Automated eye gaze coding - meeting 9/20/18

During meeting Kat will take notes. Planned attendees:

Kim Scott
Kat Adams
Mike Frank
Virginia Marchman
Rhodri Cusack
Margaret Moulson
Melissa Kline
Maybe: Lisa Oakes, Christopher Krupenye, Rachel Barr - student?, George Kachergis, Jonathan Kominsky,
Oleg Komogortsev + Tom Yan
Alexandra Papoutsaki
Laurie Bayet

Resources during meeting:
Examples of public Lookit data showing reasonable degree of movement for humans to code -
https://drive.google.com/open?id=1KBpfaiOt33X-lEZBuiWAa4wXkMDs3WWG
https://drive.google.com/open?id=1Lp-bOFyINWYsVgjv7lLx-xXFlc_E8qFb
https://drive.google.com/open?id=1liuPk4nFepvp2B0U9HqP3-2lOat4YYY7
https://drive.google.com/open?id=1LwR42YpOYgdrQ3W7E5pEwA511sqFAJMn
https://drive.google.com/open?id=1lm_CMipQF9lG1UUu4w-CokUGm5rBjC3D
https://drive.google.com/open?id=1euqrqAVC8SNlX3lpOeqc4mm3NouQ-UJN

- Our proposal: work together to establish a pilot project to evaluate & improve gaze coding from natural-light video of babies/kids.
    - Eventually want a tool that is robust & easy to use, which can be used to replace at least some human coding of data.
    - Note that a possible outcome of the pilot is that the technology is nowhere near useful for our purposes yet & it makes sense for us to try again in 5 years. But community has value in meantime.
    - Goal of meeting: gather information about priorities & approaches. Get a set of actionable goals to follow up w/ larger group on.
- Introductions
    - Note there are people who couldn't attend but are interested. ~30 dev researchers, + discussions w/ eyetracking folks
- What tools people are currently using for (semi)automated gaze coding, with what degree of success.
    - Rekognition (Amazon)

    - OpenPose - note hard to choose simple cutoff “position” but were able to train classifier on features (not just estimate of gaze) and do better (>chance, <human). Variation across subjects. Possibly very task-specific
- (esp.) eyetracking folks: what are the main challenges?
    - Frequent partial occlusion of face (leaning, turning away, bottles/toys/hands)
    - Movement, including tilting, head turns, horizontal displacement
    - Multiple faces in frame (often at least parent/child)
    - Variable positioning of child relative to screen (at least across labs, often across kids and/or within kids)
    - Others?
    - Different configuration of faces in babies vs. adults
    - Mike: Getting from features to relevant responses for a particular study
- What are our priorities / what are we ok leaving for later?
    - Totally unsupervised?
    - Realtime / works online?
    - **Works for all races / eye shapes**
    - Natural video (vs. e.g. needing a sticker on kid's head?)
    - Requires calibration? (either experimental or human coding)
    - **Open source**
    - Eyetracking on screen, eye tracking in room, left/right/away, on/off
    - Experimental setup (kid facing screen/puppet show/etc.) vs. naturalistic? How much movement?

- Potential starting points / approaches, collaborators
    - WebGazer (here! - Alexandra Papoutsaki). Validated on psych data - Kilian Semmelmann; Josh Hartshorne using. + face detection/landmark detection
    - Neural Network Eye Tracker (here! - Oleg & Yan)
    - Learning/appearance based models - Andreas Bulling (Kim talking w/ soon). See e.g. https://www.cl.cam.ac.uk/research/rainbow/projects/unityeyes/tutorial.html. I think these folks have already been working w/ Shannon Ross-Sheehy (not here but in group)!
    - Face/landmark detection: clmtracker, js-objectdetect, Tracking.js. Eduardo Lundgren contacting Veronica Teichrieb’s lab at UFPE (http://www.cin.ufpe.br/~voxarlabs/) which has good developers and might be interested, also contacting dev in community to see about contribution to this project
    - TurkerGaze - Pingmei Xu - (Kim talking w/ soon - can provide advice/info but project inactive)
    - CVC Eye Tracker - Onur & Fernando (Kim talking w/ soon)
    - ManyBabies?
    - Note Databrary not an option for project home for now
    - GazeCapture (MIT)?
    - Jim Rehg’s group?

    - DeepLabCut?
    - Other ideas?
- Potential funding streams
    - NSF: RIDIR https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505168, DLS, ...
    - NIH?
    - Private foundations:
        - Sloan?
        - Arnold (re: reproducibility / scientific integrity)?
        - Simons?
    - MIT QI (long shot, Kim may pitch; may be similar internal sources at other institutions)
    - Your ideas?
- Coordination and next steps (discuss/crystallize: do not need to assign all at this point)
    - **Data**
        - [Person] to create survey and coordinate records of available video?
            - Find out what formats available data are in (e.g., how many people really have records of frame-by-frame coding stored), what views of face, very rough racial distribution (let's get a training set that isn't all white!)
        - [Person] to decide on a standard, & coordinate necessary conversion of coding files
        - [Person] to choose data sharing solution (e.g. on Databrary, possibly w/ separate IRB protocol)
    - **Communication: [Person] to create listserv for coordinating findings, writing, etc. and send out meeting summary (today/tomorrow).** [Person] will invite/get in touch w/ additional potential collaborators discussed.
    - **Funding**:
        - [People] will investigate additional opportunities (maybe using university RD) and send summary.
        - Soon: Pursue [x,y] funding opportunity, [person] will lead writing effort, [people] available to help with sections as needed.
    - **Development/evaluation**:
        - Possible first step: see how well we can do at detecting infant face & head pose estimation
        - Starting w/ off-the-shelf solution & build layer on top of features, so we can benefit from ongoing work in machine vision
        - Task at this point is largely to settle on starting point(s). Kim will continue meetings with machine vision folks, & send summaries to list; others welcome to join.
        - [person] has a student who will try out existing approach on freely-available data now, to set clear baseline, and/or

- [person] will create a clear description of this preliminary job and look for a student at their university who would take it on, and/or
- [person] will share data on how well their solution already works with kid video.