Towards Human Gesture Recognition AI Models

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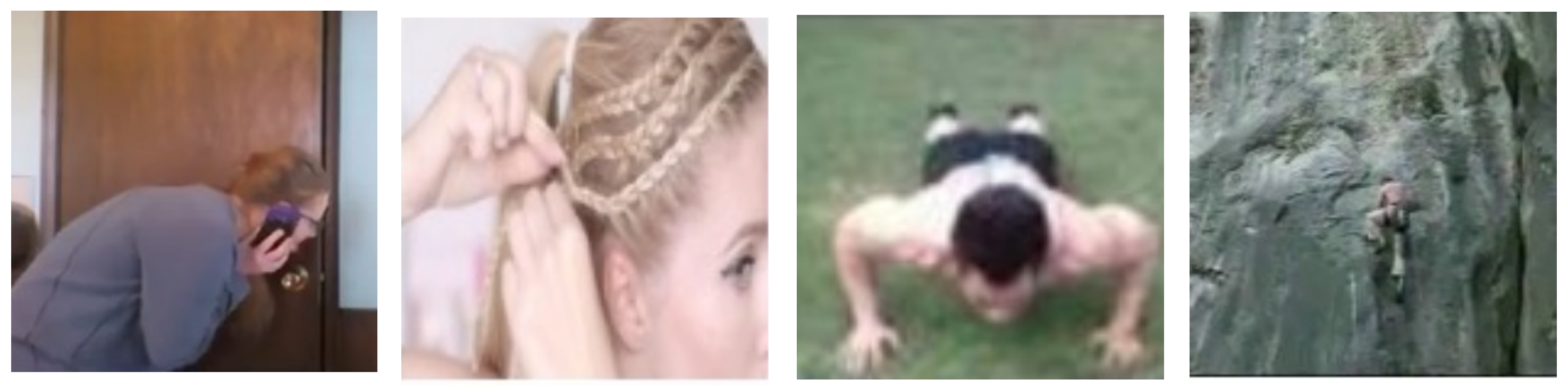
Motivation

- Understanding the complex ways in which humans use their bodies to express themselves is important for meaningful communication.
- The focus of this project is to create a supervised classification model to recognize videos of humans performing gestures, and categorize them into one of ten categories (e.g., shrugging, scratching head, shushing, etc.).

Related Datasets

- Human action recognition is already an active area of research.
- Existing datasets include Charades [1], Kinetics [2], UCF101 [3], and HMDB51 [4].
- However, none of these have been curated for the purpose of studying communicative gestures.



Holding a Phone — Braiding Hair — Push Ups — Climb

Figure 1: Examples from Charades, Kinetics, UCF101, and HMDB51 respectively.

Data Collection

- We begin by identifying ten distinct categories via crowdsourcing.
- We query Tenor API [5] to obtain 1500 GIFs per category.
- We use Detectron2 [6] object detection software to remove the GIFs that do not contain exactly one person or have an object obstructing the view of the person.

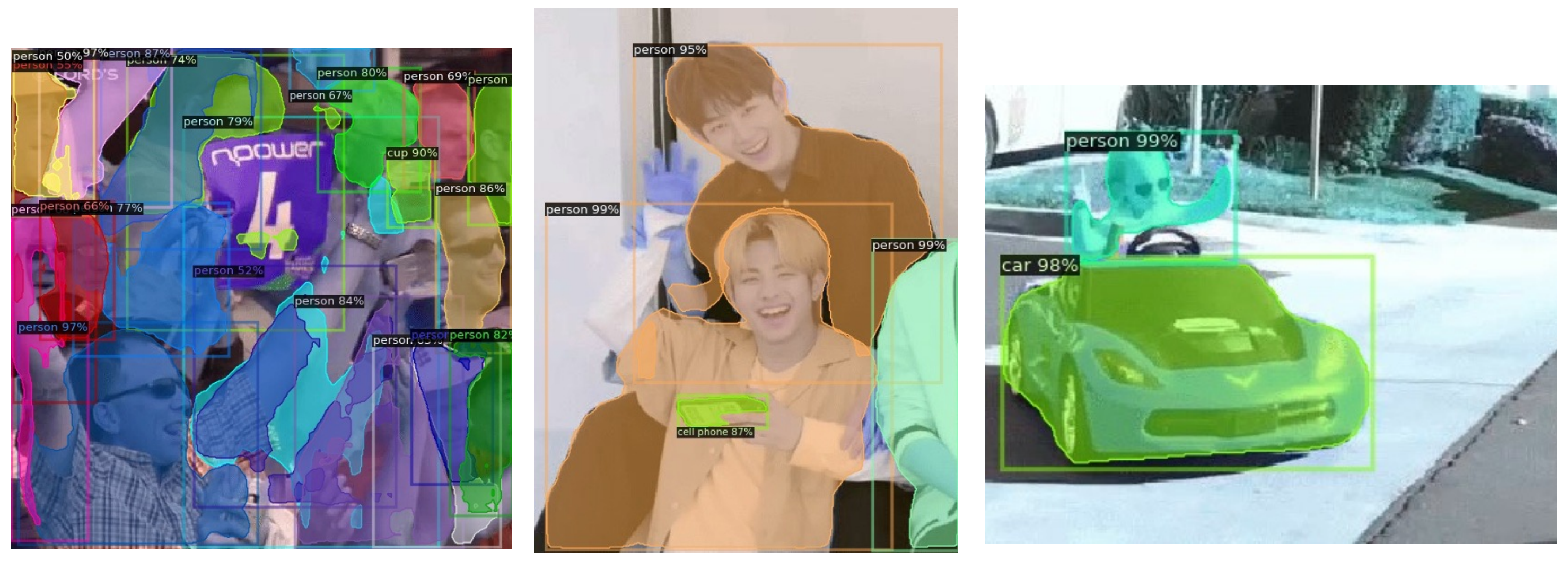


Figure 2: Examples of frames from GIFs that were cleaned out due to not meeting the criteria listed above.

Data Processing

- After cleaning the data, we apply the AlphaPose [7] model (pre-trained on Halpe dataset [8]) which detects 136 keypoints for the body, hands, and face on the GIFs.
- We prepare vector visualizations by removing the backgrounds and comparing the raw video and the AlphaPose keypoint videos.
- Our curated data visualizations can be accessed via the QR code at the bottom of this poster.

Figure 3: Shrugging.

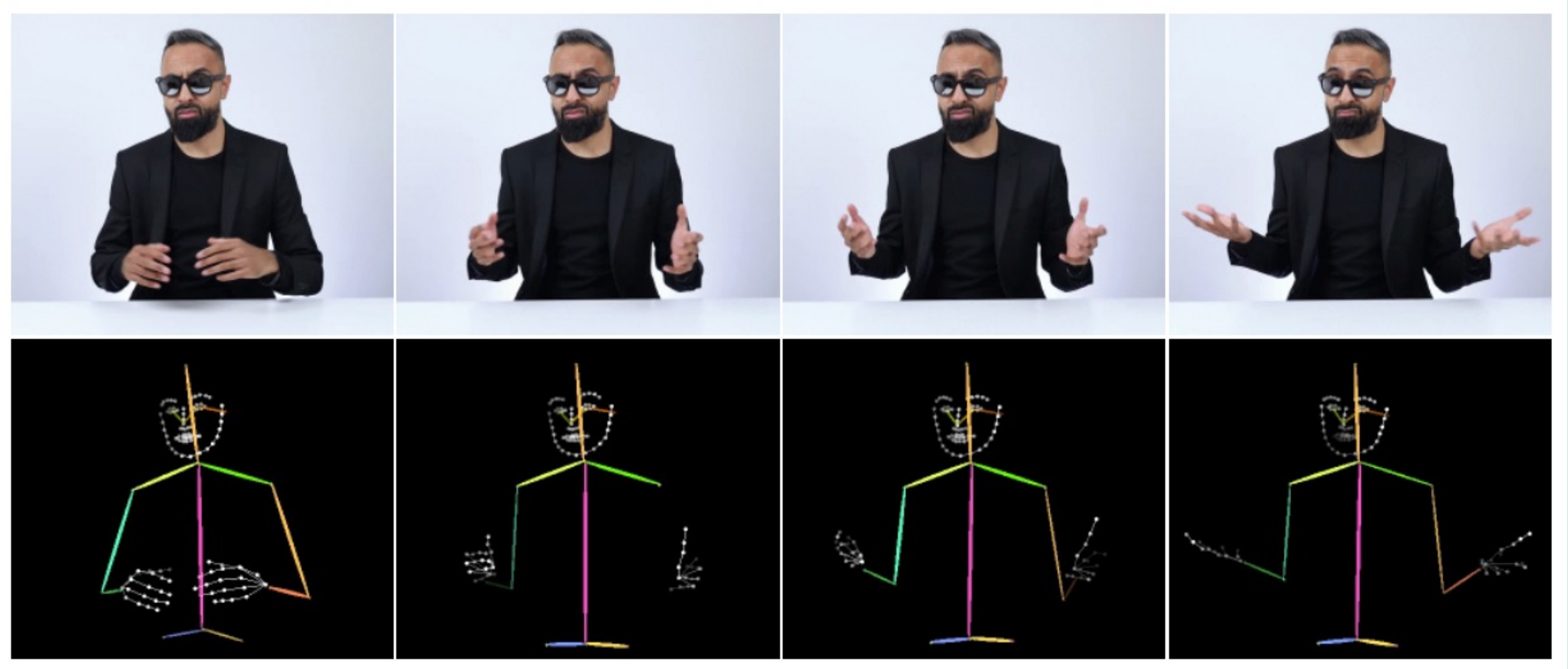


Figure 4: Mind Blown.

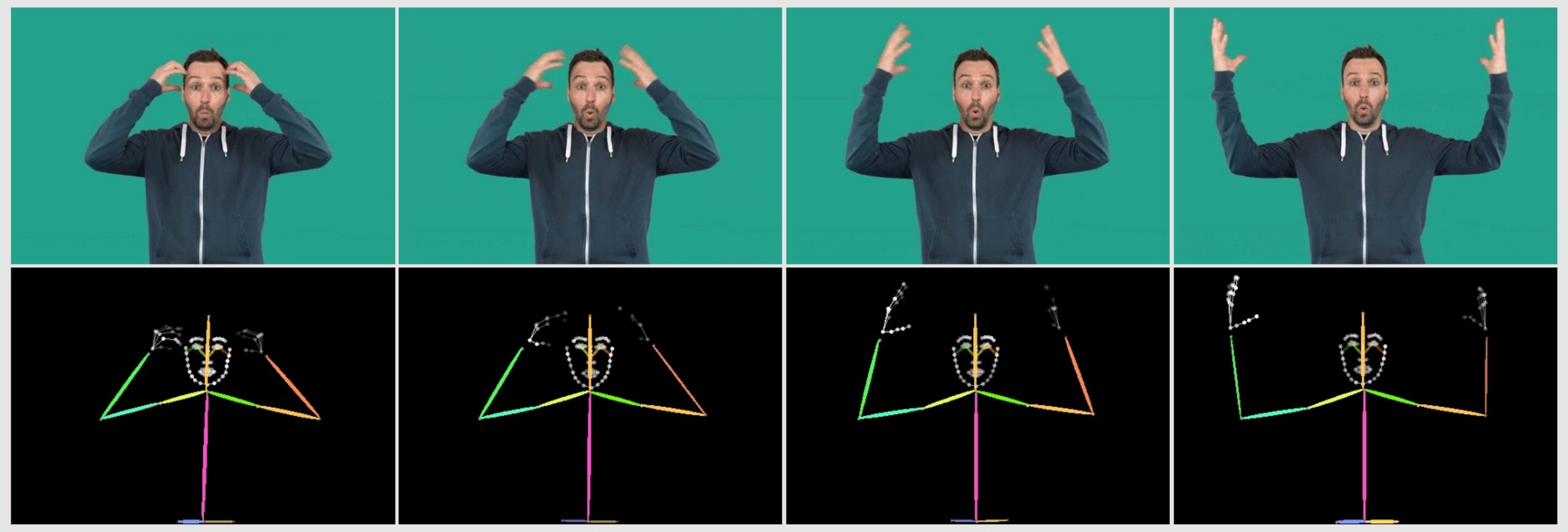
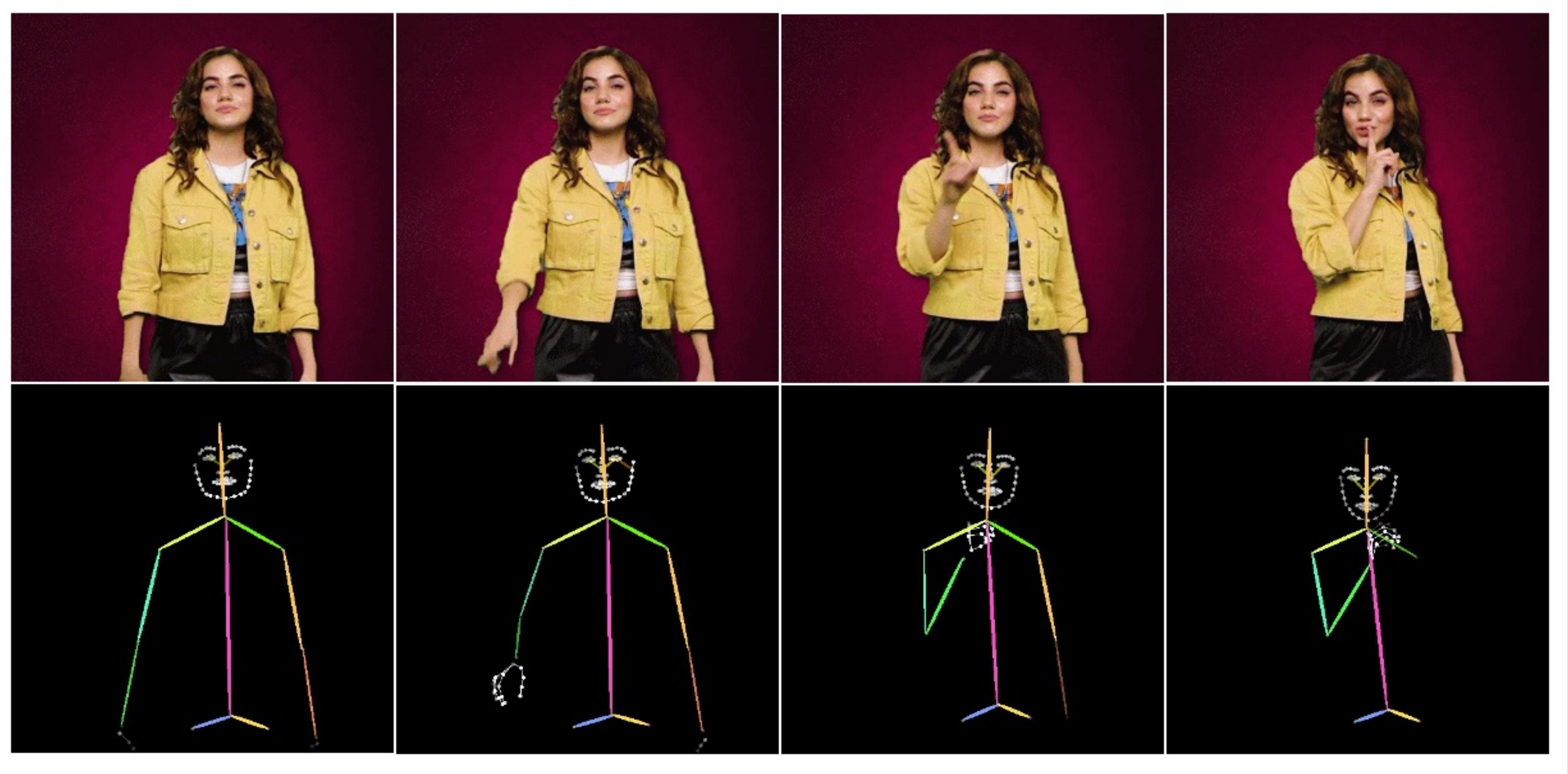


Figure 5: Shushing.



Figures 3-5: In-order frames of selected human gesture examples together with their keypoint visualizations.

Data Statistics

- We have gathered and curated a dataset for human gesture classification containing ten gestures, which is divided into an 80/10/10 data split for training, validation, and testing, respectively.

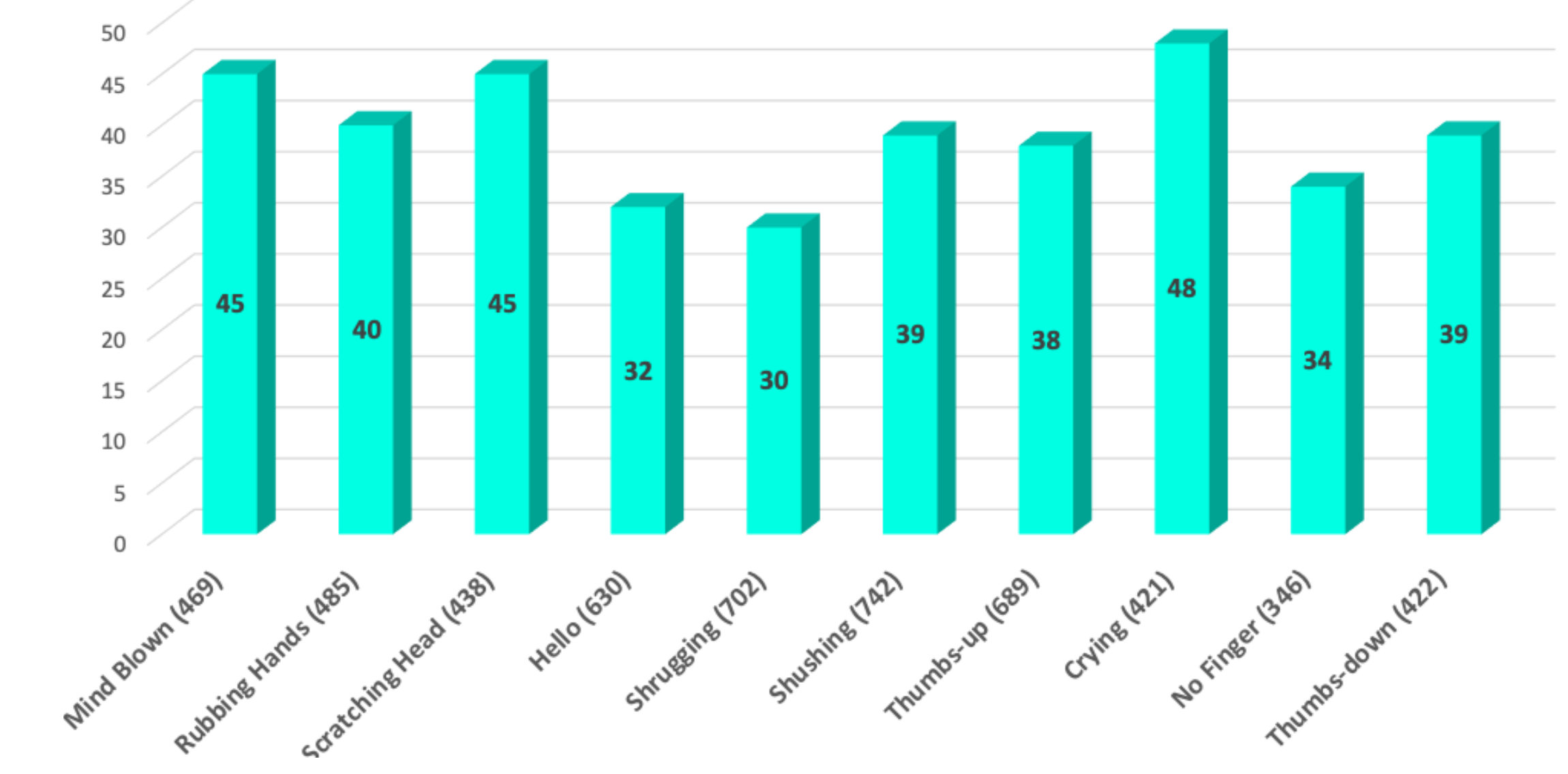


Figure 6: Average number of frames for GIFs in each of the ten gesture categories.

Summary and Next Steps

- With this curated dataset we can train, validate, and test the accuracy of supervised machine learning (ML) models for these ten gestures.
- We have setup the data processing pipeline in a way that can be easily updated to contain more gesture categories in the future, thereby creating a robust framework for human gesture classification.
- Besides human gesture classification, we can also design a conditional generative model that can generate keypoint sequences given a gesture prompt.

References

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