The Lorry I. Lokey Interdisciplinary Center
for Life Sciences and Engineering
NETWORK BIOLOGY RESEARCH LABORATORIES

Gait Analysis from 3D-imagery for Neurological Disorders

Background

Psychiatric conditions manifest considerable variance in their movement characteristics. While at some situations patients move normally and without apparent difficulty, at other points of time they occasionally or routinely have difficulty performing even simple motor actions. The variance is caused by the psychiatric condition as well as by the drugs taken by patients. Walking involves several distinct circuits in both the central and peripheral nervous systems, including the cerebral cortex, subcortical structures, other parts of the brain and the spinal cord. Psychiatric disorders, which often involve complex brain diseases, often have a visible effect on walking which has nevertheless received little attention in the literature. This project would focus on elucidating the relationship between patients' clinical status and their locomotion by analyzing a unique dataset of video recordings of hospitalized patients. Achieving this goal may offer an opportunity to diagnose patients and monitor their condition using video images alone and using image processing technology to improve patient care.
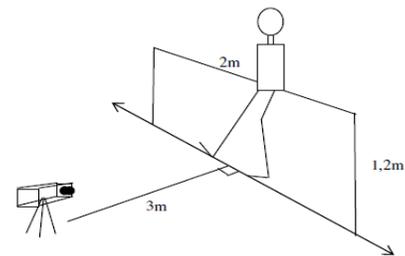

Figure 2: Illustration of the calibrated plane in reference to the camera setup.

Project Goals

In this project we will use an RGB-D camera to create a "virtual-hall" [1], and extract the human-skeleton in 3D. We will use the data to evaluate the properties of a 2D-walking path within the virtual-hall setting using the body's center-of-mass. We will analysis the temporal behavior of these walking-paths and later the 3D-walking paths to find distinctive features that can help in the classification of a specific neurological disease.
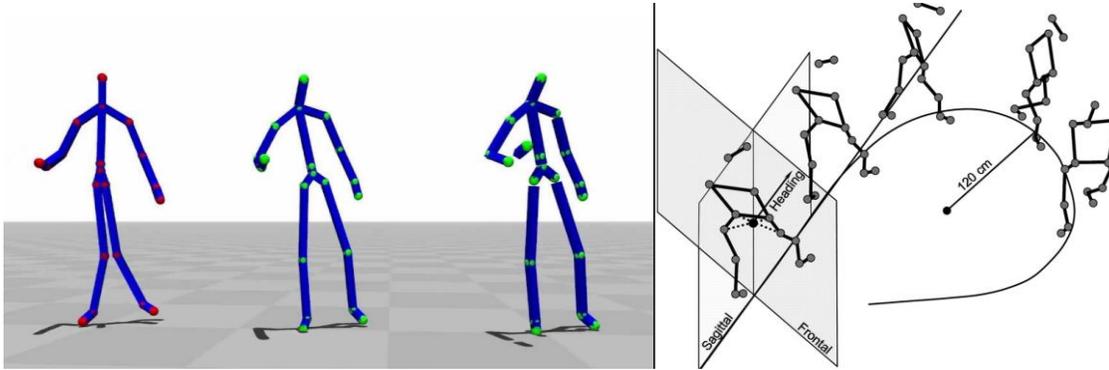

Illustration of Kinect V.2 Skelton-joints

2D trajectories of 3D
walking Path

Prerequisites

- MATLAB coding skills.
- C++ coding skills
- Motivation and interest in computer-vision, data-analysis and machine-learning.

Literature

1- Daphne *et al*, "Kinematic Validation of a Multi-Kinect v2 Instrumented 10-Meter Walkway for Quantitative Gait Assessments".
2- Goffredo *el al,* "2D Markerless Gait Analysis".
3- Gabe *et al*, "Full Body Gait Analysis with Kinect".

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Relevant Links:

Videos of gait for various neurological conditions:

http://library.med.utah.edu/neurologicexam/html/gait_abnormal.html#05

http://stanfordmedicine25.stanford.edu/the25/gait.html

https://www.youtube.com/watch?v=PZBiv0uSXVg