Drink Water Activity Recognition

1. **Algorithm**
   The workflow of the algorithm is:

   - Get the joints' positions by OpenPose.
   - Track each person. Euclidean distance between the joints of two skeletons is used for matching two skeletons.
   - Fill in a person's missing joints by these joints' relative pos in previous frame.
   - Add noise to the (x, y) joint positions to try to augment data.
   - Use a window size of 0.5s (5 frames) to extract features.
   - Extract features of (1) body velocity and (2) normalized joint positions and (3) joint velocities.
   - Apply PCA to reduce feature dimension to 80. Classify by DNN of 3 layers of 50x50x50 (or switching to other classifiers in one line)
   - Mean filtering the prediction scores between 2 frames. Add label above the person if the score is larger than 0.8. See class ClassifierOnlineTest in lib_classifier.py

2. **Main scripts**
   src/s1_get_skeletons_from_training_imgs.py
   src/s2_put_skeleton_txts_to_a_single_txt.py
   src/s3_preprocess_features.py
   src/s4_train.py
   src/s5_test.py

3. **Config**
   The input and output of these files as well as some parameters are defined in the configuration file **config/config.yaml**.

   The classes are set in config/config.yaml under the key word classes. No matter how many classes you put in the training data (set by the folder name), only the ones that match with the classes in config.yaml are used for training and inference.

4. **Training**
   1. Data format

   Each data subfolder (e.g. data/source_images3/drink_03-02-12-34-01-795/) contains images named as 00001.jpg, 00002.jpg, etc.

   The naming format of each image is defined in config/config.yaml by the sentence: image_filename_format: "{:05d}.jpg".

   The images to be used as training data and their label are configured by this txt file: data/source_images3/valid_images.txt.

   2. **Data Collection**
      It is recommended to use same camera angle for both testing and training.

There should be multiple camera's installed at different angles to capture subject's activity. As shown in below figure.
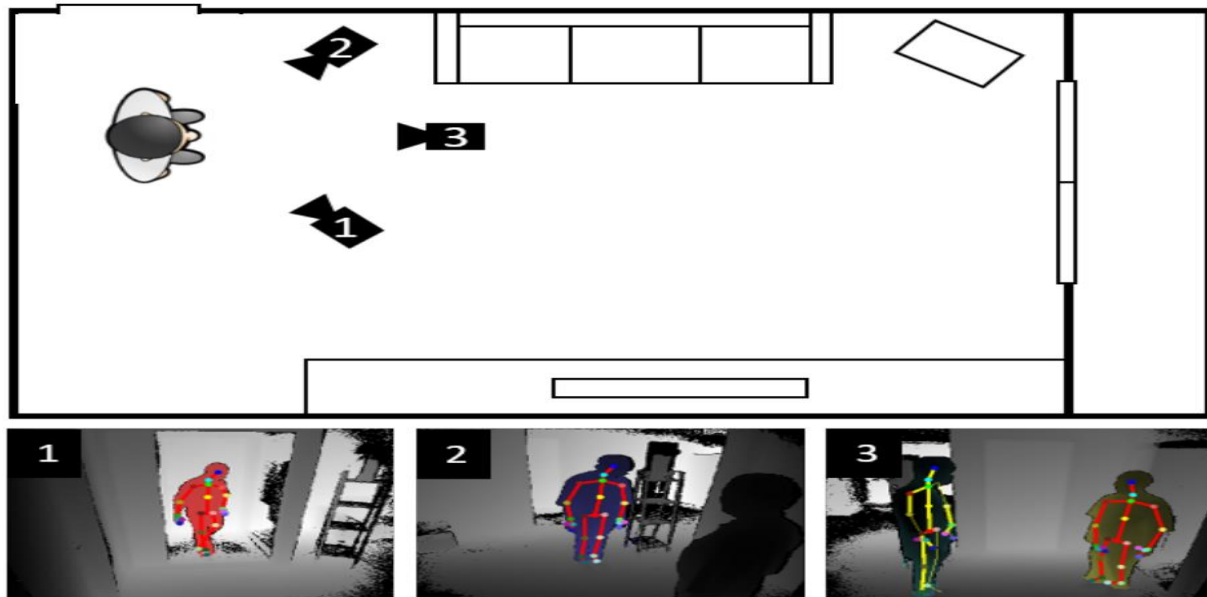
Apart from water drinking activity. We should also record "Pouring water, Standing and sitting activity"

Training on AWS EC2 instance:

Login in to ec2 via ssh

Run following comamnds

- Sudo vncserver
- Source activate tensorflow_p36

Ubuntu desktop has been already installed on instance, so use Vnc Viewer to connect.

- IP: (Dynamic) check ec2 dashboard
- Password: pacman94
- Once connected, navigate to Pose directory and run following commands.
- Depending on your need, you may change parameters in config/config.yaml such as output classes, input training directory path etc..

Finally run these command in sequence.

```
python src/s1_get_skeletons_from_training_imgs.py
python src/s2_put_skeleton_txts_to_a_single_txt.py
python src/s3_preprocess_features.py
python src/s4_train.py
```

Program would first run openpose pre trained model to generate skeletons from training images, then these feature are used in recognizing human activities.