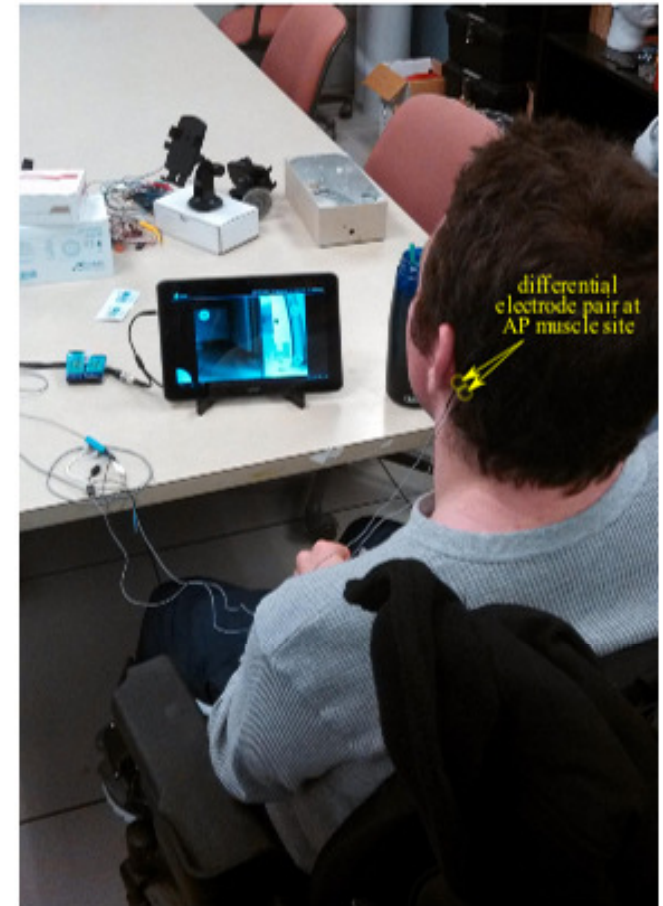


Paralyzed Subject Controls Telepresence Mobile Robot Using Novel sEMG Brain-Computer Interface: Case Study

K. R. Lyons, S. S. Joshi: University of California, Davis

- Novel BCI uses single muscle site for continuous cursor control in 2D
- Cursor selects buttons which control a robot in a remote location
- Video feedback allows user to navigate obstacle course
- Case study validates integration of BCI and robot systems
- Presents new communication possibilities for the disabled



Brain Computer Interface based Robotic Rehabilitation with Online Modification of Task Speed

M Sarac, E Koyas, A Erdogan, M Cetin, V Patoglu: Sabanci University, Turkey

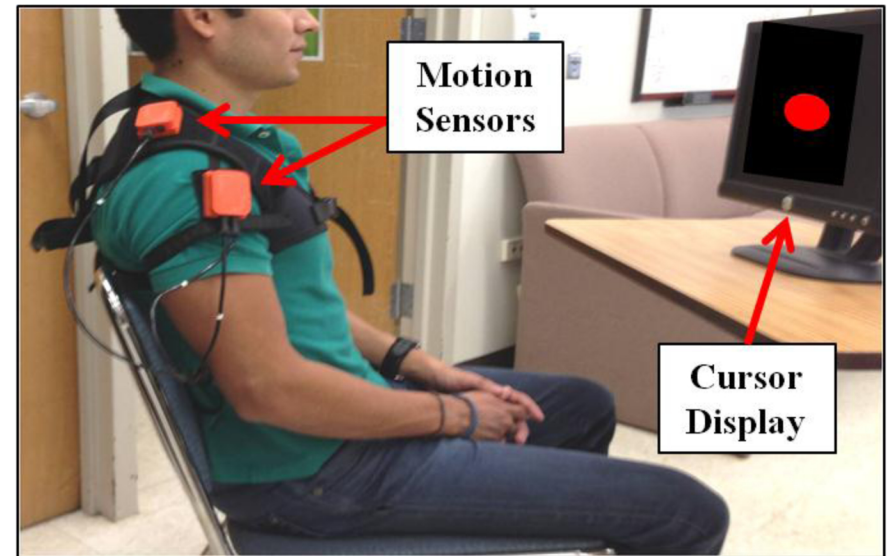
- A systematic approach that modifies robotic rehabilitation exercises online, by continuously monitoring intention levels through EEG-based BCI.
- Speed of contour following tasks is determined by continuous posterior probabilities extracted by LDA classifiers during motor imagery of right arm.
- Feasibility studies have been conducted with a holonomic mobile platform based series elastic robot, ASSISTON-MOBILE.



A Body-Machine Interface for the Control of a 2D Cursor

I Seanez, F Mussa-Ivaldi: Northwestern University (NU)

- A body-machine interface was developed for the control of a virtual cursor on a monitor
- Inertial Measurement Units were placed on the shoulders to capture body motion
- A Kalman filter model learned a system that encoded cursor movement along with training data



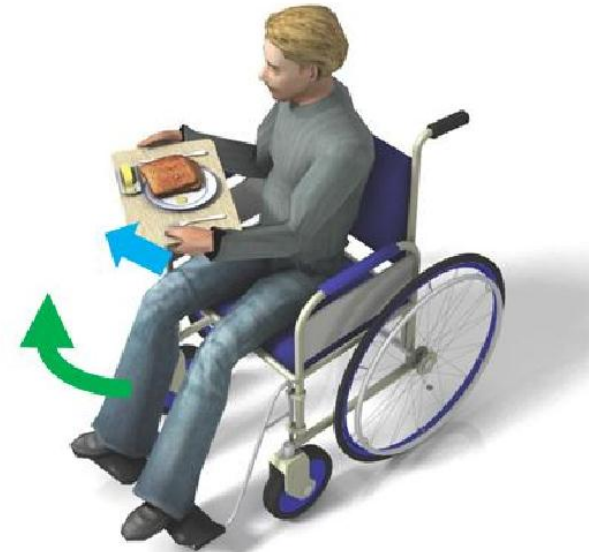
Toward Gesture Controlled Wheelchair: A Proof of Concept Study

Noriyuki Kawarazaki: Kanagawa Institute of Technology, Japan

Dimitar Stefanov: Coventry University, UK

Alejandro Israel Barragan Diaz: Kanagawa Institute of Technology, Japan

- We propose a gesture-based wheelchair control system for helping wheelchair users in activities that require holding an object with both hands and driving the wheelchair at the same time.
- The wheelchair control system contains an image sensor directed to the user's arms.
- An initial wheelchair prototype, operated by the intentional motions of one hand, was built and was tested by several initial experiments.



A Wheelchair Operation Assistance Control for a Wearable Robot Using the User's Residual Function

Naoto Mizutani, Tatsuya Watanabe, Ken'ichi Yano,
Takaaki Aoki, Yutaka Nishimoto and Yasuyuki Kobayashi

- This paper is discussed about a upper limb motion assist robot for an individual with C5-level Cervical Cord Injury.
- A wearable 1 axis type robot was developed to support of disabled persons with upper limb dysfunction.
- This upper limb motion assist robot was applied to the wheelchair operation system which uses a user's residual function.



Upper limb motion assist robot

A Five-wheel Wheelchair with an Active-caster Drive System

Y Munakata, A Tanaka, M Wada:

Tokyo University of Agriculture and Technology, Japan (TUAT)

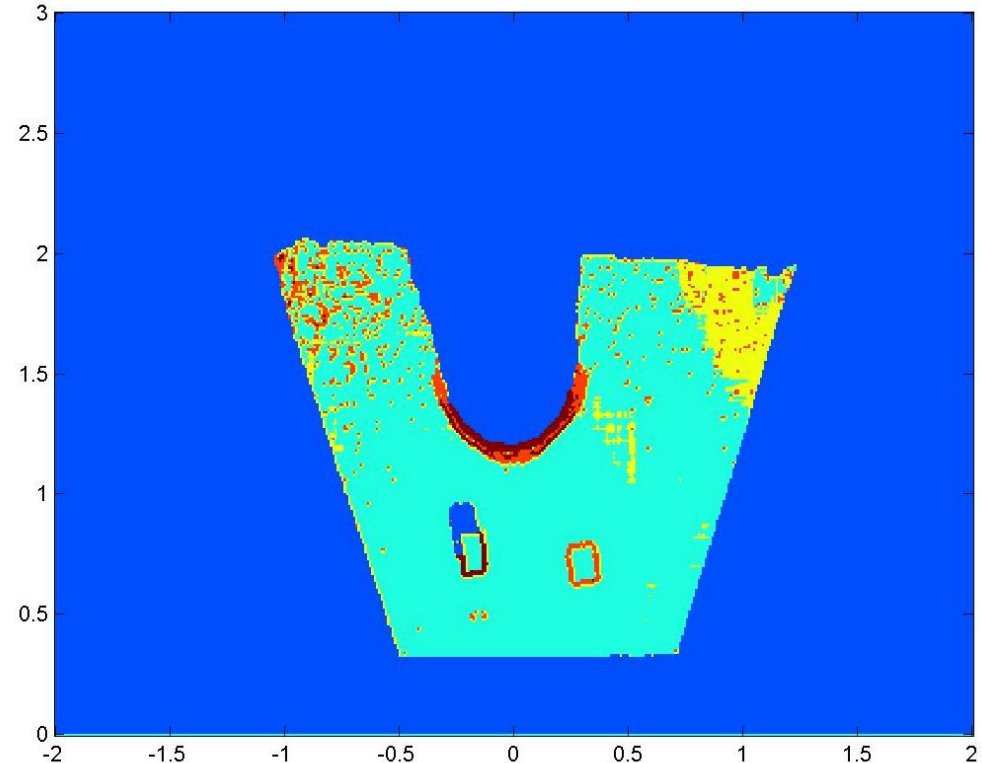
- A five-wheel wheelchair with an active-caster mechanism is proposed.
- Independent 2DOFs of the wheelchair can be controlled by a single drive-wheel with two electric motors.
- Two drive modes (front or rear drive) can be changeable by a user.



Determining Navigability of Terrain Using Point Cloud Data

S Cockrell, G Lee, W Newman: Case Western Reserve University

- An algorithm to detect navigable terrain in front of a wheeled robot
- Enables a robotic wheelchair to detect stairs, ramps, obstacles
- Uses depth data from Xbox Kinect

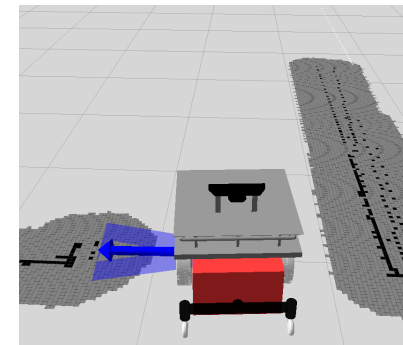
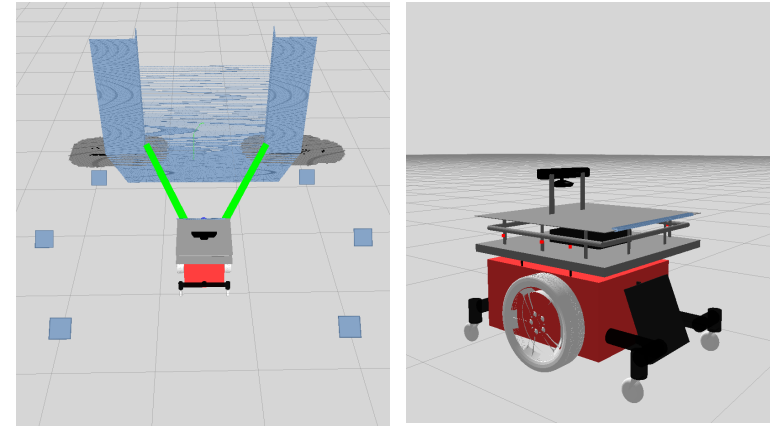


Using Machine Learning to Blend Human and Robot Controls for Assisted Wheelchair Navigation

Aditya Goil, Matthew Derry: Northwestern University, Evanston, IL

Brenna D. Argall: Northwestern University, Evanston, IL and Rehabilitation Institute of Chicago, Chicago, IL

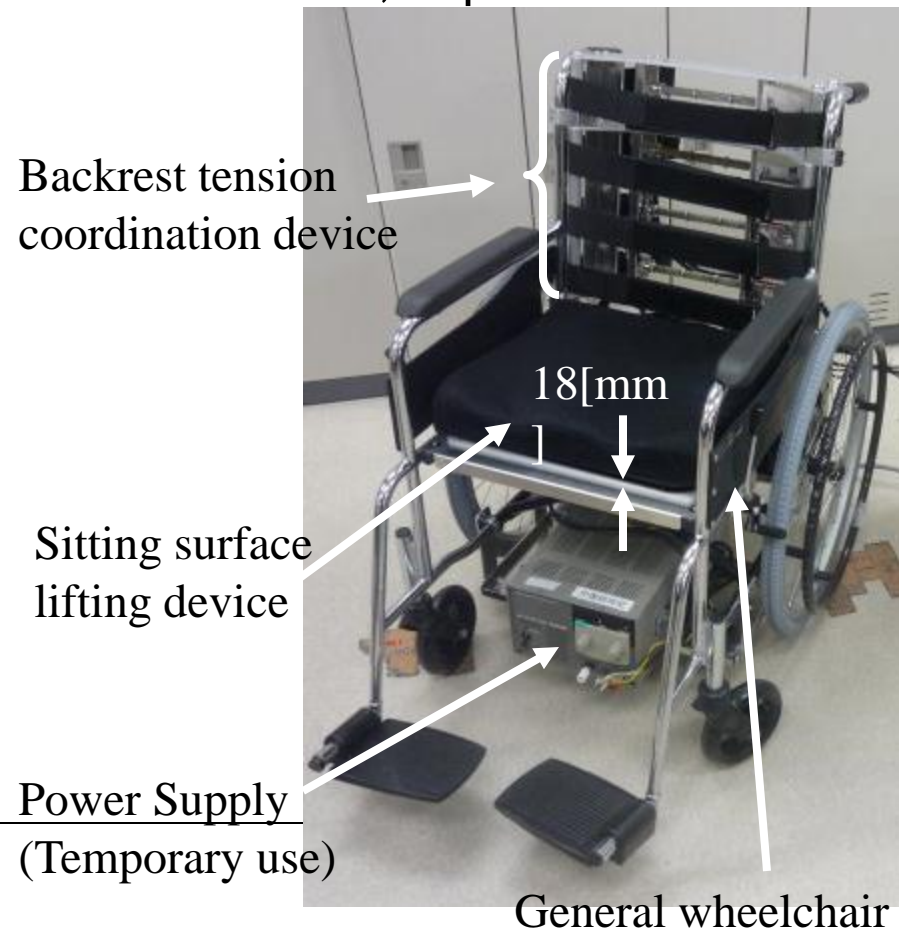
- A shared control system has been developed, that blends user and robot controls based on task variance learned from demonstrations using a statistical machine learning algorithm.
- Successfully developed specifically for doorway traversal, but could be expanded to other scenarios



A Depressurization Assistance System with a Suitable Posture for a Seated Patient on a Wheelchair

K. Shiotani, D. Chugo: Kwansei Gakuin University, Japan
Y. Sakaida: RIKEN, Japan, S. Yokota: Setsunan Univ., Japan
H. Hashimoto: Advanced Inst. of Industrial Tech., Japan

- The depressurization assistance system for a wheelchair user.
- The sitting surface device and the adjustable backrest coordinates a suitable posture of a patient.
- By the experiments with elderly subjects, our device demonstrates the depressurization performance as the nursing specialist.



Autonomous Function of Wheelchair-Mounted Robotic Manipulators to Perform Daily Activities

Cheng-Shiu Chung, Hongwu Wang, Rory A. Cooper: Human Engineering Research Laboratories, Department of Rehabilitation Science and Technology, University of Pittsburgh

- A novel personal assistive robotic system with autonomous functions has been developed to allow users focus more on the task
- System was evaluated through a drinking task: pick up a drink, convey to the user, and place it back
- Preliminary results illustrates the potential benefit to quality of life in self-care activities.



Development and Preliminary Testing of a Novel Wheelchair Integrated Exercise/Rehabilitation System

Beomsoo Hwang and Doyoung Jeon
Sogang University, Korea

- A wheelchair integrated lower limb exercise/ rehabilitation system is proposed to help quadriplegics' daily access to automated physical training programs.
- Based on the design concept, a prototype is fabricated and its performance is evaluated through preliminary experiments.



Concept Proposal for a Detachable Exoskeleton-Wheelchair

Jaimie F. Borisoff, Johanne Mattie, Vince Rafer
British Columbia Institute of Technology (BCIT)

An integrated exoskeleton-wheelchair concept to merge wheeled mobility functions with therapeutic walking benefits

- Manual wheelchair seating and propulsion
- Dynamic seat positioning throughout the day
- Detachable powered exoskeleton for walking
- Activities of daily living + health benefits



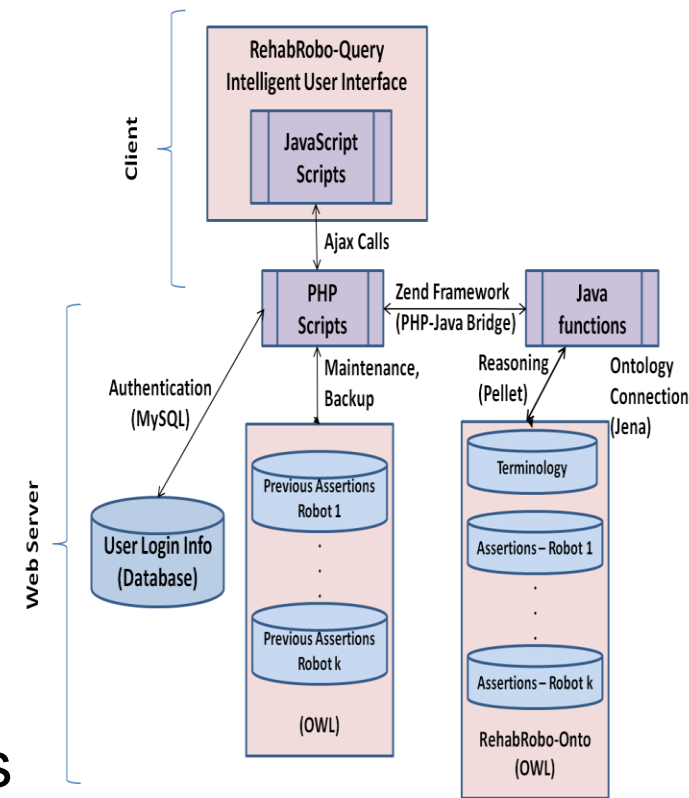
Rehabilitation Robotics Ontology on the Cloud

Z Dogmus, E Erdem, V Patoglu: Sabanci University, Turkey

A Papantoniou: National Technical University of Athens, Greece

M Kilinc, SA Yildirim: Hacettepe University, Turkey

- RehabRobo-Onto: first formal open-source rehabilitation robotics ontology, to represent knowledge about rehabilitation robots
- RehabRobo-Query: Web-based software system, to facilitate access to this ontology
- Intelligent-user interface guides researchers to add/modify information in ontology, and ask complex queries in natural language
- Automated reasoners find answers to complex queries about rehabilitation robotics

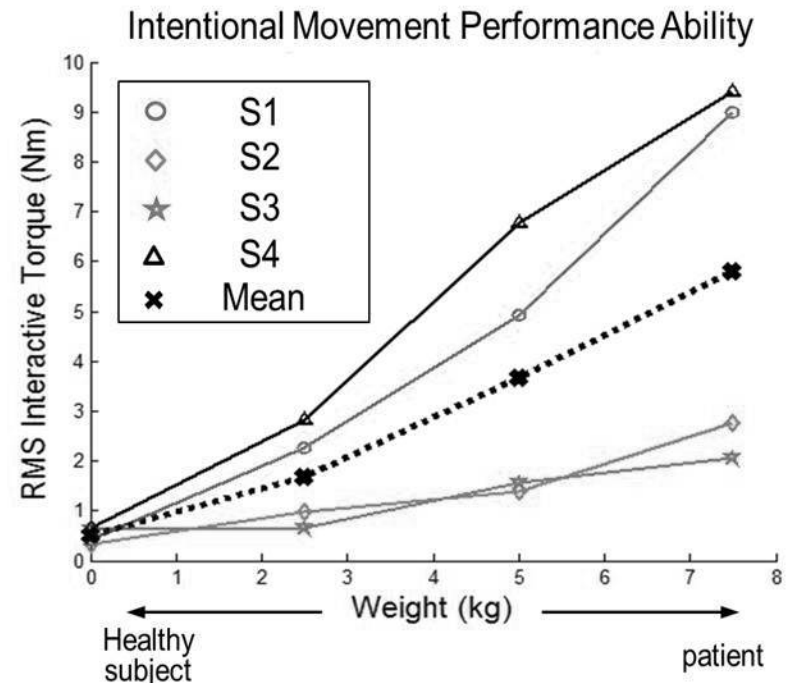
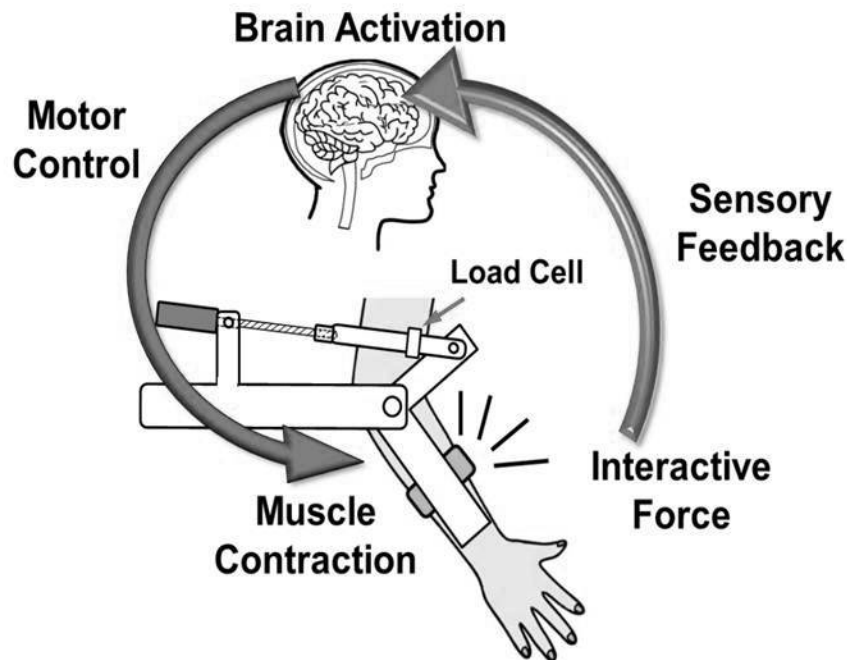


Intentional Movement Performance Ability (IMPA): A Method for Robot-Aided Quantitative Assessment of Motor Function

Sung Yul Shin, Jung Yoon Kim, Sanghyeop Lee, Junwon Lee Seong-Jong Kim and ChangHwan Kim

Center for Bionics, Korea Institute of Science and Technology (KIST)
National Rehabilitation Center, Korea (NRC)

IMPA – Quantitative assessment method for evaluating motor function level by using interactive torque between subject and robot

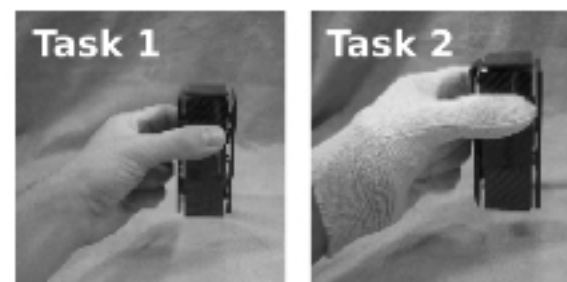


An instrumented object for the analysis of grasping strategies and function in hemiparetic patients

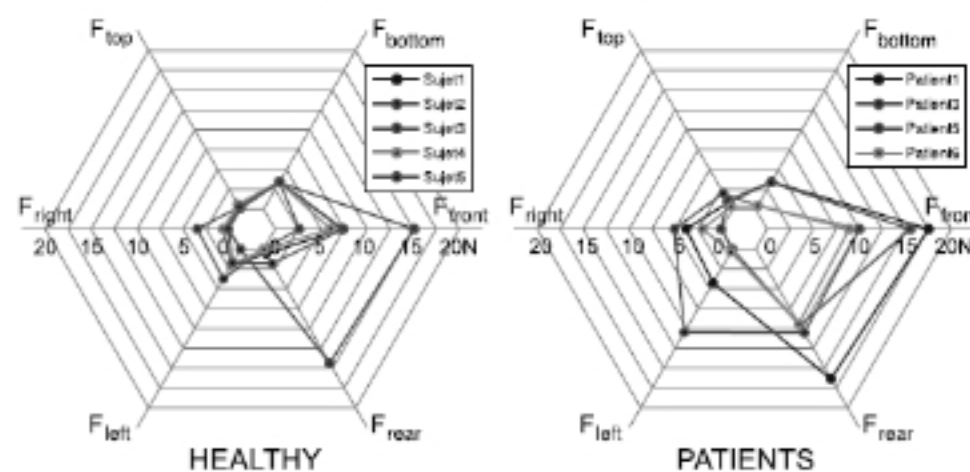
Nathanaël Jarrassé*; Markus Kuehne* ; Nick Roach†, Asif Hussain†, Sivakumar Balasubramanian†; Etienne Burdet† and Agnès Roby-Brami*

*Universite Pierre et Marie Curie, CNRS UMR 7222, France †Imperial College of Science Technology and Medicine, London, UK

- We have designed an instrumented box object dedicated to the analysis of grasping and manipulation in patients.
- Based on preliminary experiments with subjects and hemiparetic stroke patients, we developed a set of indicators to characterize patients grasping strategies.
- First results show that the device can be used for the physiopathological analysis and assessment of the motor performances of patients suffering from sensorimotor disorders.



Example of grasping tasks

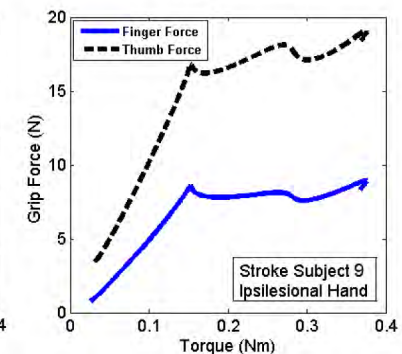
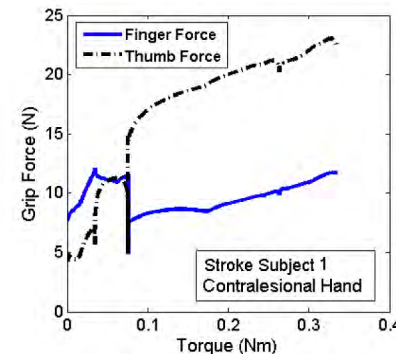
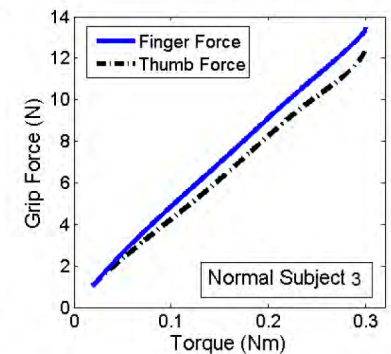
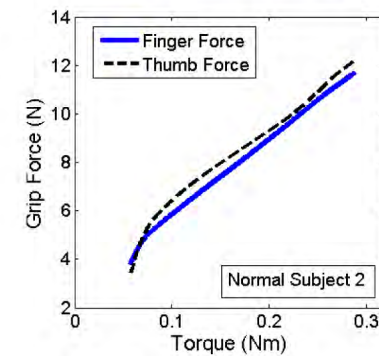


Mean force repartition during one grasping for patients and subjects

Characterizing Coordination of Grasp and Twist in Hand Function of Healthy and Post-stroke Subjects

Hamed Kazemi, Robert Kearney and Theodore Milner
Department of Biomedical Engineering – McGill University

- Normal grip coordination involved the linear modulation of grip force with load torque. Also, the force generated by the thumb was highly correlated with the force generated by the index, middle and ring fingers.
- Chronic post-stroke subjects generally: (1) exerted excessive grip force to stabilize grasp using their ipsilesional hand; (2) lost the close amplitude coupling between grip force and load torque; and (3) lost the close modulation of the thumb force with finger force using their contralesional hand.



Prediction of Stroke-related Diagnostic and Prognostic Measures Using Robot-Based Evaluation

Sayyed Mostafa Mostafavi, Janice I. Glasgow, Stephen H. Scott, Parvin Mousavi: Queen's University, ON, Canada

Sean P. Dukelow: University of Calgary, AB, Canada

- Stroke-related diagnostic and prognostic scores were predicted using KINARM evaluation metrics.
- Fast Orthogonal Search and Parallel Cascade Identification make better predictions of clinical scores than simple regression.
- Preliminary results highlight the importance of proprioceptive information for prediction of motor-based scores.



Bilateral Symmetric Robotic Motion Training With The EXO-UL7

A collaboration between UCSC and UCSF with support by CITRUS

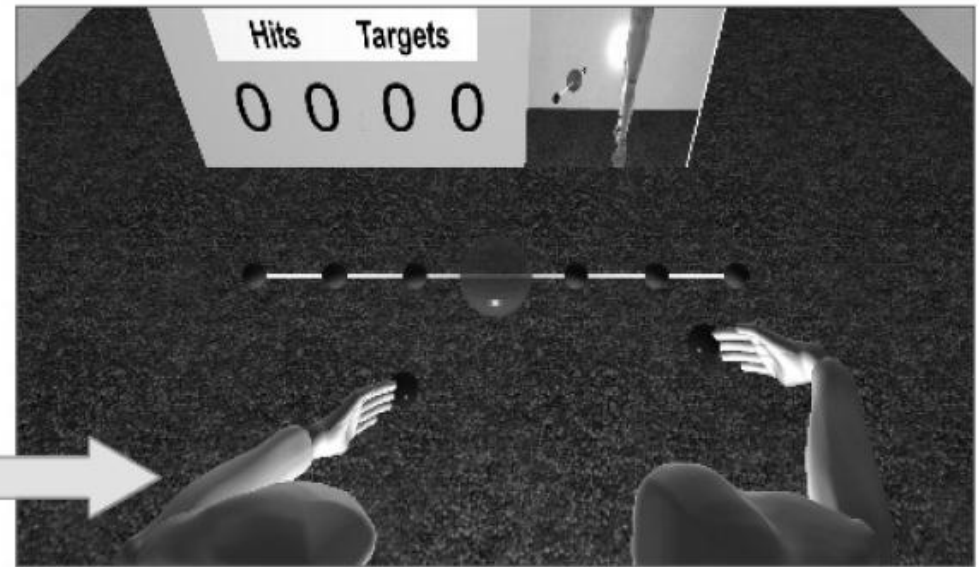
Study Design:

- Bilateral Group
- Unilateral Group
- Standard Care Group
- 90-minute for 24 sessions



Results:

- Bilateral and Standard Care groups had improvements in Range of Motion
- Unilateral movement training was not as effective



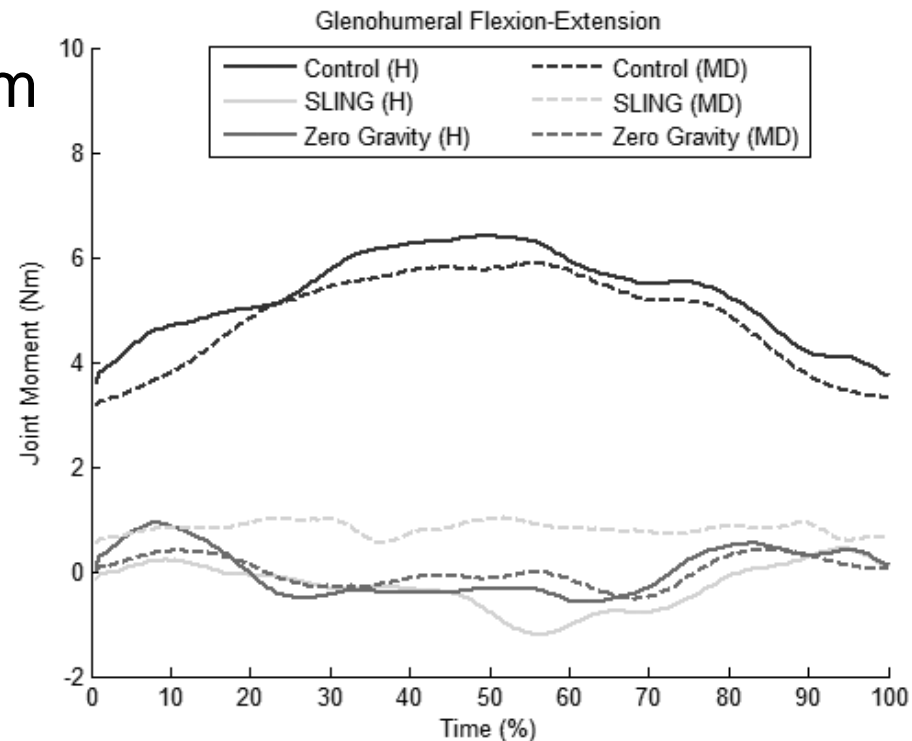
An inverse dynamic analysis on the influence of upper limb gravity compensation during reaching

J.M.N. Essers, A. Bergsma, K. Meijer: Maastricht University (MUMC+)

Alessio Murgia: University of Groningen (UMCG)

Paul Verstegen: Focal Meditech BV

- Shoulder and elbow moments are reduced with an arm support system during reaching in healthy (H) and muscular dystrophy (MD) subjects
- Compensatory strategies while using the support may result in additional shear loads on the joints
- Preliminary results can be used to design better arm supports for subjects with muscular dystrophies



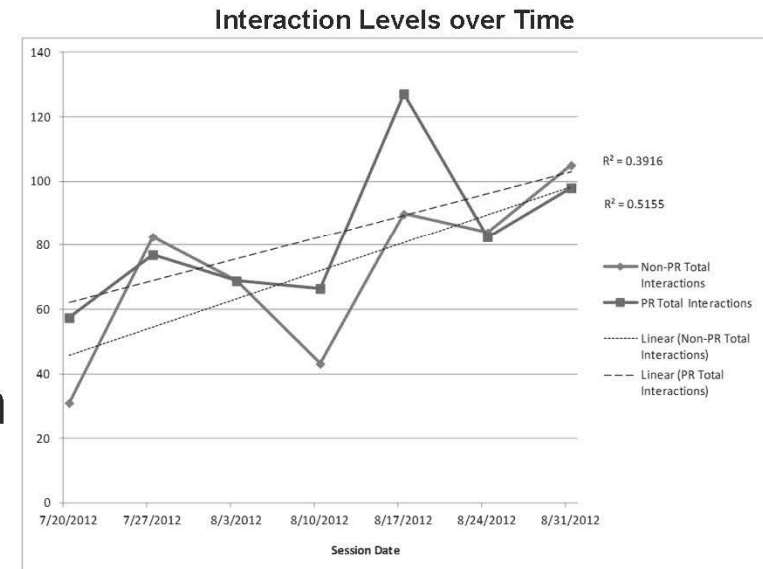
PARO Robot Affects Diverse Interaction Modalities in Group Sensory Therapy for Older Adults with Dementia

S. Sabanovic¹, C. Bennett^{1,2}, W. Chang¹, L. Huber¹

¹Indiana University Bloomington (IUB)

²Centerstone Research Institute (CRI)

- We studied the use of the seal-like robot PARO in sensory therapy with cognitively impaired older adults in a nursing home.
- Onsite and video coding tracked each participant's interactions with PARO, other participants, and the therapist.
- PARO had both direct and indirect effects on participants' behavior which differed for primary and nonprimary interactors.
- Participants' activity levels increased steadily for the duration of the study.



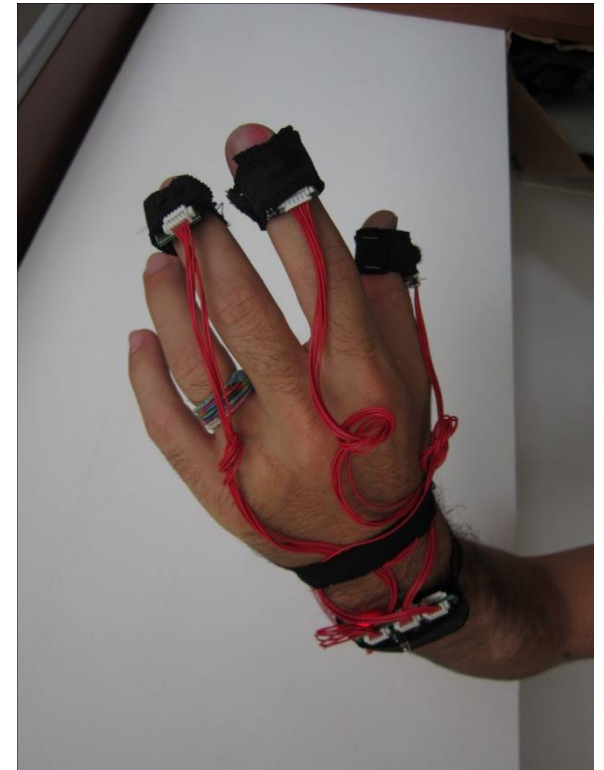
Preliminary evaluation of SensHand V1 in assessing motor skills performance in Parkinson Disease

Filippo Cavallo, Dario Esposito, Erika Rovini, Michela Aquilano, Maria Chiara Carrozza, Paolo Dario: Scuola Superiore Sant'Anna - The BioRobotics Institute

Carlo Maremmani: ASL1, Neurology Operative Unit

Paolo Bongioanni: AOUP, Neuroscience Department, Neurocare Onlus

- SensHand V1, a new full inertial wearable sensor system for fingers/hand movement analysis.
- Motor exercises from the UPDRS III scale for Parkinson assessment performed, by 10 patients and 5 healthy subjects.
- Preliminary results illustrate the potential for quantitative and objective diagnosis and rehabilitation assessments.



Development of the iPAM MkII System and Description of a Randomized Controlled Trial with Acute Stroke Patients

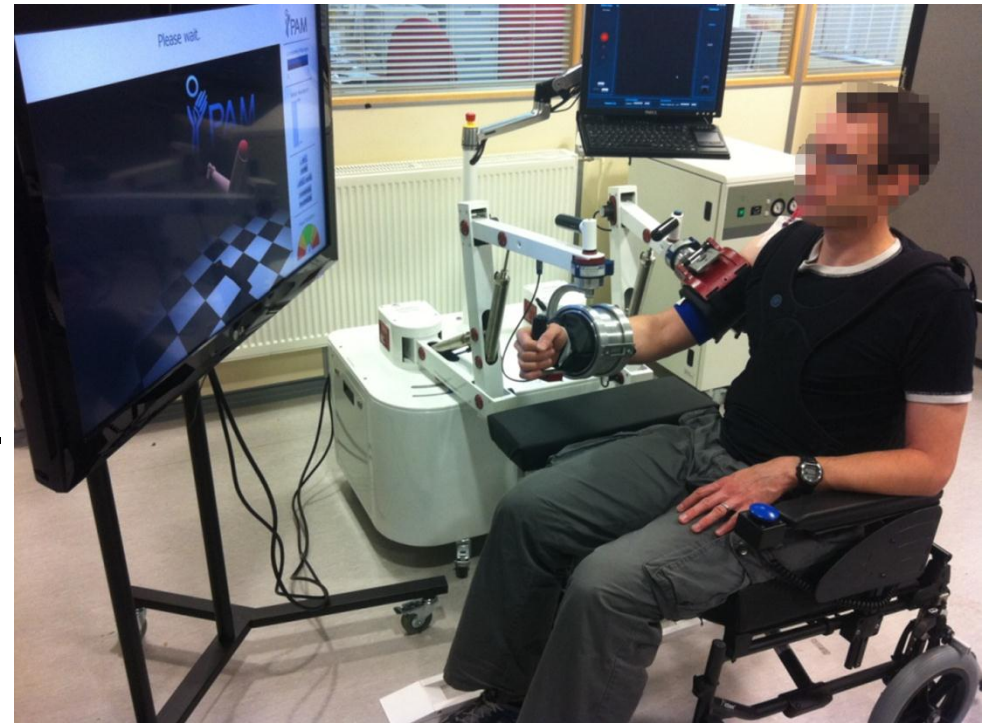
A. E. Jackson, M. C. Levesley: University of Leeds, UK

S. G. Makower: Leeds Community Healthcare NHS Trust, UK

J. A. Cozens: Grampian NHS, UK

B. B. Bhakta: Leeds Teaching Hospitals Trust, UK

- iPAM is a dual robot rehabilitation device for upper-limb therapeutic exercise.
- Refinements to iPAM MkI system based on patient feedback and study experience.
- Protocol of ongoing Randomized Controlled Trial introduced.



Effects of upper limb robot-assisted therapy on motor recovery of subacute stroke patients: a kinematic approach

S. Mazzoleni, PhD, Scuola Superiore Sant'Anna, Pisa, Italy

P. Sale, PhD, IRCCS San Raffaele Pisana, Roma, Italy

M. Tiboni, PT, Auxilium Vitae Rehabilitation Centre, Volterra, Italy

M. Franceschini, MD, IRCCS San Raffaele Pisana, Roma, Italy

M. C. Carrozza, PhD, Scuola Superiore Sant'Anna, Pisa, Italy

F. Posteraro, MD, Auxilium Vitae Rehabilitation Centre, Volterra, Italy

- Analysis of the effects of upper limb robot-assisted therapy on motor recovery of subacute stroke patients
- Integrated analysis of (i) kinematic data and (ii) clinical outcome measures
- Effectiveness of the upper limb robotic rehabilitation treatment to reduce functional impairment
- Need of frequent assessment measurements for identification of appropriate number of sessions tailored on the patient needs



Stroke patient during the upper limb robot-assisted therapy

Performance of Daily Activities by Older Adults with Dementia: The Role of an Assistive Robot

- We conducted a pilot study to investigate the feasibility and usability of an assistive robot to assist older adults with dementia (OAWD) in their activities of daily living.
- A prototype mobile robot, ED, provided (through tele-operation) need-based step-by-step guidance to five OAWDs while they make a cup of tea in the kitchen of the HomeLab.
- OAWDs and their caregivers were interviewed afterward to provide their feedback on the assistive robot as well to express their expectations from such robots .

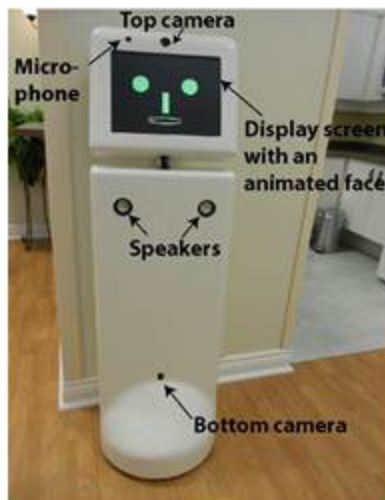


Fig. (Left) Prototype assistive robot "ED" (Right) ED assisting an older adult With dementia To make a cup of tea in the kitchen of HomeLab

Selecting Services for a Service Robot

Evaluating the problematic activities threatening the independence of elderly people

Sandra Bedaf: Zuyd University of Applied Sciences, the Netherlands

- ACCOMPANY project
- Care-O-bot 3 robot
- What should a service robot do to make a difference in daily care?



Initial Development of Direct Interaction for a Transfer Robotic Arm System for Caregivers

H Jeannis, G Grindle, A Kelleher, H Wang, B Brewer, R Cooper :
University of Pittsburgh (PIT)

- Caregivers are frequently injured during transfers
- Current transfer assistive systems use non-intuitive control methods
- Direct interaction is applied to a robotic transfer system called the Strong Arm
- Thresholds were tested to prevent unintentional forces by the user's hand



Study on a Practical Robotic Follower to Support Home Oxygen Therapy Patients

- Questionnaire-Based Concept Evaluation by the Patients -

G Endo, Y Iemura, EF Fukushima, S Hirose: Tokyo Institute of Technology
M Iribe, R Ikeda, K Onishi, N Maeda: Osaka Electro-Communication University
T Takubo: Tokyo Women's Medical University
M Ohira: East Nagano Hospital

a Meeting for the Pulmonary Rehabilitation Studies in Hokushin

- Mobile robots that can carry oxygen equipment has been developed to help home oxygen therapy patients to go out
- Two different prototypes were evaluated by a questionnaire survey for the patients
- The results show the basic concept and performance of the robot is acceptable and patients prefer to the small-sized prototype

