Kinder-Gator: The UF Kinect Database of Child and Adult Motion

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† Work conducted while these authors were summer interns at the University of Florida.

Disney Pixar characters (Image courtesy of www.wallpapercave.com)

Existing Datasets

- **Datasets of Adult motions**
  - MOBO (Gross and Shi, Tech Rep'01)
  - MADS (Kolykhalova et al., INTETAIN'16)
  - G3D (Bloom et al., CVPR '12)
  - K3Da (Leightley et al., APSIPA '15)
  - OTHER DATASETS (van Boxtel)
- **Datasets of Child-like motions**
  - MPI Database (Volkova et al., PLoS ONE'14)

C. Adult expressing pride (Volkova et al. '14)

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Addressing the Limitations of Existing Datasets

- Movements and Poses of Children differ from those of adults (Animation Addicts ’13)

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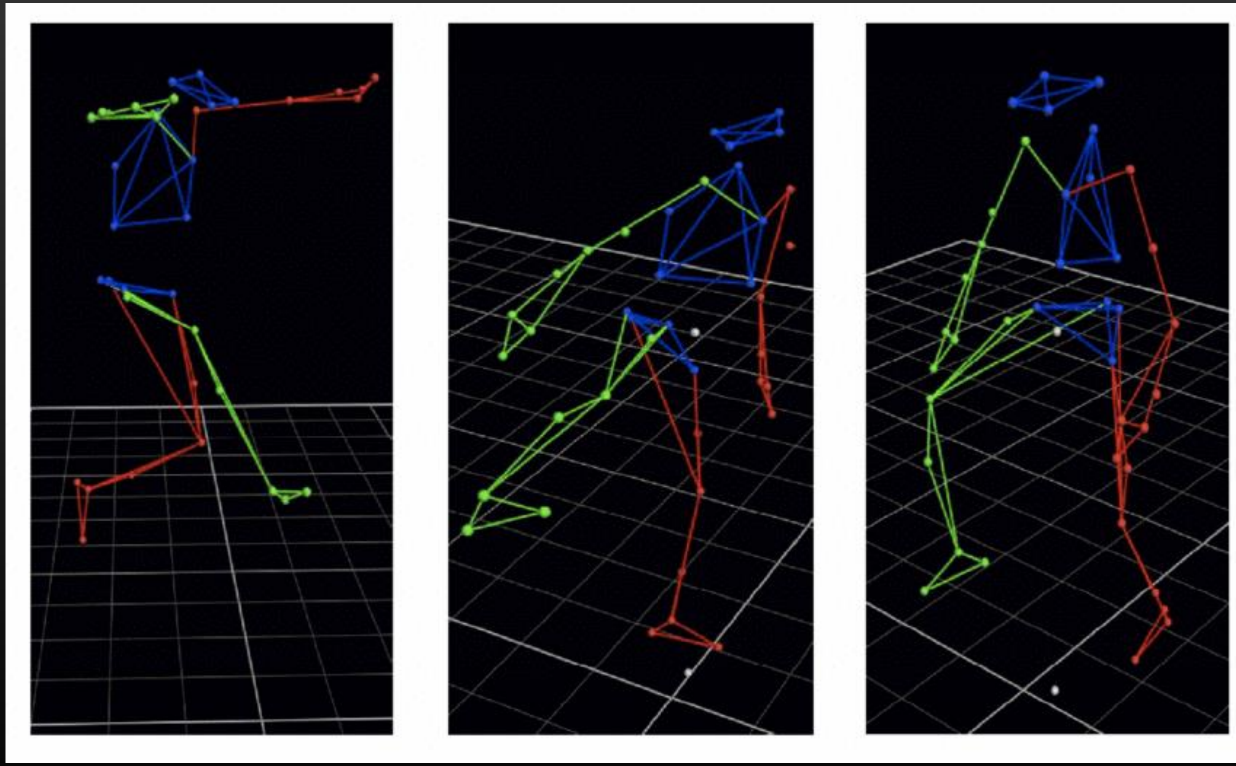
The Human Motion Database: A Cognitive and Parametric Sampling of Human Motion [9]

Guerra-Filho and Biswas (2012)

- 50 children and adults (ages 7 to 82) and 70 actions (e.g., walk, wave)



Example gestures: Jump, Kick, and Step Up

Addressing the Limitations of Existing Datasets

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Kinder-Gator

A **Kinect** database of **10 Children** and **10 adults** performing **58 Motions Naturally**

https://jainlab.cise.ufl.edu/pose-perception.html

Motions in Kinder-Gator

Motions in Kinder-Gator

Warm-Up (9 motions)	Exercise (14)	Mime (16)	Communication (19)
Raise your hand	Put your hands on your hip and lean to the side	Push an imaginary button in front of you	Point at the camera
Wave your hand	Walk in place	Fly like a bird	Motion someone to come here
Bow	Run in place as fast as you can	Kick a ball	Draw a [circle, square, Triangle] in the air
Bend your Knee	Jump as high as you can	Kick a ball as hard as you can	Draw the letter [A,C,K,M,X] in the air
Bend your other Knee	Do Five Jumping Jacks	Climb an imaginary ladder	Make the letter [Y,M,C,A,K,P,T,X] with your body

Example Motions

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Warm-up Motions (9)

- Used in day-to-day activities

Example Motions

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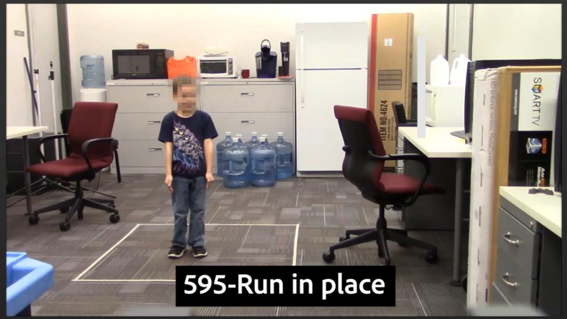
Exercise Motions (14)

- Induce physical exertion and used in exercise and fitness activities



Example Motions

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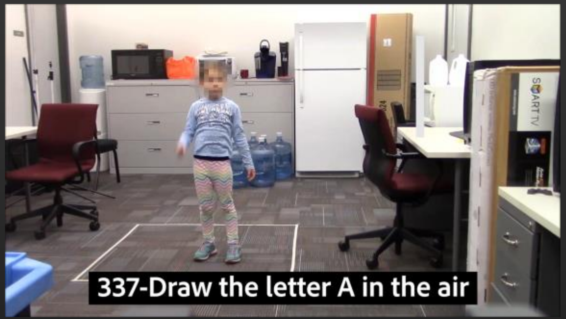
Mime Motions (16)

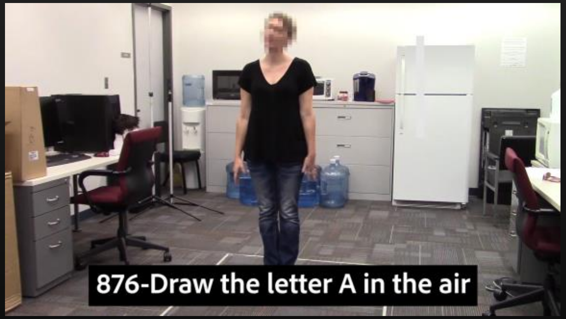
- Conceptualize imaginary objects

Example Motions

Communication Motions (19)

- Used to convey information





Example Motions

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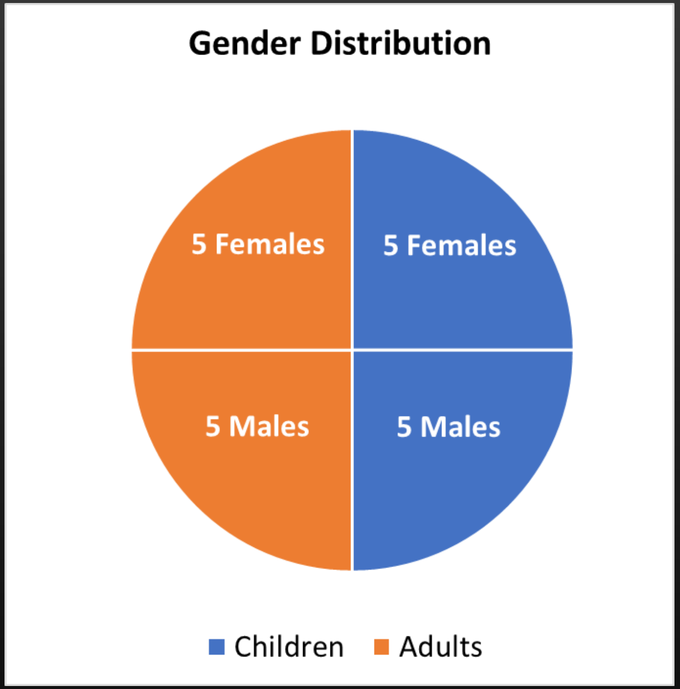
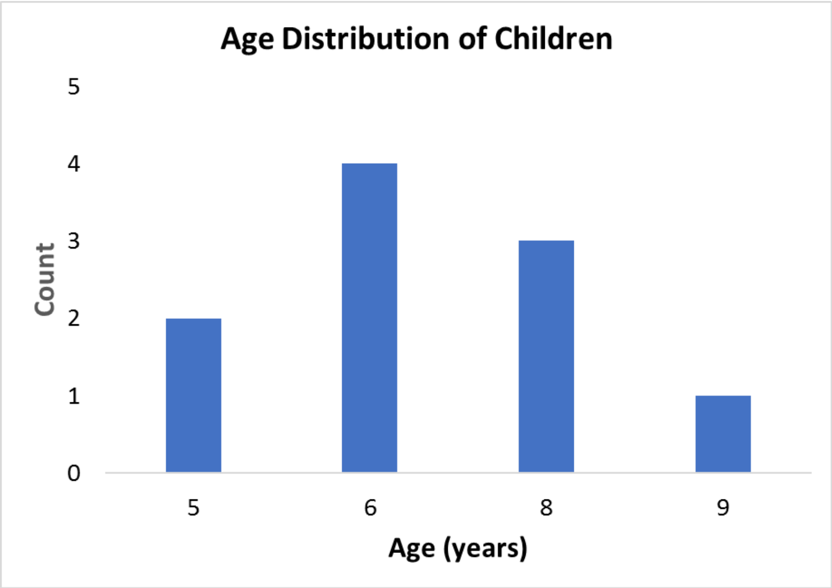
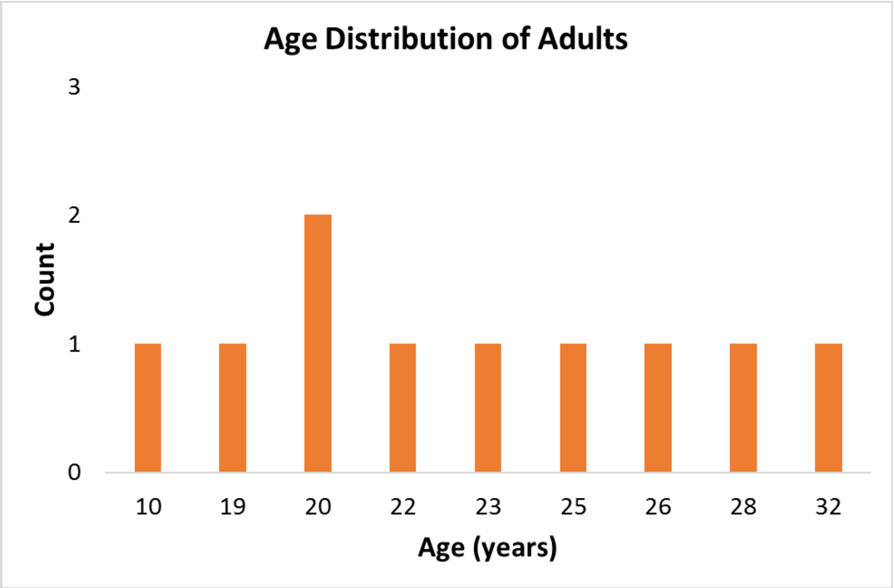
Demographics

Gender



Age





10 Children: M= 6.70 years, SD: 1.42

10 Adults: M = 23.40 years, SD = 4.33

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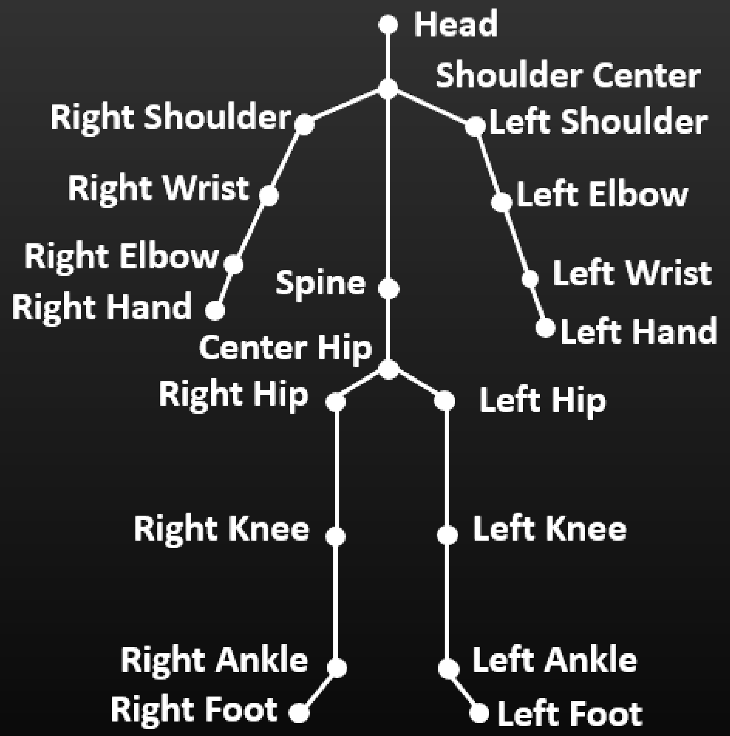
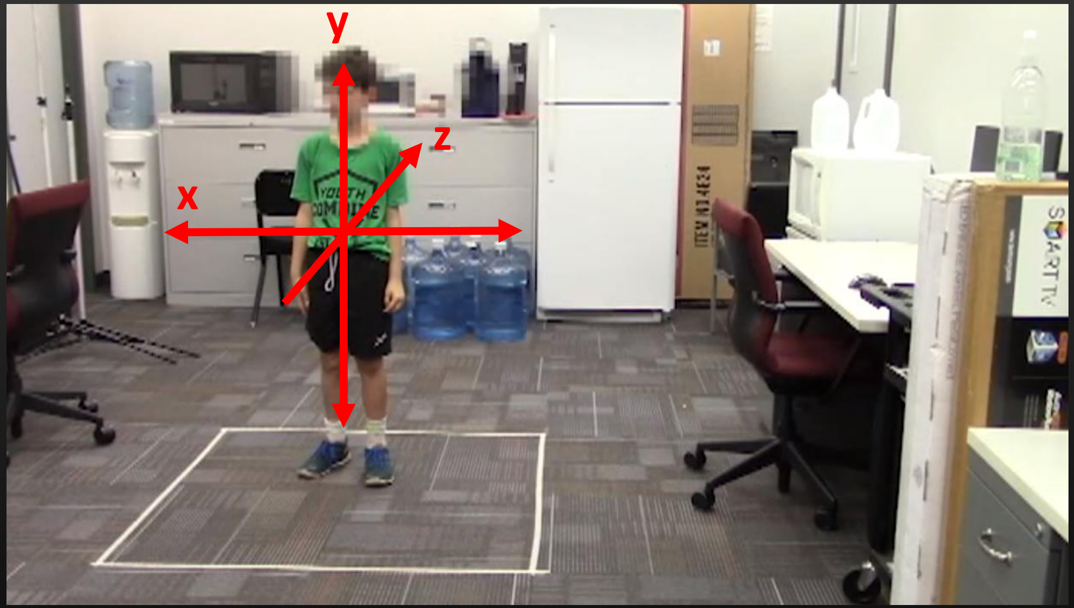
The Kinect v1.0

- Tracks 3D positions of 20 joints along 3 dimensions



Joints tracked by the Kinect



Coordinate Frame centered at Kinect

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Study Setup

- Participants stood within an area (47 x 47 inches) forward-facing the Kinect
- Duration of motion is dependent on the motion being performed

Child performing the T-pose

Study Setup

- Participants stood within an area (47 x 47 inches) forward-facing the Kinect
- Duration of motion is dependent on the motion being performed


Child performing the T-pose


723-Swipe across an imaginary screen in front of you


Child with arms to the side

Data Collection

- A total of 19 RGB videos and 1159 motion trials (58 motions * 20 participants)

Timestamp	HipCenterX	HipCenterY	HipCenterZ	…	User-ID	Motion
48546673.98	-0.0419986	-0.1512957	3.057717	…	103	Raise-your-hand
48546708.98	-0.04312875	-0.151742	3.058163	…	103	Raise-your-hand
48546740.99	-0.04372106	-0.1516228	3.058321	…	103	Raise-your-hand
48546772.99	-0.0443305	-0.1512319	3.059047	…	103	Raise-your-hand

Dataset Example

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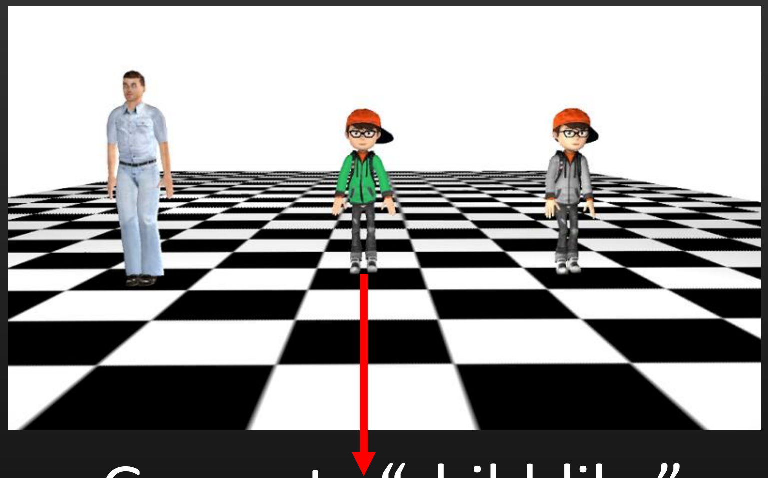
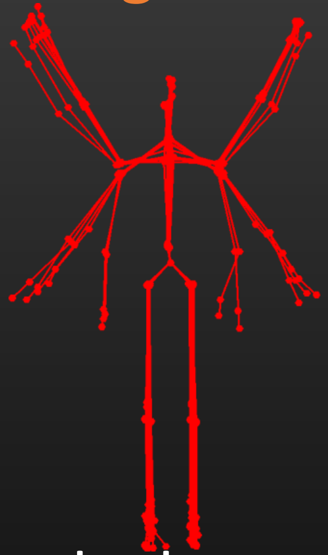
Applications

Animation



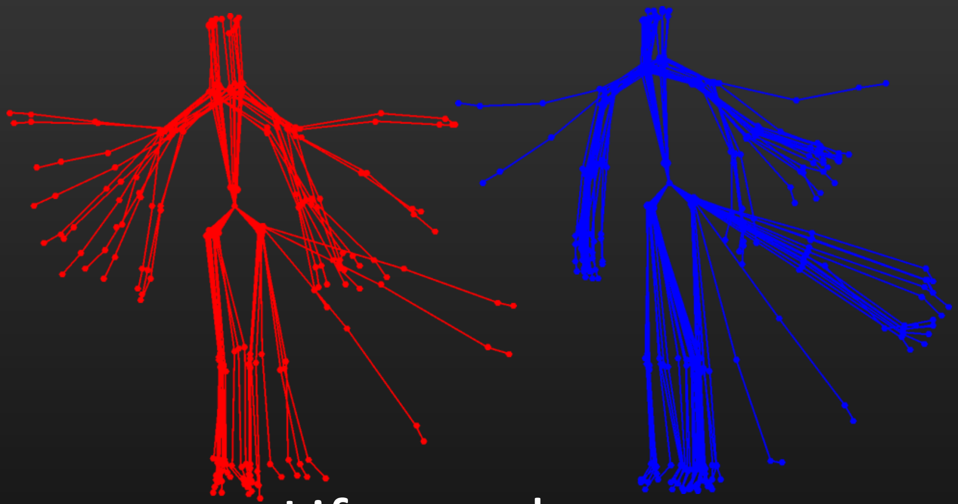
Generate "child-like" avatar

Recognition



Make the letter "Y" with your body

Human Motion Characteristics

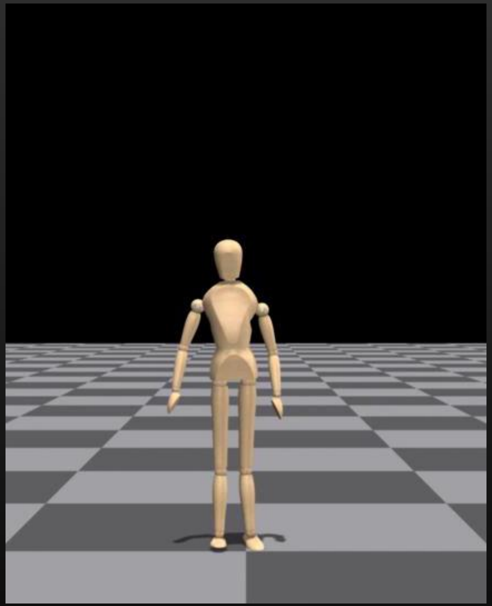


Lift your leg to one side motion

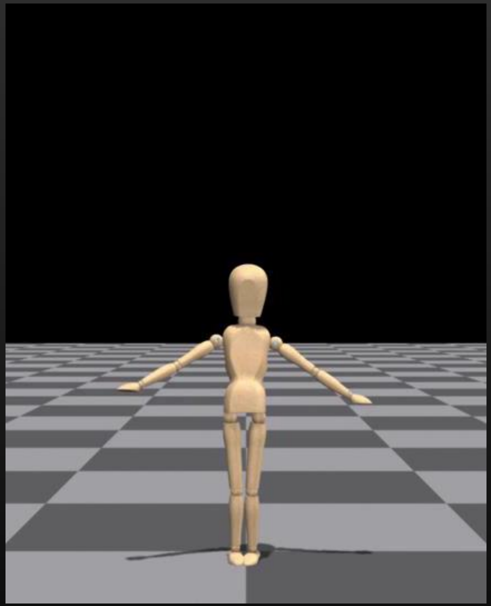
Animation: Cross-Generational Morphing

- The dynamic scaling law was used to transform adult motion to child motion (Dong et al. [MIG' 17])

Adult



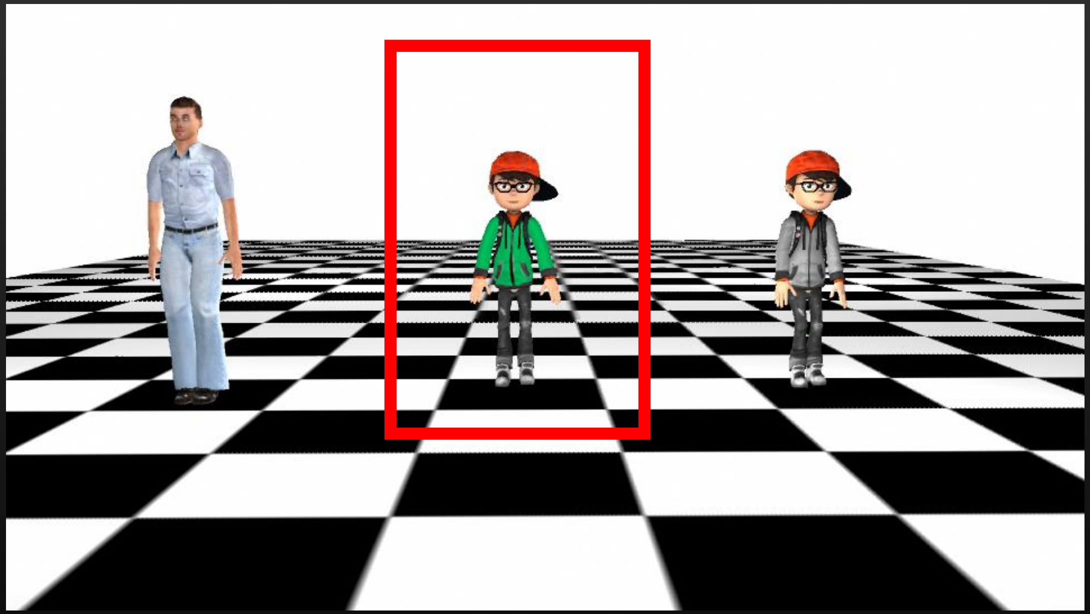
Dynamically-Scaled Adult



Child

Animation: Cross-generational Morphing

- ‘**Child-like**’ motion created using a style translation algorithm is more similar to the motion of a child (Dong et al. [Eurographics’ 18])



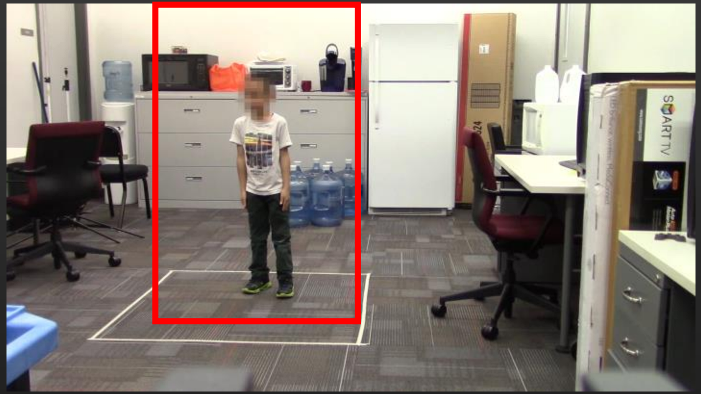
Child in the **middle** is the result of converting adult to child

Eurographics Poster Session (Today 12:00-13:15)

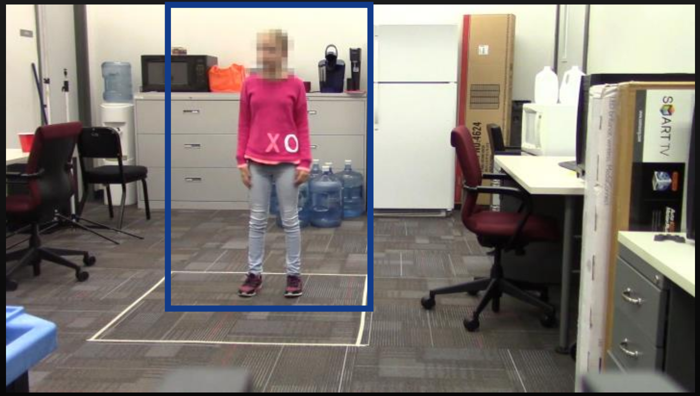
Recognition

Gait Recognition

Human Activity Recognition

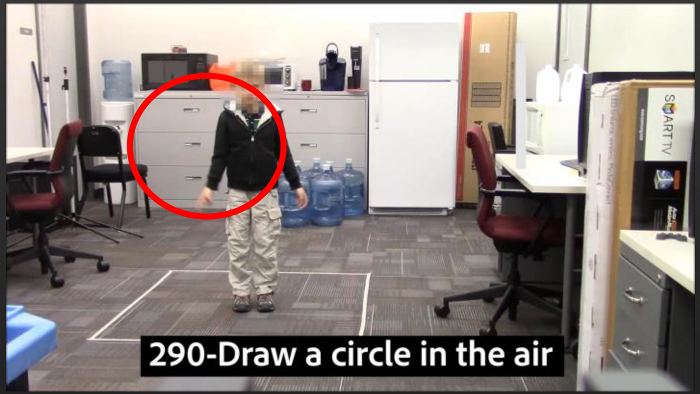


Jumping Jacks



Jump

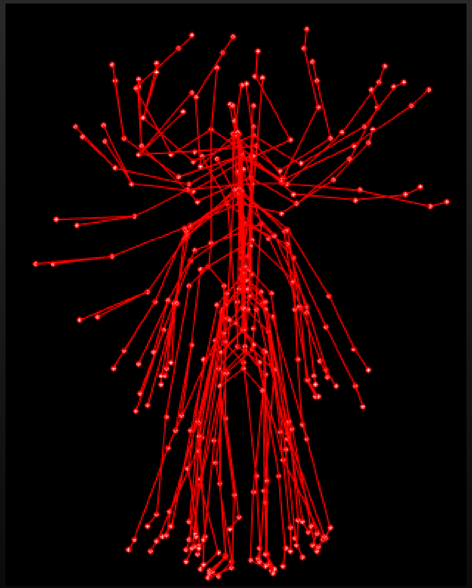
Stroke Gesture Recognition



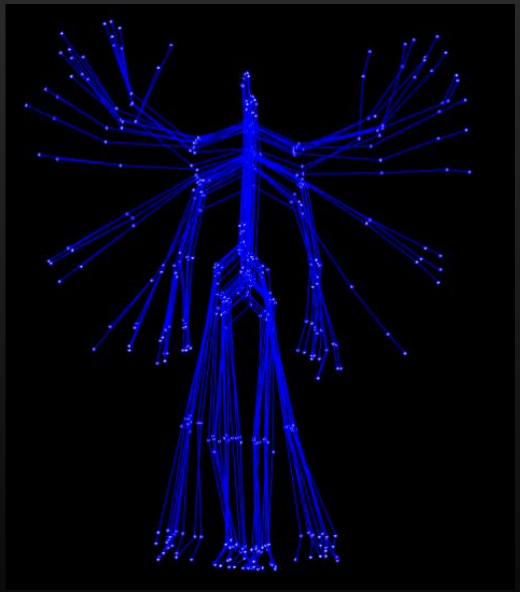
Human Motion Characteristics

- Perceive the differences between child and adult motions (Jain et al. [TAP' 16])

Child



Adult

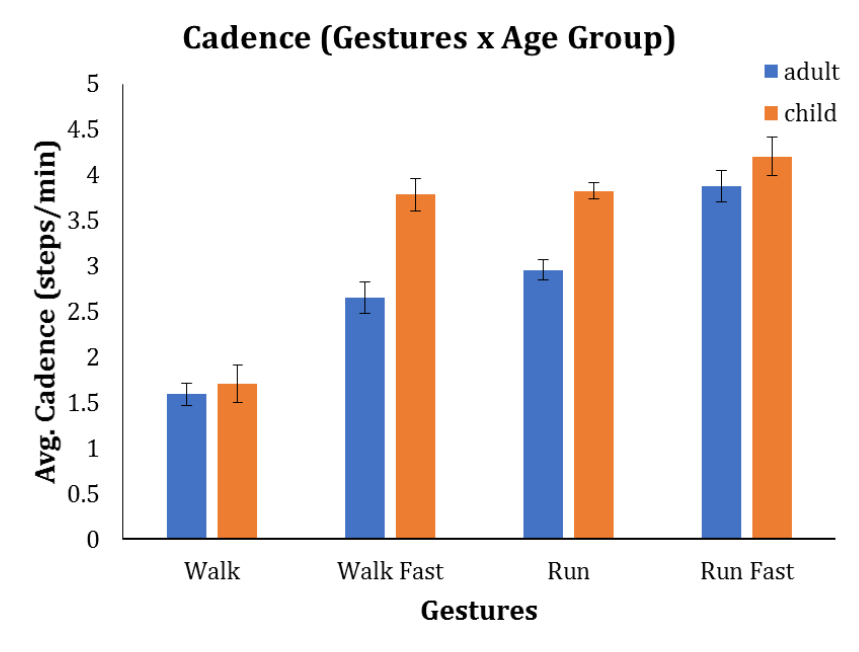


Rendering every 10th frame of the jumping jacks motions for one child and one adult.

Human Motion Characteristics (Ongoing Work)

- Extract spatial and temporal gait features to quantify the differences between child and adult motions (Ongoing work)
- Walk in place, Walk fast, Run, Run fast

Spatial Features	Temporal Features
Step Height	Step Time
Step Width	Cycle Time
Relative Step Height	Cycle Frequency
Walk Ratio	Cadence
	Step Speed



Cadence

Conclusion

- Kinder-Gator is a Kinect database containing 58 motions performed by 10 children (ages 5 to 9) and 10 adults (ages 19 to 32)
- The database contains **19 RGB videos and 1159 motion trials**
- The database is publicly available at:

  https://jainlab.cise.ufl.edu/pose-perception.html

- Application of the database includes **animation**, **recognition**, and **human motion characteristics** of children and adults

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Thank You!

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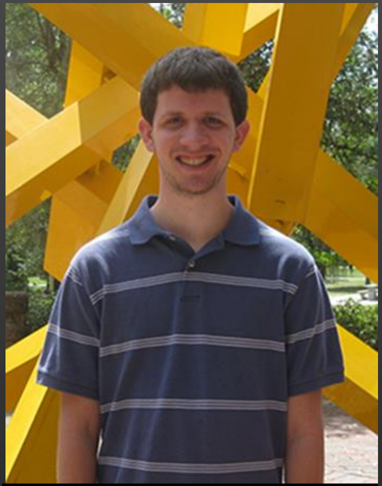

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References

1. SIGAL L., BALAN A. O., BLACK M. J.: HumanEva: Synchronized video and motion capture dataset and baseline algorithm for evaluation of articulated human motion. International Journal of Computer Vision 87, 1-2 (2010), 4–27. doi: 10.1007/s11263-009-0273-6.
2. GROSS R., SHI J.: The CMU Motion of Body (MoBo) Database. Tech. Rep. 1, 2001. doi:10.1109/MP.2008.4430762.
3. KOLYKHALOVA K., CAMURRI A., VOLPE G., SANGUINETI M., PUPPO E., NIEWIADOMSKI R.: A Multimodal Dataset for the Analysis of Movement Qualities in Karate Martial Art. In Proceedings of the 7th International Conference on Intelligent Technologies for Interactive Entertainment (2015). doi:10.4108/icst. intetain.2015.260039.
4. BLOOM V., MAKRIS D., ARGYRIOU V.: G3D: A gaming action dataset and real time action recognition evaluation framework. 2012 IEEE Computer Society Conference on Computer Vision and Pattern Recognition Workshops (2012), 7–12. doi:10.1109/CVPRW.2012.6239175.
5. LEIGHTLEY D., YAP M. H., J. COULSON Y. B., MCPHEE J. S.: Benchmarking Human Motion Analysis Using Kinect One: an open source dataset. IEEE Conference of sia-Pacific Signal and Information Processing Association, December (2015), 1–7. doi:10.1109/APSIPA.2015.7415438.
6. VOLKOVA E., DE LA ROSA S., BULTHOFF H. H., MOHLER B.: The MPI emotional body expressions database for narrative scenarios. PLoS ONE 9, 12 (2014), e113647.
7. VAN BOXTEL J. J.: Free mocap databases. http://jeroenvanboxtel.com/ MocapDatabases.html. Accessed:2017-12-28.
8. ANIMATIONADDICTS: The challenge of animating underaged adults. http://www.animation-addicts.com/2013/ 01/30/animating-kids/, 2013. Accessed: 2017-11-12
9. GUERRA-FILHO G., BISWAS A.: The human motion database: A cognitive and parametric sampling of human motion. Image Vision Comput. 30, 3 (Mar. 2012), 251– 261. URL: http://dx.doi.org/10.1016/j.imavis.2011.12.002, doi: 10.1016/j.imavis.2011.12.002.
10. JAIN E., ANTHONY L., ALOBA A., CASTONGUAY A., CUBA I., SHAW A., WOODWARD J.: Is the motion of a child perceivably different from the motion of an adult? ACM Trans. Appl. Percept. 13, 4 (July 2016), 22:1–22:17. URL: http://doi. acm.org/10.1145/2947616, doi:10.1145/2947616.
11. DONG Y., PARYANI S., RANA N., ALOBA A., ANTHONY L., JAIN E.: Adult2child: Dynamic scaling laws to create child-like motion. In Proceedings of the Tenth International Conference on Motion in Games (New York, NY, USA, 2017), MIG ’17, ACM, pp. 13:1–13:10. URL: http://doi.acm.org/10.1145/3136457. 3136460, doi:10.1145/3136457.3136460.
12. DONG Y., ALOBA A., ANTHONY L., JAIN E.: Style translation to create child-like motion. Eurographics (2018), [to appear].