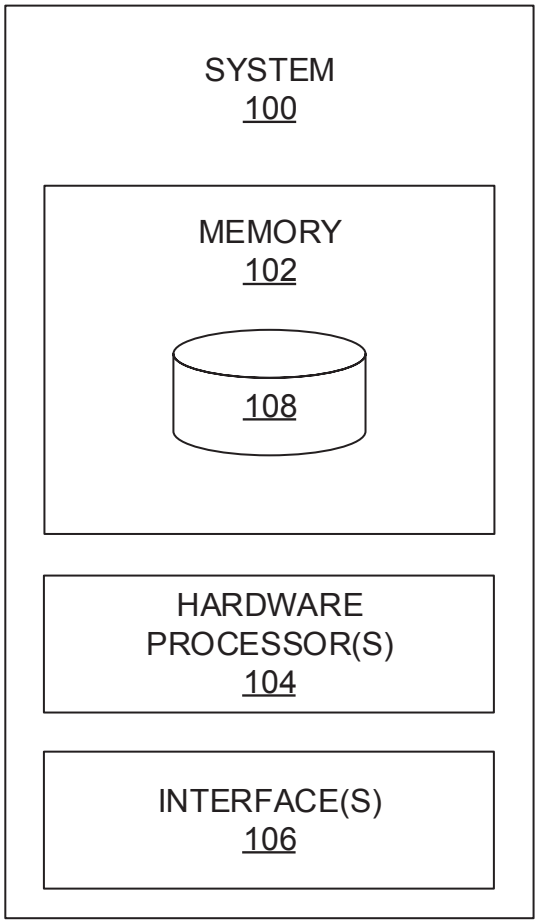
SYSTEM
100
MEMORY
102
108
HARDWARE
PROCESSOR(S)
104
INTERFACE(S)
106

FIG. 1

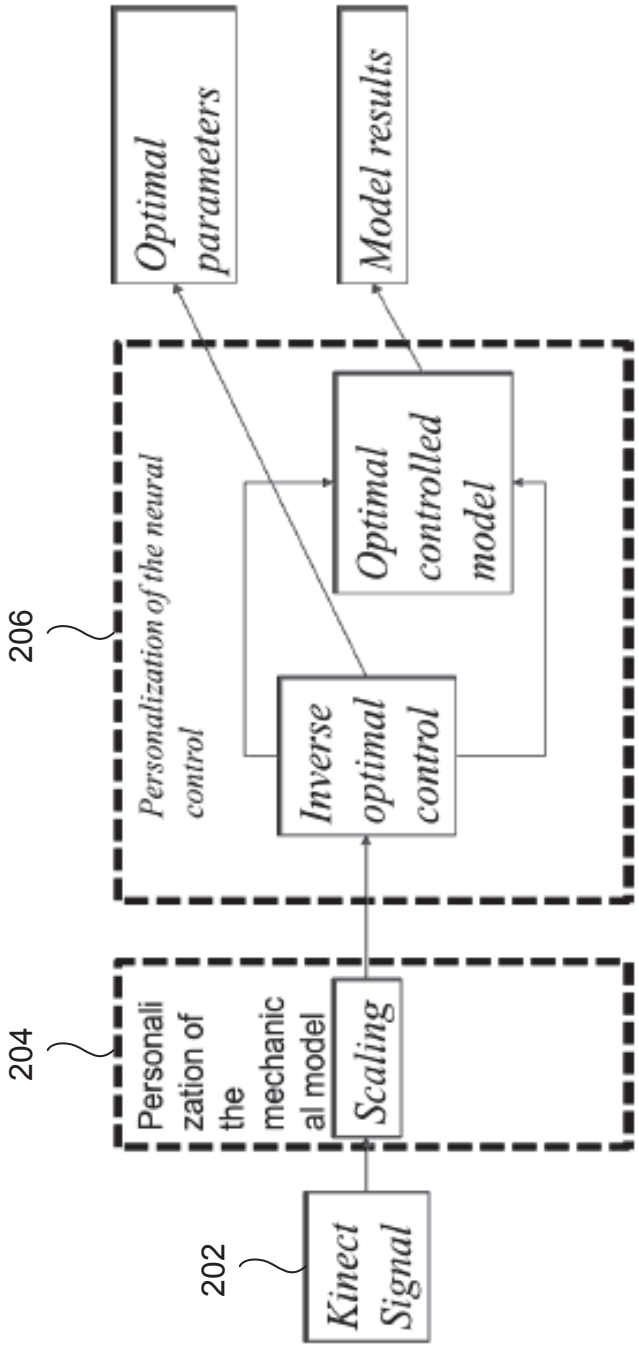
202
Kinect Signal
204
Personali zation of the mechanic al model
Scaling
206
Personalization of the neural control
Inverse optimal control
Optimal controlled model
Optimal parameters
Model results

FIG. 2

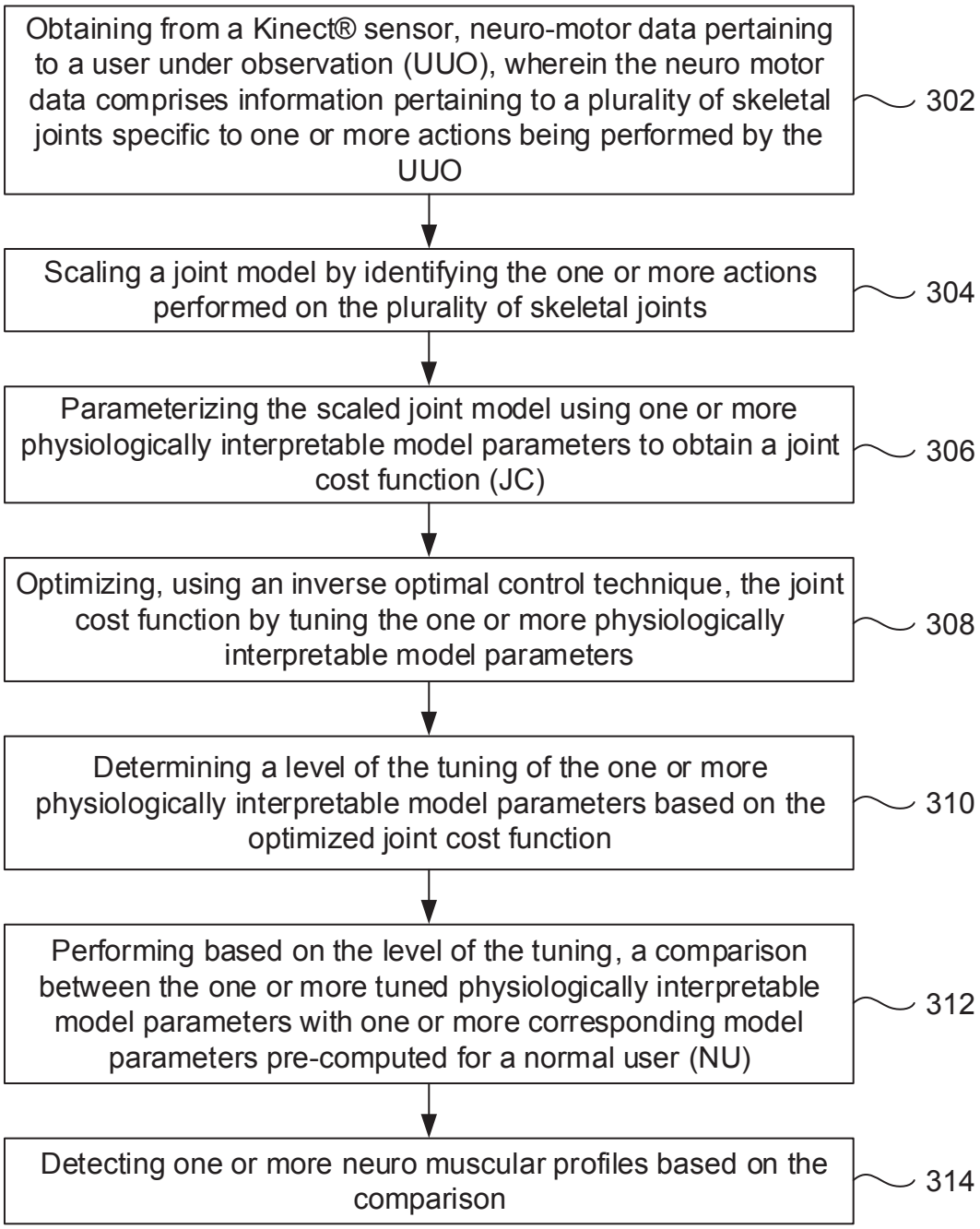
Obtaining from a Kinect® sensor, neuro-motor data pertaining to a user under observation (UUO), wherein the neuro motor data comprises information pertaining to a plurality of skeletal joints specific to one or more actions being performed by the UUO
302
Scaling a joint model by identifying the one or more actions performed on the plurality of skeletal joints
304
Parameterizing the scaled joint model using one or more physiologically interpretable model parameters to obtain a joint cost function (JC)
306
Optimizing, using an inverse optimal control technique, the joint cost function by tuning the one or more physiologically interpretable model parameters
308
Determining a level of the tuning of the one or more physiologically interpretable model parameters based on the optimized joint cost function
310
Performing based on the level of the tuning, a comparison between the one or more tuned physiologically interpretable model parameters with one or more corresponding model parameters pre-computed for a normal user (NU)
312
Detecting one or more neuro muscular profiles based on the comparison
314

FIG. 3

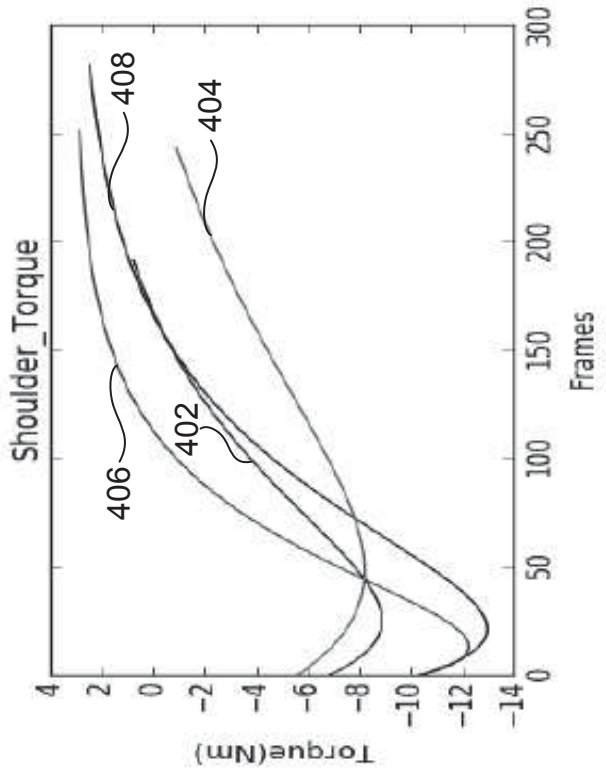
Shoulder_Torque
Torque(Nm)
Frames
406
402
404
408
4
2
0
−2
−4
−6
−8
−10
−12
−14
0
50
100
150
200
250
300

FIG. 4B

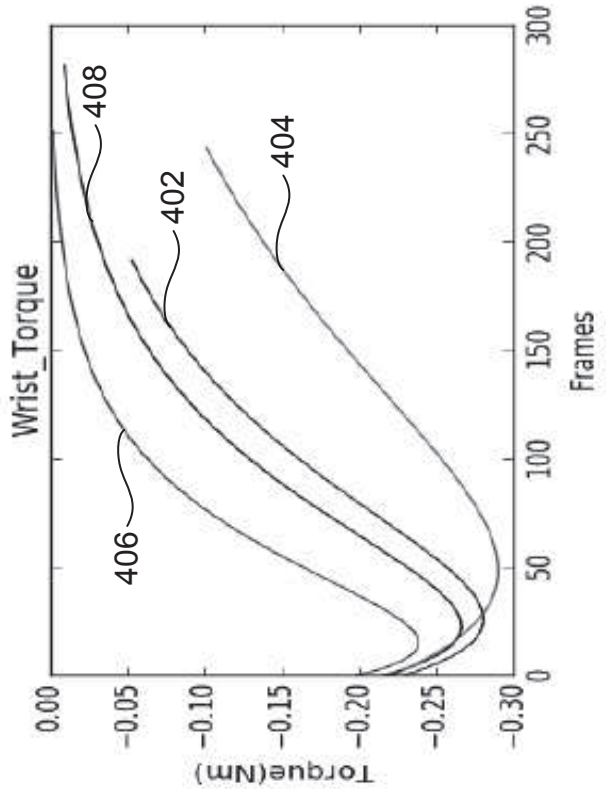
Wrist_Torque
Torque(Nm)
Frames
406
402
404
408
0.00
−0.05
−0.10
−0.15
−0.20
−0.25
−0.30
0
50
100
150
200
250
300

FIG. 4A

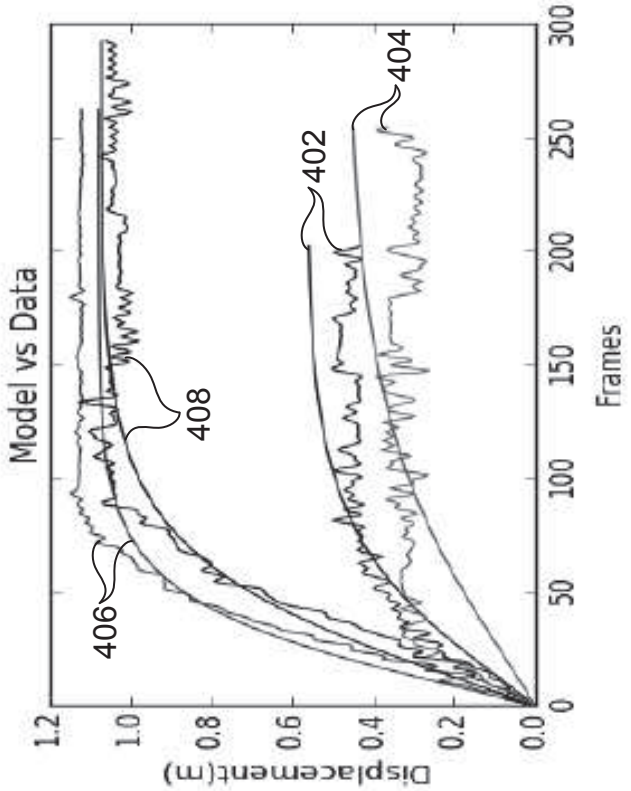
Model vs Data
Displacement(m)
Frames
406
408
402
404
0.0
0.2
0.4
0.6
0.8
1.0
1.2
0
50
100
150
200
250
300

FIG. 4D

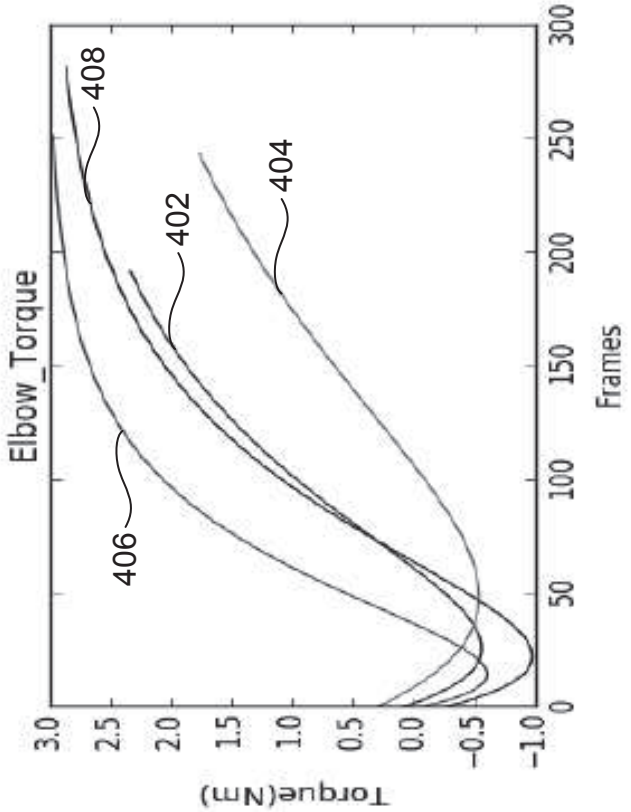
Elbow_Torque
Torque(Nm)
Frames
406
408
402
404
−1.0
−0.5
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0
50
100
150
200
250
300

FIG. 4C

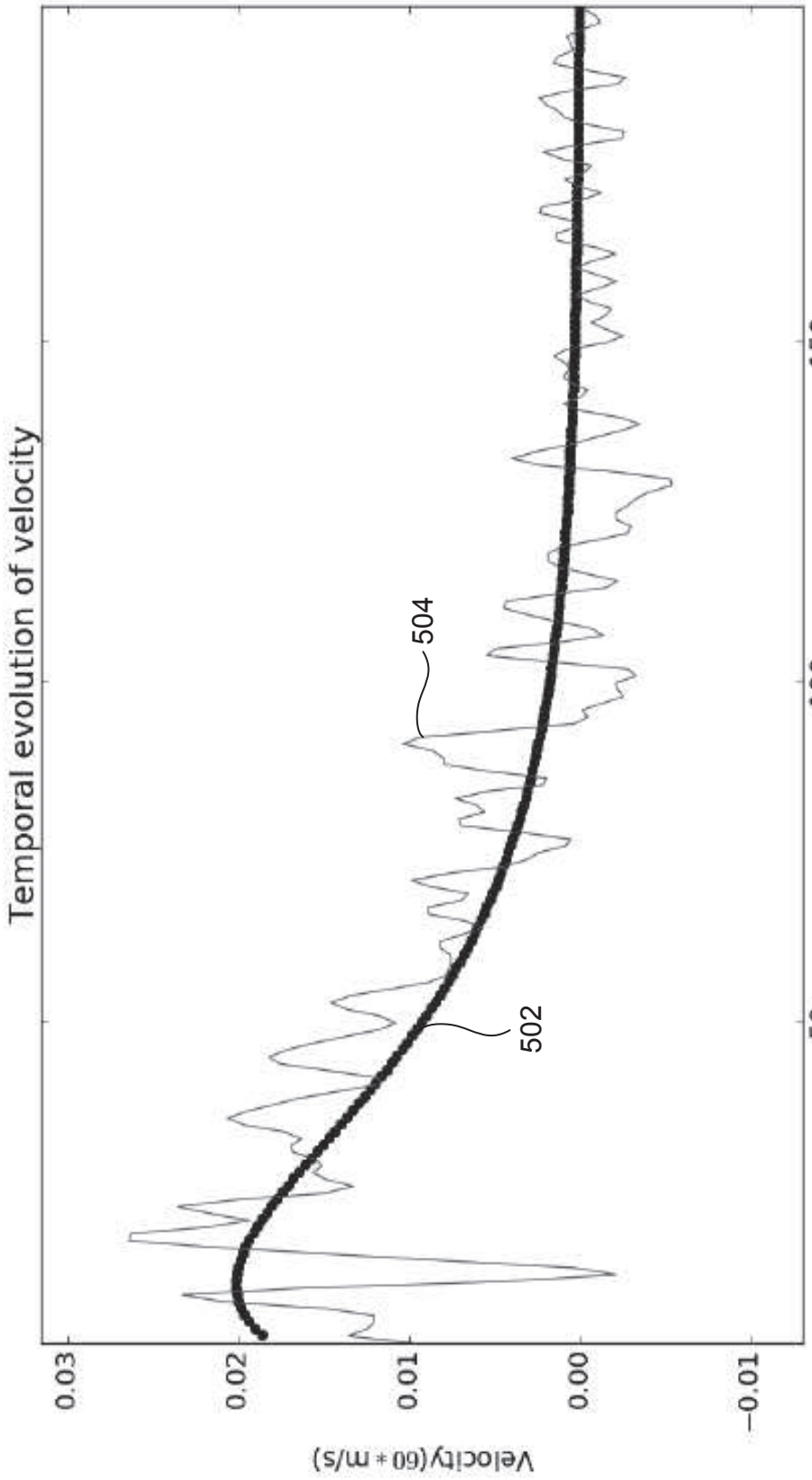
Temporal evolution of velocity
Velocity(60 * m/s)
0.03
0.02
0.01
0.00
−0.01
50
100
150
Frame
502
504

FIG. 5

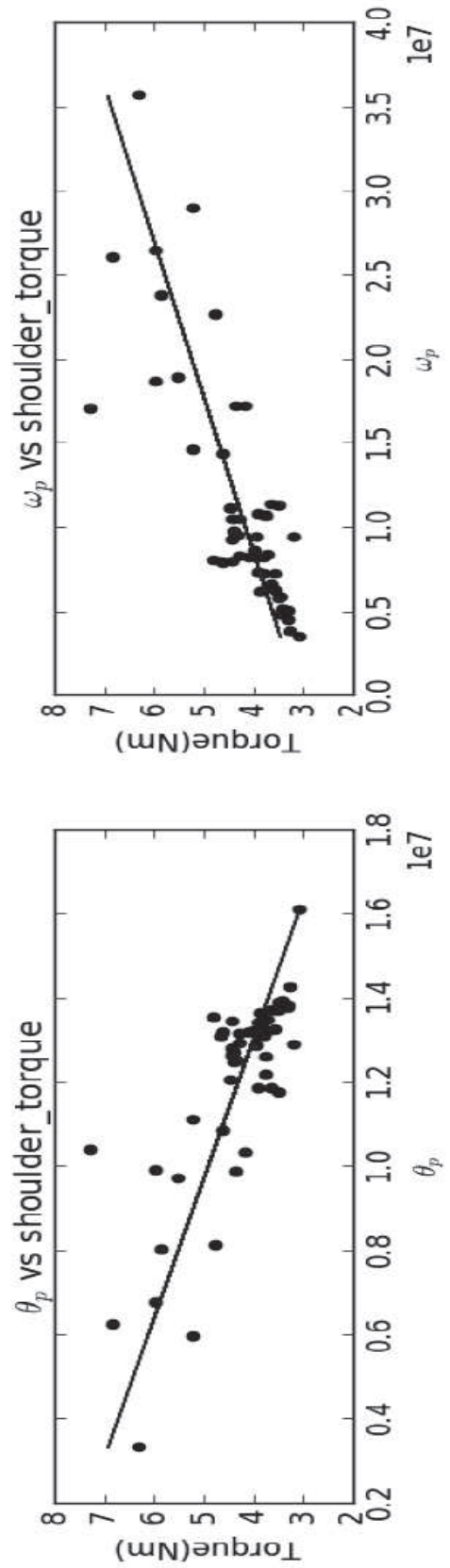
ω_p vs shoulder_torque
Torque(Nm)
ω_p
1e7
θ_p vs shoulder_torque
Torque(Nm)
θ_p
1e7

FIG. 6A

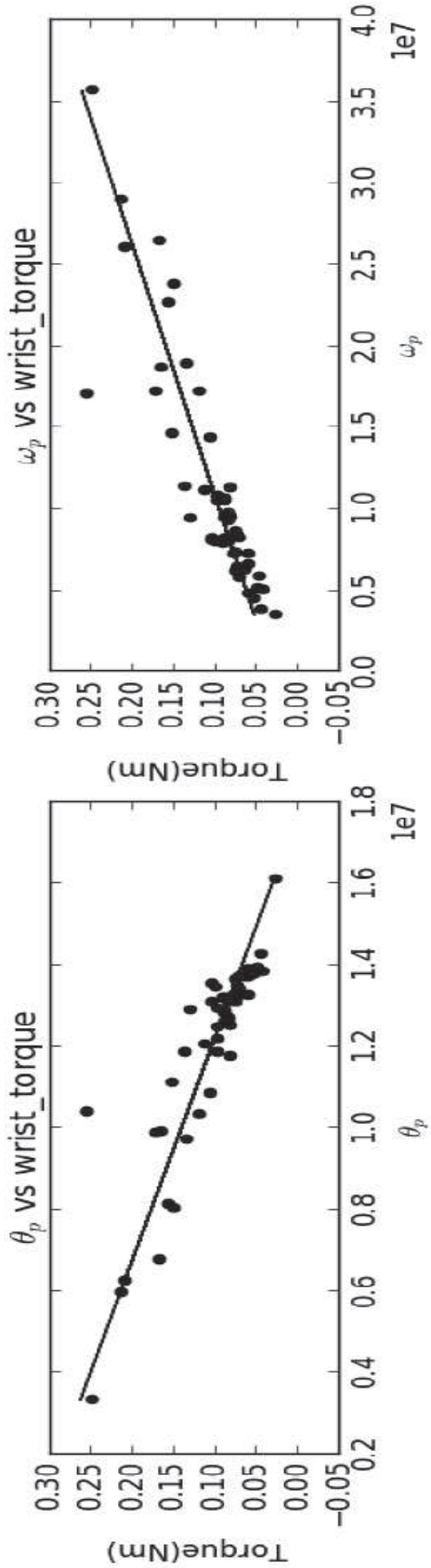
θ_p vs wrist_torque
Torque(Nm)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
−0.05
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
1e7
θ_p
ω_p vs wrist_torque
Torque(Nm)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
−0.05
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
1e7
ω_p

FIG. 6B

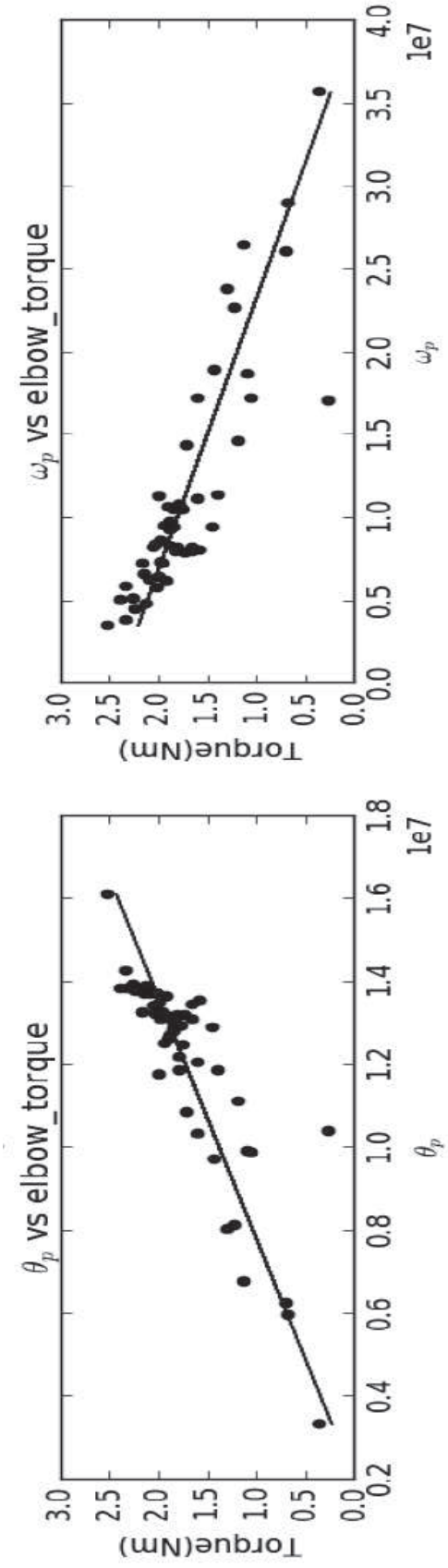
θ_p vs elbow_torque
Torque(Nm)
θ_p
1e7
ω_p vs elbow_torque
Torque(Nm)
ω_p
1e7

FIG. 6C

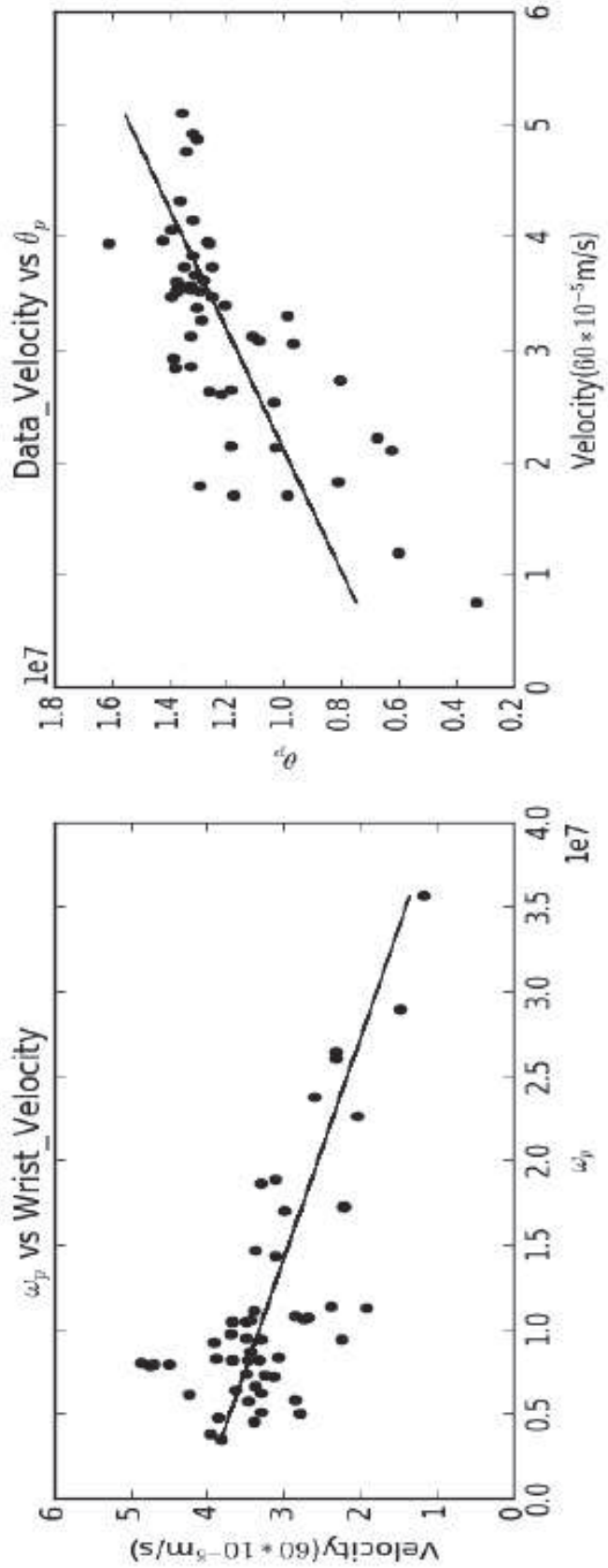
Data_Velocity vs θ_p
1e7
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
θ_p
0
1
2
3
4
5
6
Velocity($60*10^{-5}$m/s)
ω_p vs Wrist_Velocity
Velocity($60*10^{-5}$m/s)
6
5
4
3
2
1
0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
1e7
ω_p

FIG. 7A

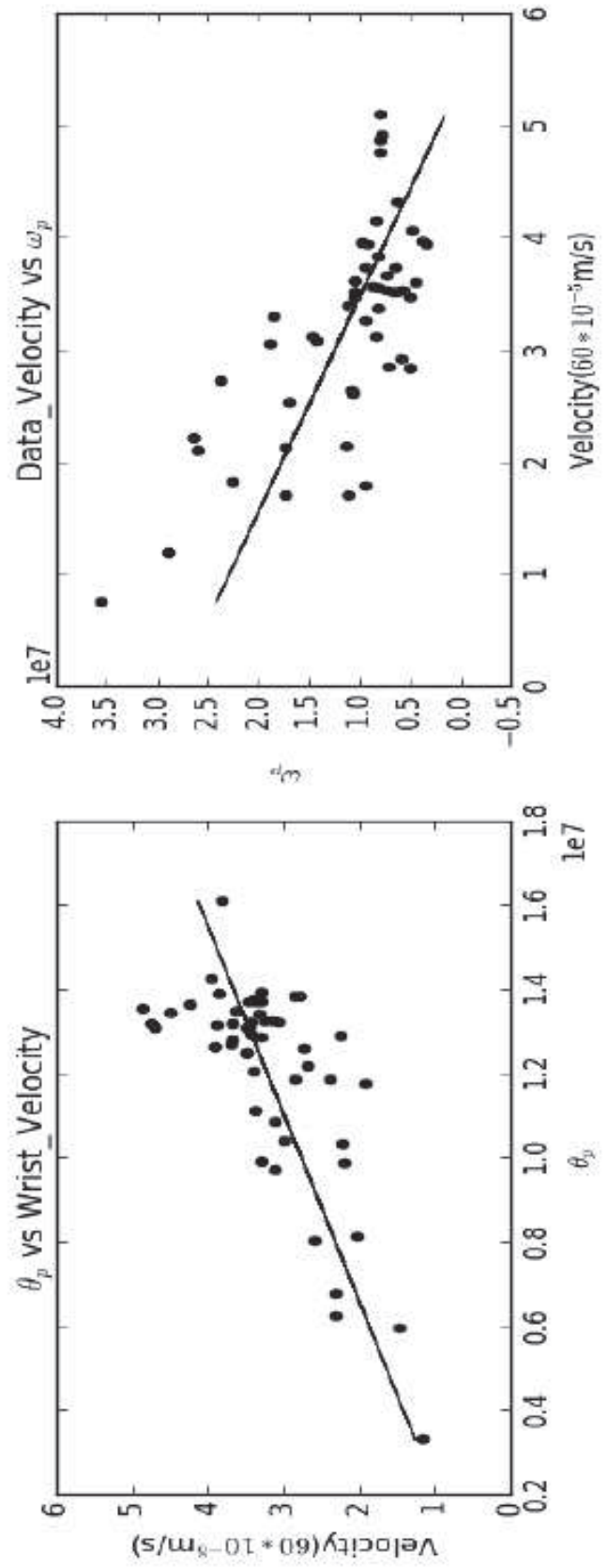
Data_Velocity vs ω_p
1e7
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
0
1
2
3
4
5
6
Velocity($60 * 10^{-5}$m/s)
$\frac{\omega_p}{3}$
θ_p vs Wrist_Velocity
Velocity($60 * 10^{-5}$m/s)
0
1
2
3
4
5
6
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
1e7
θ_p

FIG. 7B

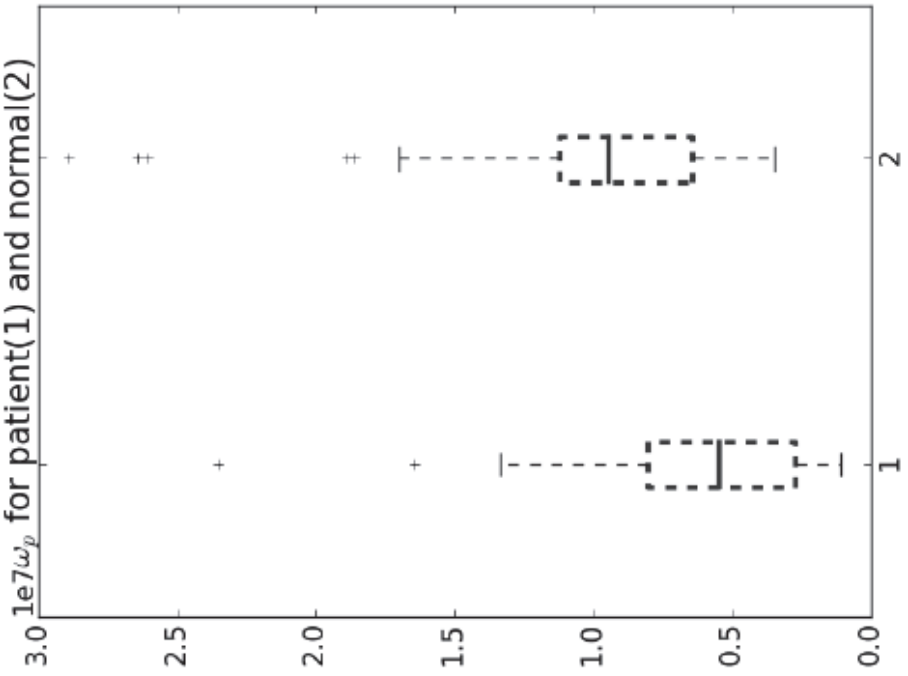
1e7ω_p for patient(1) and normal(2)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1
2

FIG. 8B

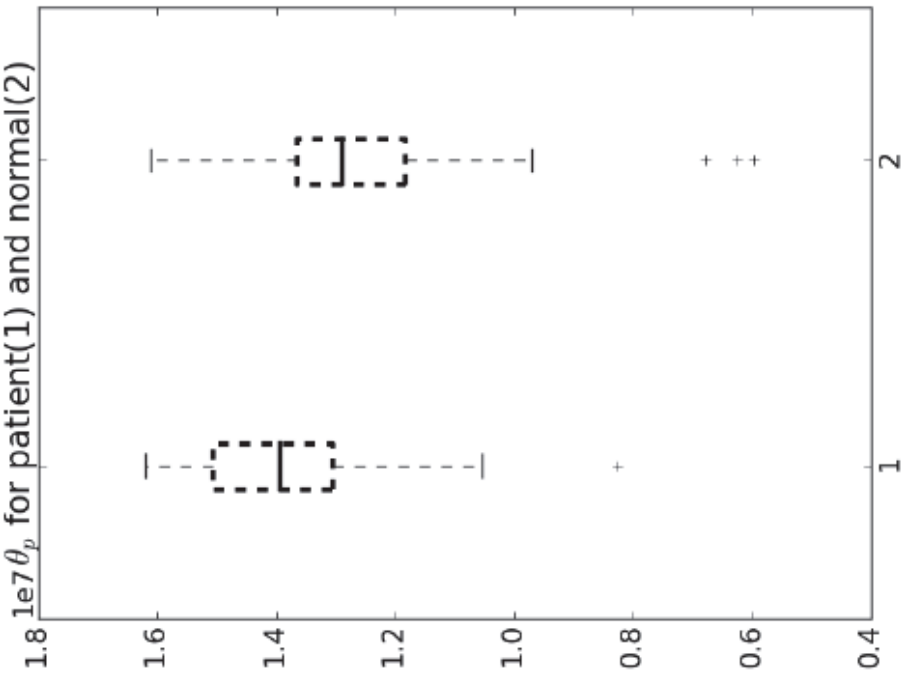
1e7θ_p for patient(1) and normal(2)
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
1
2

FIG. 8A