3D Human Pose Estimation

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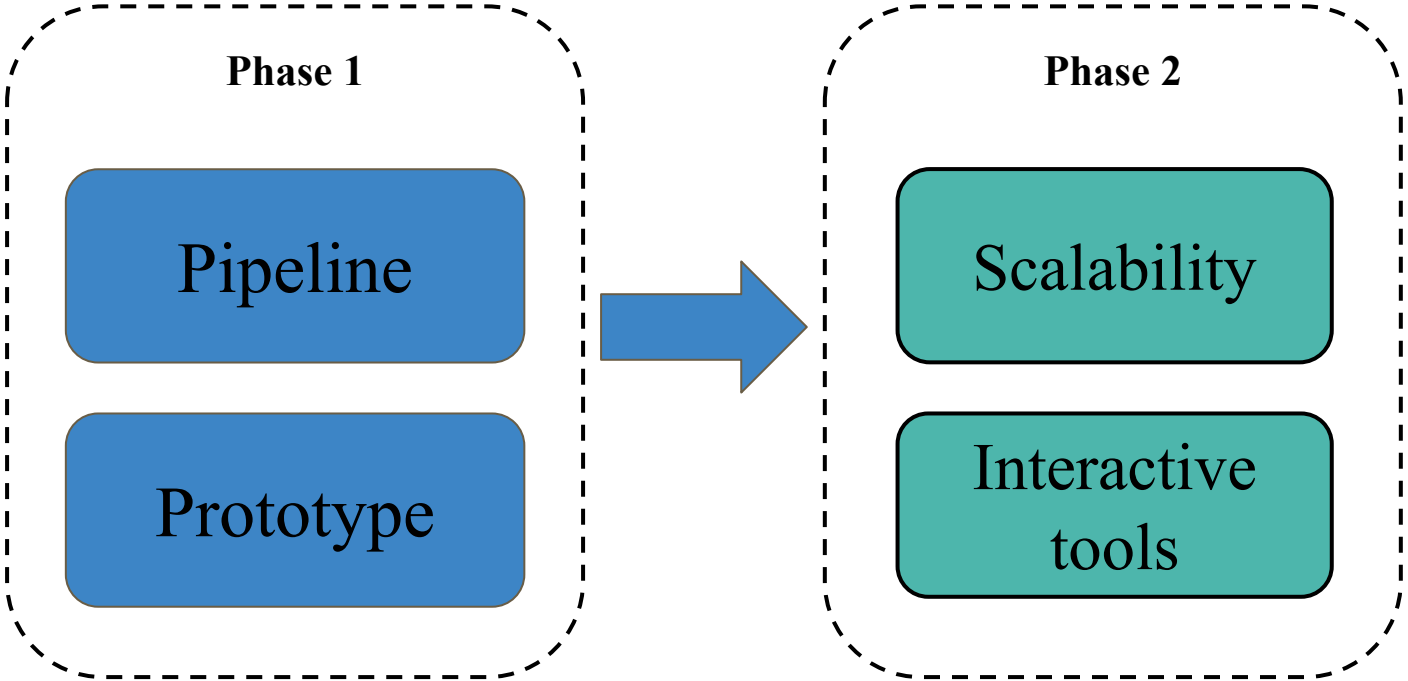
Project Goal

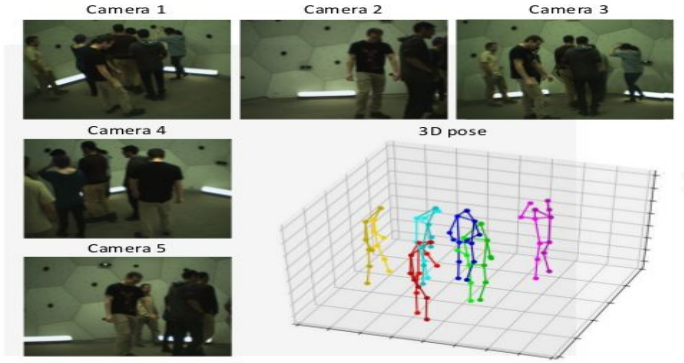
Perform 3D human pose estimation on monocular RGB images and videos, and make an interactive tool that helps in using this technology with convenience.

Summary of Phase 1

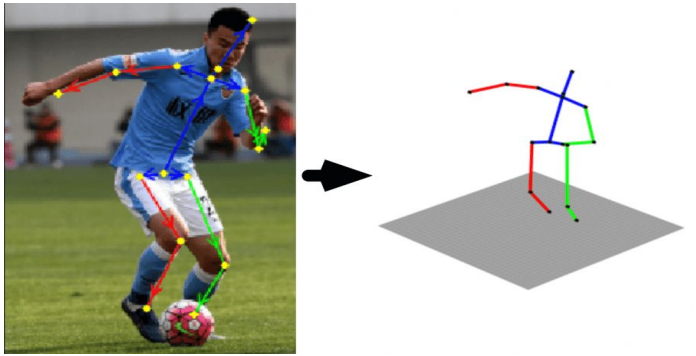


Where Can We Use It?

Robotics



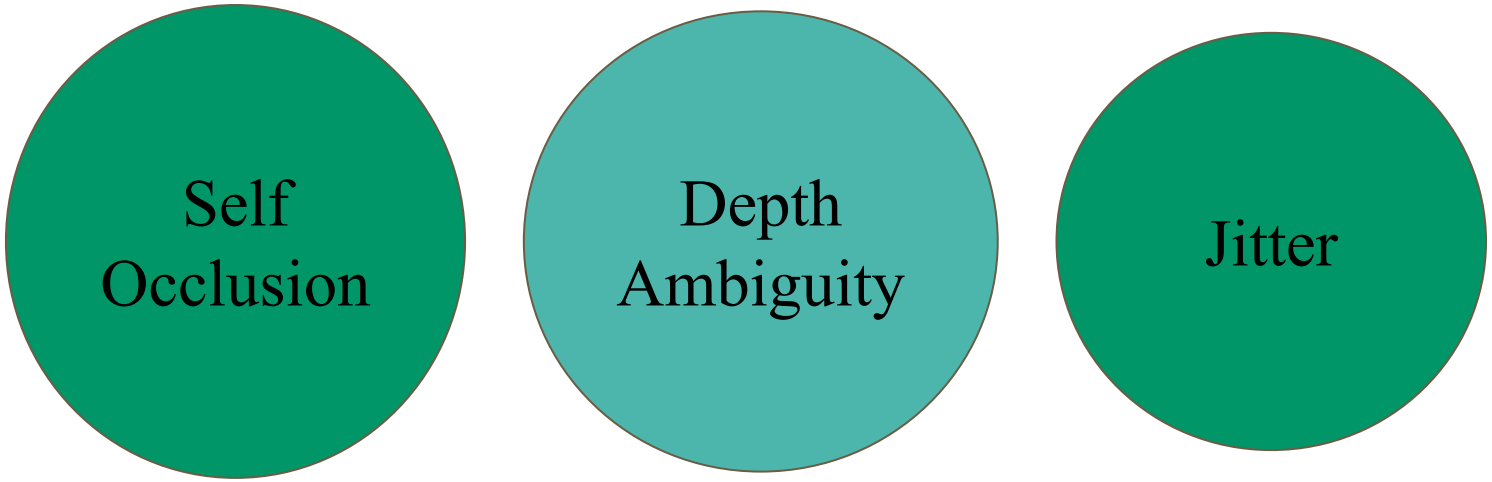
Surveillance



Motion Capture

CGI

What are the main challenges?

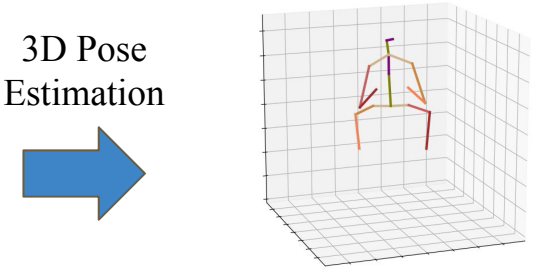


How to estimate 3D pose from monocular RGB Image?

- One step method directly estimates 3D poses from RGB images in an end-to-end fashion

One-step Method:

3D Pose Estimation

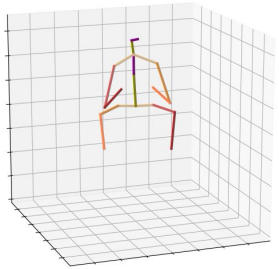


- Two-step method first predict 2D keypoints from RGB images and then lift them to 3D poses.

Two-step Method:

2D Keypoint Prediction

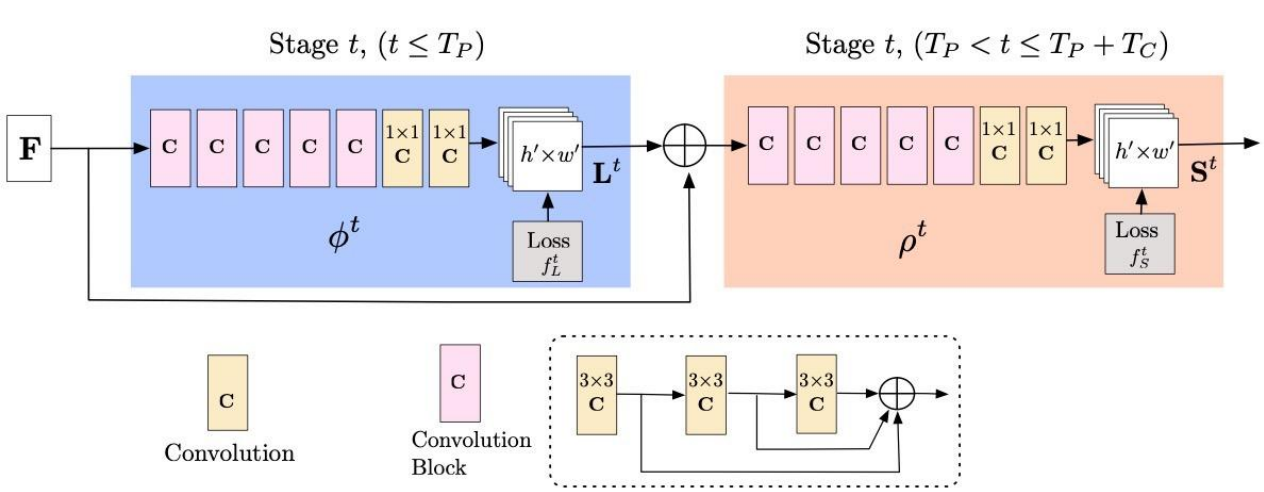
3D Pose Reconstruction

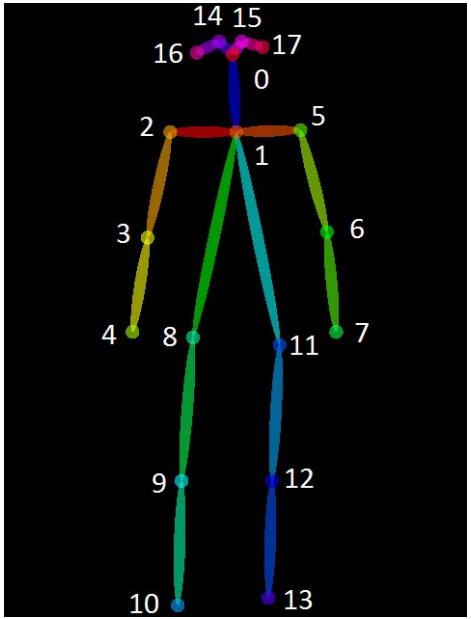


Why two-step methods?

- Compatible with existing 2D pose estimation methods
- Avoids influence of background and human surface features
- 2D pose acts as auxiliary output for better convergence
- Has better generalization in the wild

OpenPose (Input-to-2D)





(Top): OpenPose Architecture for the multi-stage CNN.
(Right): 18 Keypoint skeleton for COCO Dataset

OpenPose Output

Squats: 2D keypoint prediction

GAST-Net (2D-to-3D)

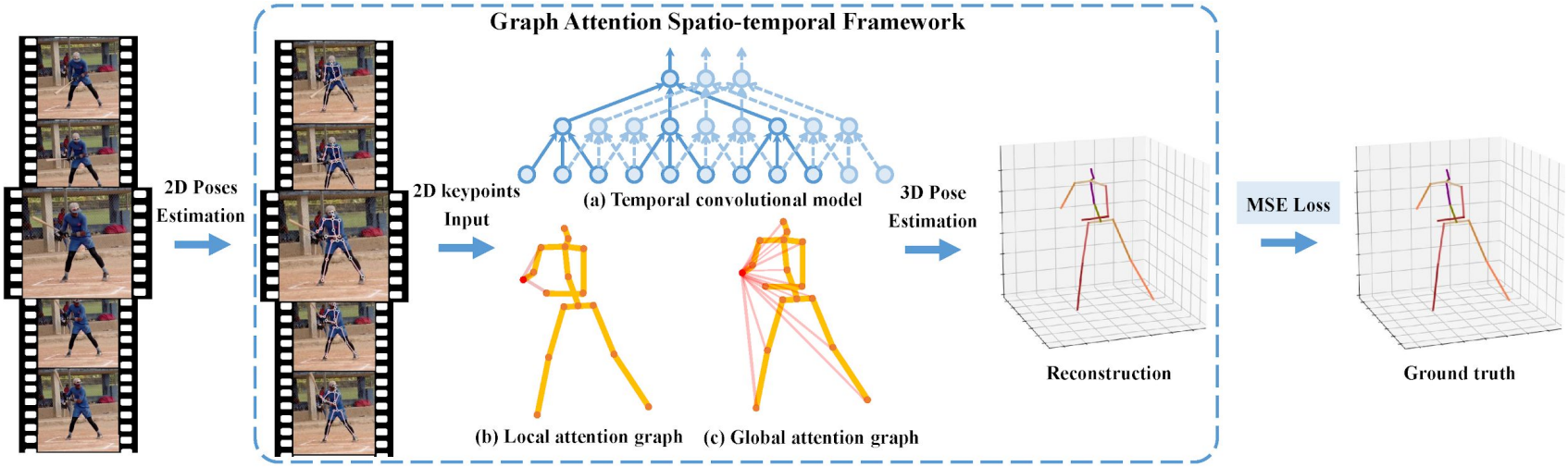
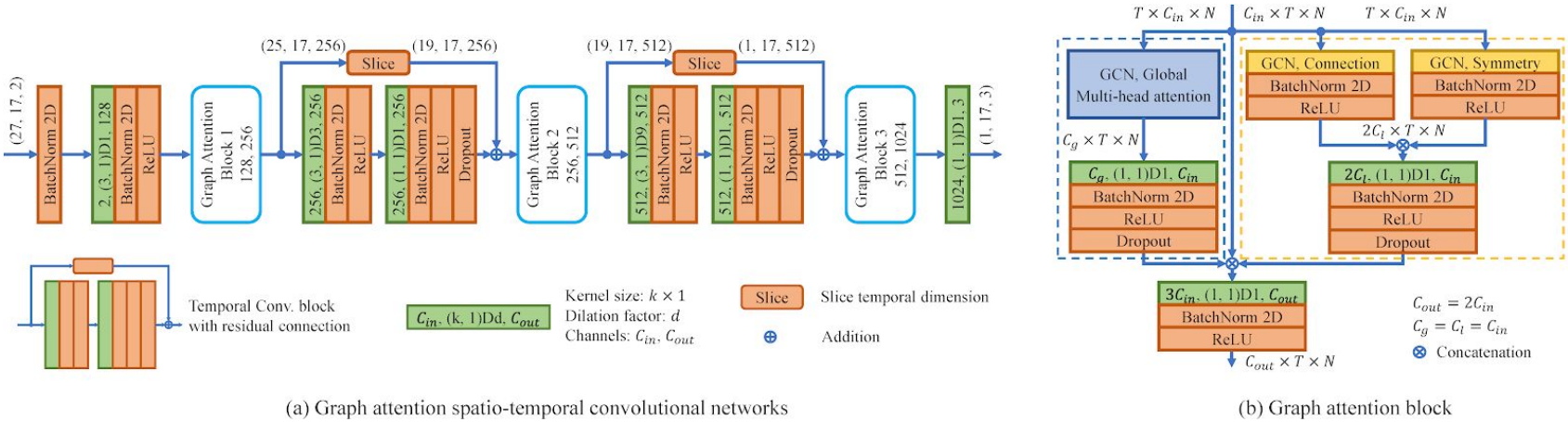


Fig: Schematic overview of GAST-Net Framework

GAST-Net (2D-to-3D)



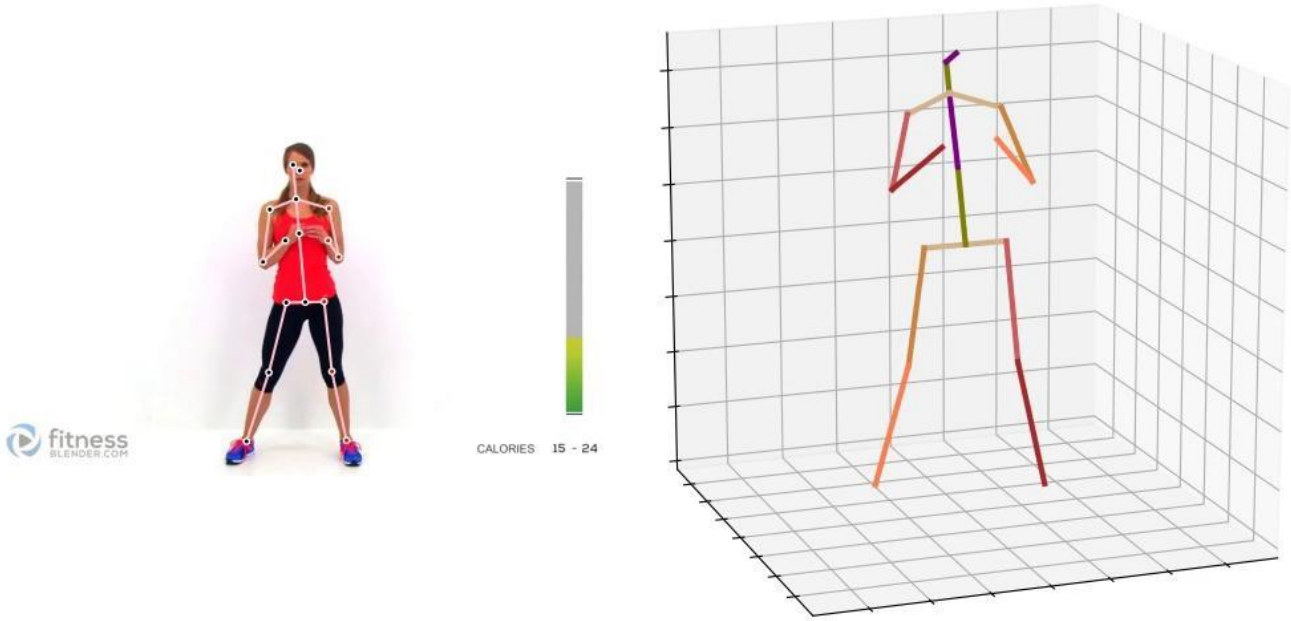
(a) Graph attention spatio-temporal convolutional networks

(b) Graph attention block

Fig: GAST-Net Architecture

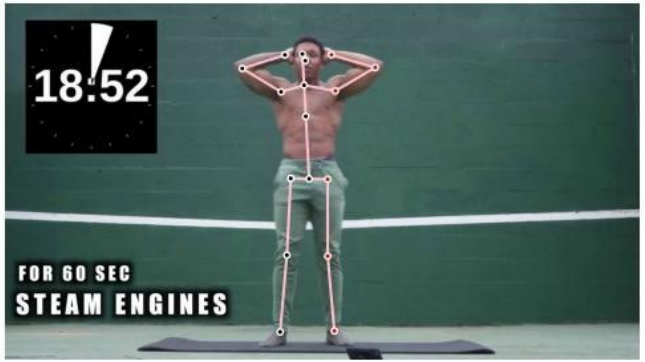
GAST-Net Output

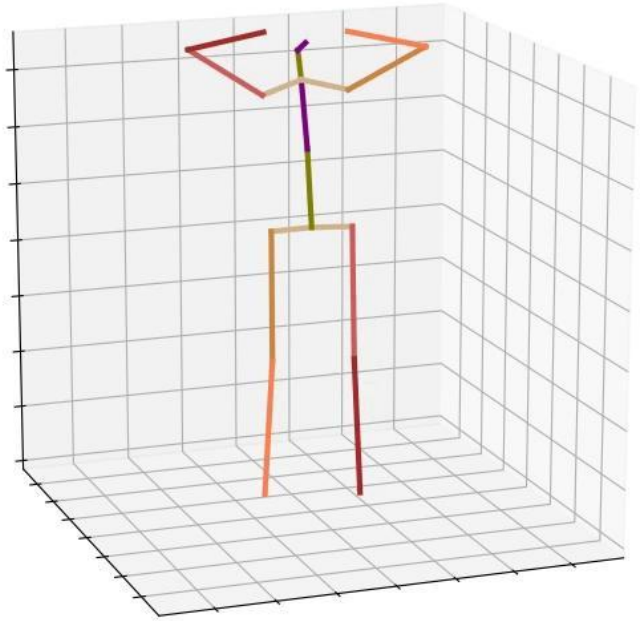
Squats: 3D pose reconstruction using 2D Keypoints



Unstable 3D Estimation because of Jittering

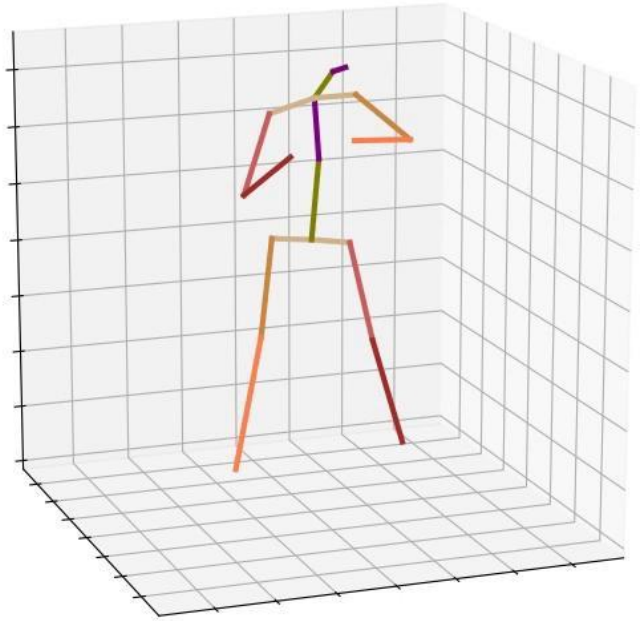
Complicated exercises makes the 2D keypoints tracking difficult





Self occlusion makes the estimation go haywire

Hidden body parts are difficult to assign a keypoint



Future Work

- Fixing existing problem
- Retraining model
- Improving results
- Developing interactive tool for application usage
- Improving Scalability

Thank You!

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