

MotiHomeT (Motivate Home Training)

Team 2

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Home Training

- One of the most trendy way of exercise.
 - To save time and money.
 - To keep social-distance.



Problems

- Lack of motivation to workout from home
- -> Connect with your friends to keep each other responsible
- However this requires to track the exercises manually, which can be exhausting
- -> Our app offers a solution



Motivate Home Training with Mobile App

- Motivate people to work out by
 - automatically track their exercises
 - letting them compete with friends
- With mobile application
 - It works on existing commercial device

Target Users

- People who want to exercise in from home and be able to compete with their friends effortlessly
 - People who want to save time and money.
 - People who can't go to the gym.
(due to corona...)



Approach

- Mobile (smartphone) application.
- Counting push-ups with vision-based 3D pose tracking.
- Competition with friends.

Existing Solutions and Limitations

- Manual social workout logging (e.g. Hevy, Jetfit)
- Correcting exercise posture (Pose trainer)

Challenges

- **How much accurate existing real-time 3D pose tracking techniques are?**
 - Need searching and initial verification.
- **How to determine the user finished “a push-up”?**
 - Different from person to person.
 - How to fragment the movements?
 - How to determine cheating? (80/90/95% of a push-up?)
 - Pose tracking may not be perfect.

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System Design: MotiHomeT

- **Initial Settings**

- a. Record the standard push-up of the user.

- **Runtime**

- a. Recording the push-up of the user.

- b. Running pose tracking in real-time.

- c. Calculating the distance between the real-time and standard push-ups poses.

- d. Push-ups Classification/Counting.

- e. Competition with your friends.



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Pose Tracking

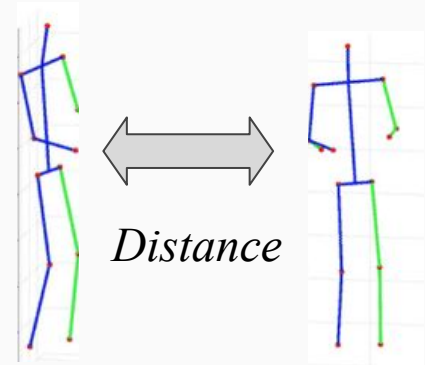
- Using deep-learning based pose tracking techniques.
- Figuring out how pose tracking works.
- Port the network to the mobile devices.

- [Learning to Move with Affordance Maps](#) -William Qi, Ravi Teja Mullapudi, Saurabh Gupta, Deva Ramanan (ICLR 2020)
- [Depth Estimation by Learning Triangulation and Densification of Sparse Points for Multi-view Stereo](#) -Ayan Sinha, Zak Murez, James Bartolozzi, Vijay Badrinarayanan, Andrew Rabinovich (arxiv 2019)
- [Differentiable Volumetric Rendering: Learning Implicit 3D Representations without 3D Supervision](#) -[CODE] - Niemeyer, Michael and Mescheder, Lars and Oechsle, Michael and Geiger, Andreas (CVPR 2020)
- [SeqXYZSeqZ: Structure Learning for 3D Shapes by Sequentially Predicting 1D Occupancy Segments From 2D Coordinates](#) - Zhizhong Han, Guanhui Qiao, Yu-Shen Liu, Matthias Zwicker (arxiv 2020)
- [Real-Time Camera Pose Estimation for Sports Fields](#) -Leonardo Citraro, Pablo Márquez-Neila, Stefano Savare, Vivek Jayaram, Charles Dubout, Félix Renaut, Andrés Hasfura, Horeh Ben Shitrit, Pascal Fua (arxiv 2020)
- [DO OPTIMIZATION METHODS IN DEEP LEARNING APPLICATIONS MATTER](#) -[CODE] -Buse Melis Ozyildirim, Mariam Kiran (arxiv 2020)
- [Occlusion-Aware Depth Estimation with Adaptive Normal Constraints](#) -Xiaoxiao Long, Lingjie Liu, Christian Theobalt, Wenping Wang (arxiv 2020)
- [DualConvMesh-Net: Joint Geodesic and Euclidean Convolutions on 3D Meshes](#) -Jonas Schult, Francis Engelmann, Theodora Kontogianni, Bastian Leibe (CVPR 2020)
- [Robust Single Rotation Averaging](#) -Seong Hun Lee, Javier Civera (Arxiv 2020)



Push-up Classification/Counting

1. Get standard push-up video from the user. (A-pose, B-pose)
2. Classify the real-time movement as A-pose, B-pose, or other based on the pose-distance.
3. Count the push-up
One push-up: $A \Rightarrow B \Rightarrow A$



Competition

- Create a friend system and leaderboard UI to compare your daily/monthly push-ups.

Evaluation strategy

- Compare the amount of push-ups in datasets with our estimation
 - Using existing push-up videos.
 - Recording push-up videos by ourselves...(Really healthy project)
- User study
 - How much are you motivated?
 - Want to use more?

Final Deliverable and Success Criteria

- A working app
- Estimating push-ups correctly
- Users are motivated

Overall Timeline

DN: Dennis, NL: Nils, CM: Changmin, JS: Jisoo, HW: Hyunwoo

	April - 2	April - 3	April - 4	April - 5	May - 2	May - 3	May - 4	May - 5	June - 1
Searching for Pose Tracking Techniques	DN, CM, JS								
Searching for Gamification Papers	NL, HW								
Implement Pose Tracking		DN, NL, CM	DN, NL, CM						
Designing the Application Interface		JS, HW	JS, HW						
Implement Push-up Classifier				DN, CM	DN, CM				
Collect Data for Push-up Counter				ALL	ALL				
Implement the Basic Application Interface				JS, HW	JS, HW				
Extension Plan				NL	NL				
Evaluation for Push-up Counter						DN, NL, CM	DN, NL, CM		
Implement Competition Board						JS, HW	JS, HW		
User Study								HW, CM	HW, CM
Extension								DN, NL, JS	DN, NL, JS

Extension

- Other kind of exercise (Sit-up, pull-up....)
- Customized exercise
- Calorie tracking tool
- Pose correction tool

Thank You!