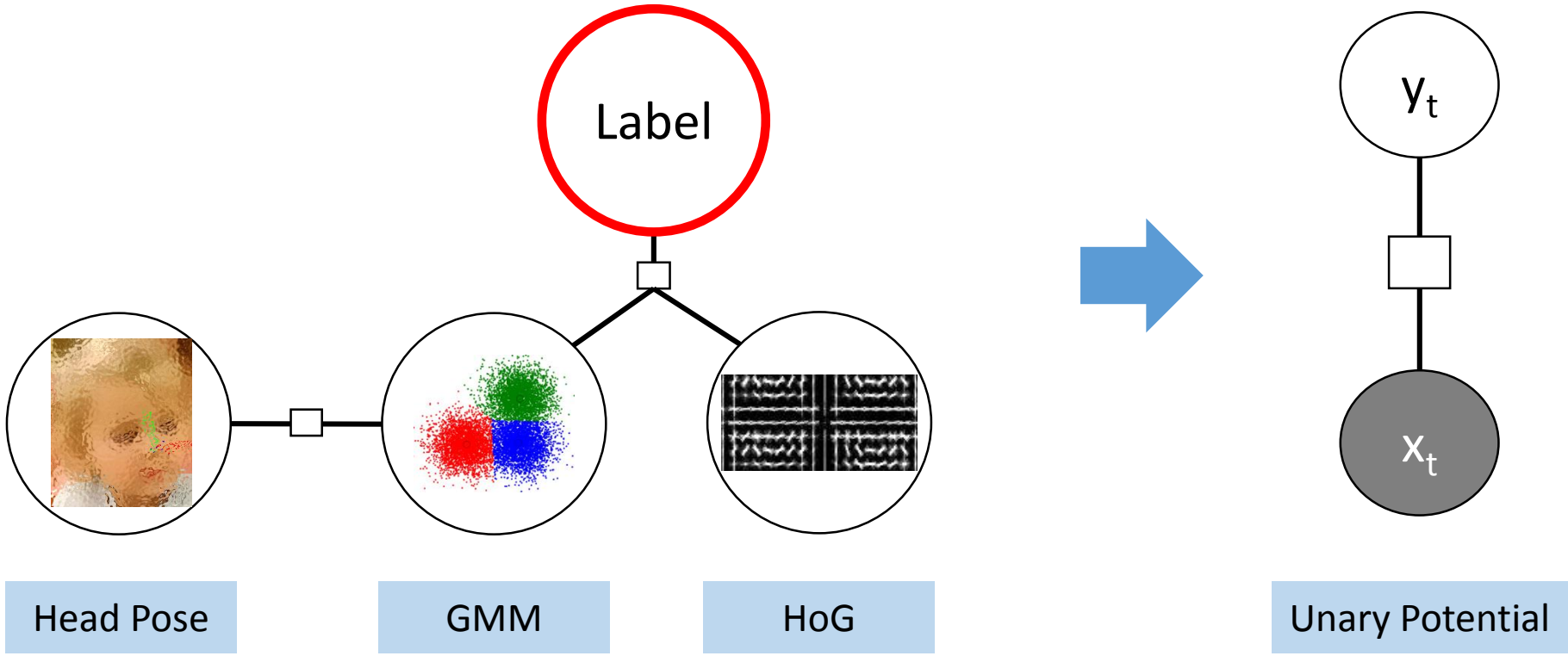
Eye Regions

HoG

Random Forest



Frame-level Model



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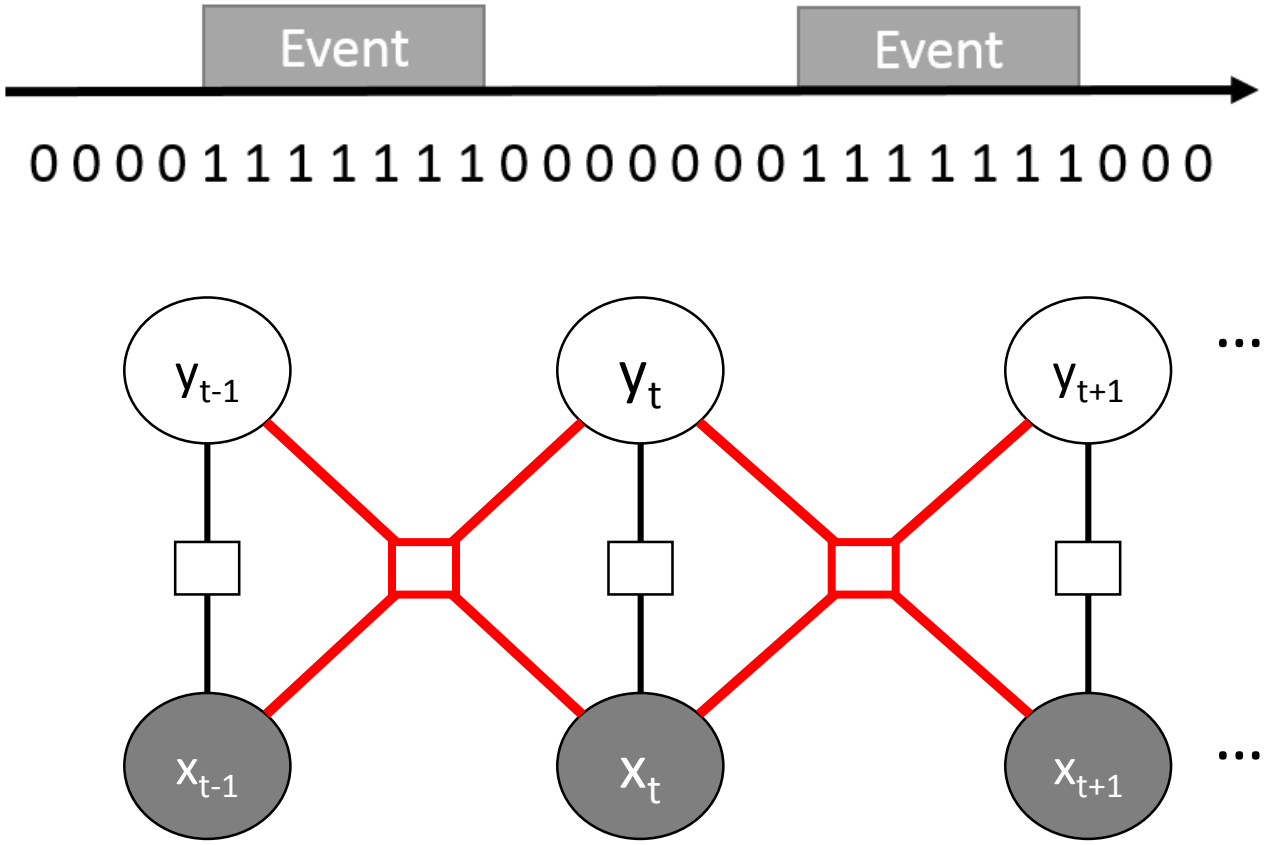
Linear-Chain CRF



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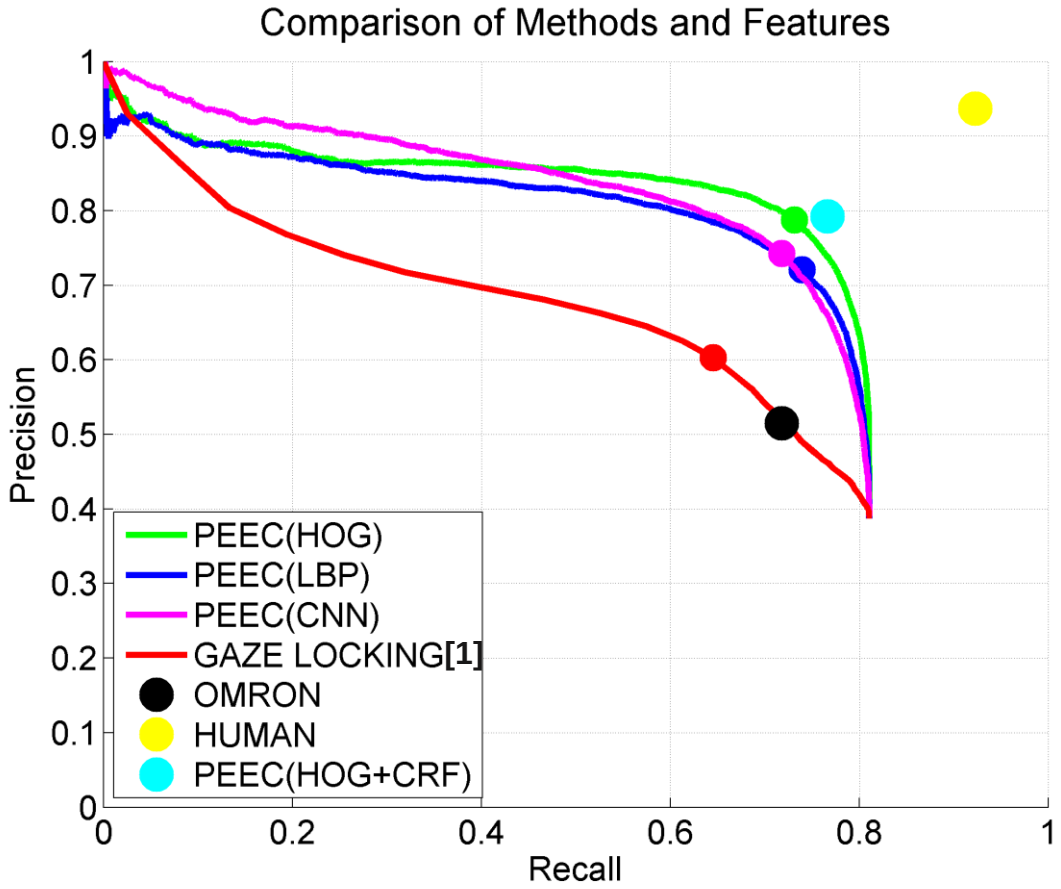
Ground Truth and Experiments

- *12 annotated sessions*
- *5 annotators*
  - Majority vote
- *Leave-one-subject-out cross-validation*

Video Result

Frame-level Result



Error Case 1

Face Occlusion

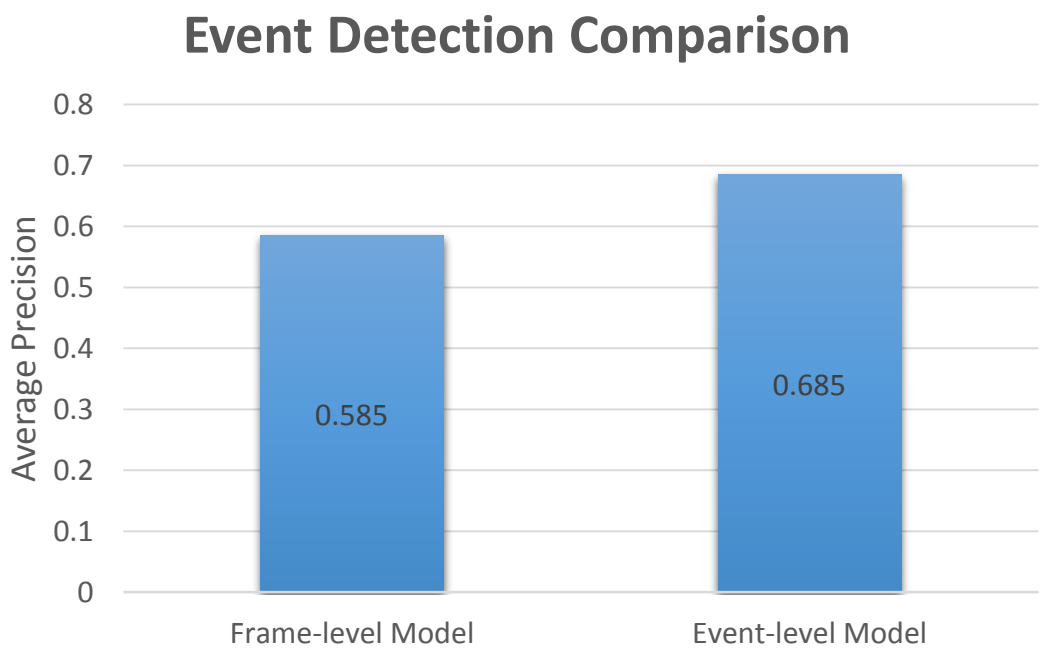
Error Case 2

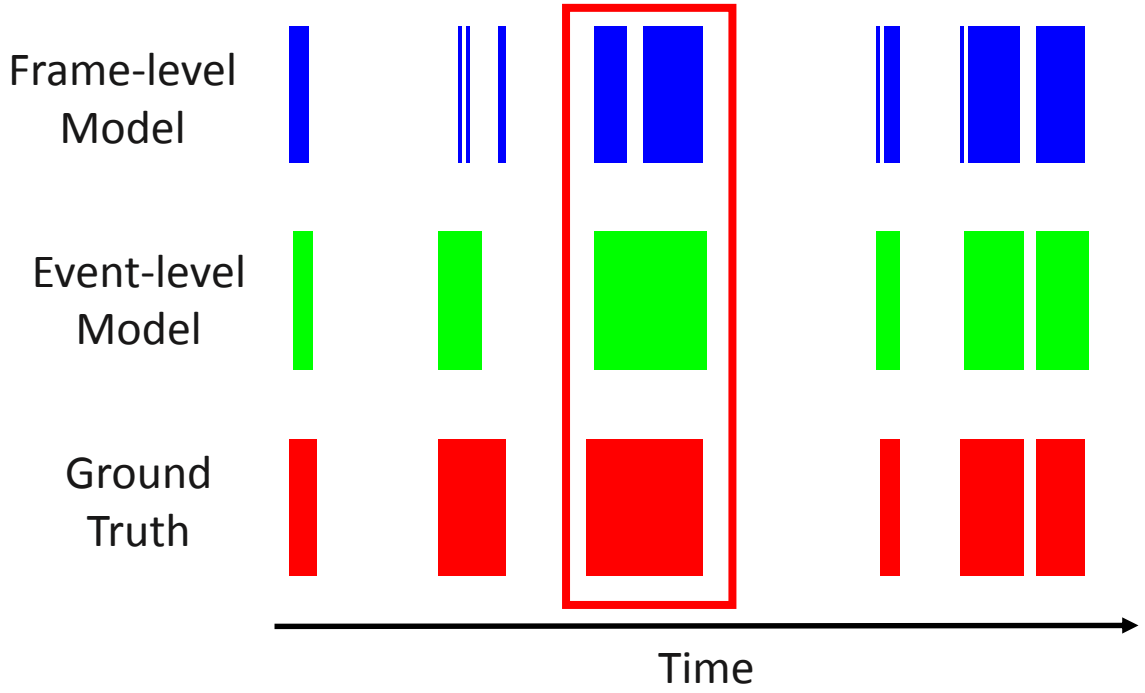
Face Rotation

[1] B. Smith, Q. Yin, S. Feiner, and S. Nayar. Gaze Locking: Passive Eye Contact Detection for Human Object Interaction. In *ACM Symposium on UIST*, pages 271–280, Oct 2013.

Event-level Result

- *Average Precision*





Conclusion

- *Non-invasive detection of eye contact during face-to-face social interactions can be achieved through first-person vision*
- *Developed a prototype system for automatically-measuring the frequency and duration of eye contact events*
- *Temporal smoothing can improve the accuracy of event level detection*
- *Dataset of first-person social interactions available to the research community via MMDB*

Q&A

Thank you for your attention