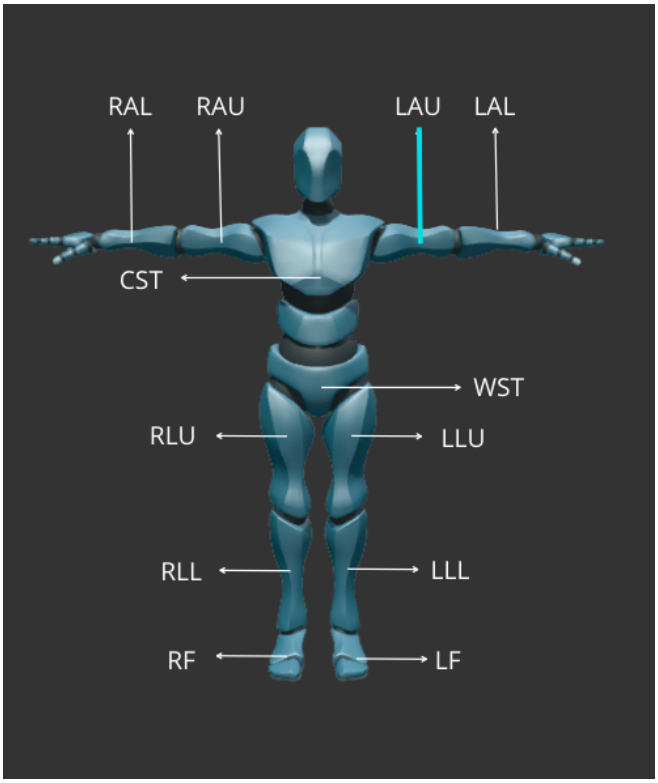
Tweek labs have created a motion capture suit with 12 sensors that goes to different limbs of the body. These 12 sensors provide the 3D orientation of their respective limbs. Combining these 12 orientation values we are able to recreate the whole 3D motion of the body. At any particular moment, we obtain the positions and angles of all the limbs of the body. By differentiating position vectors we get velocities for different limbs, and similarly, by differentiating velocities we get accelerations for different limbs.



LAL: Left Arm Lower

LAU: Left Arm Upper

RAL: Right Arm Lower

RAU: Right Arm Upper

CST: Chest

WST: Waist

LLU: Left Leg Upper

LLL: Left Leg Lower

RLU: Right Leg Upper

RLL: Right Leg Lower

RF: Right Foot

LF: Left Foot

For our first activity, we are focusing on fast bowling mechanics where we are trying to provide key performance indicators to our customers. One of those KPI's "Ground Contact Time".

Ground Contact Time is the measurement of the amount of time you are in contact with the ground during strides when running, from foot-strike to toe-off.

As mentioned before we only have access to angles and orientation of the body, so we don't have any reference of the ground. In order to find the ground contact time precisely, we need to find when the foot strikes and leave the ground.

Problem statement :

We are trying to build an **ML model** which will predict the landing and leaving time of both feet (front foot & backfoot) separately based on the available features with minimum error (≤ 30 milliseconds).

(For right-handed bowlers: front foot: Left foot,

For left-handed bowlers: front foot: Right foot)

- We have time-series data of all the needed angles and positions as mentioned below.
- Each row of the data represents a frame in time.
- The timestamp in each row or frame is locally generated and is in milliseconds and has a gap of 10 milliseconds.

Our dependent variable is 'landing_detected' which is essentially a series of 0 and 1. When the foot is on the ground we denote it as 1 rest we denote as 0.

For the prediction of ground contact, we have separated out specific features that are related to the dependent variable.

Here is the final dataset for the front foot here

Tasks :

- Develop your approach on Jupyter notebooks for pre-processing the data frame, feature engineering, and sampling(train-test split)
- Suggest suitable algorithms for modeling and give a proper explanation as to why your approach is suitable and check for accuracy.