1. Record Nr. UNINA9911006985203321

Autore	Zhao Wenbing
Titolo	Technology-Enabled Motion Sensing and Activity Tracking for Rehabilitation
Pubbl/distr/stampa	Institution of Engineering & Technology, 2022 Bristol : , : Institution of Engineering & Technology, , 2023 ©2022
ISBN	9781523155460 1523155469 9781839534119 1839534117
Edizione	[1st ed.]
Descrizione fisica	1 online resource (319 pages)
Collana	Healthcare Technologies Series
Disciplina	617.03
Soggetti	Medical rehabilitation Machine learning Motion detectors
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di contenuto	Intro -- Title -- Copyright -- Contents -- About the author -- List of figures -- List of tables -- Introduction -- Part I Motion sensing technologies -- 1 Inertial measurement units -- 1.1 Accelerometer -- 1.2 Gyroscope -- 1.3 Magnetometer -- 1.4 Rehabilitation studies using IMUs -- 1.4.1 Studies using low-level IMUs -- 1.4.2 Studies using prepackaged professional sensors containing IMUs -- 1.4.3 Studies using consumer-grade devices containing IMUs -- 1.4.4 Studies using wearable trackers -- 2 Force and pressure sensing -- 2.1 Types of pressure sensors -- 2.1.1 Piezoelectric pressure sensors -- 2.1.2 Resistive pressure sensors -- 2.1.3 Capacitive pressure sensors -- 2.1.4 Optical pressure sensors -- 2.2 Applications in motion tracking for rehabilitation -- 2.2.1 Epionics SPINE system -- 2.2.2 Force plates -- 2.2.3 Smart insoles and smart shoes -- 2.3 Energy harvesting in smart shoes -- 3 E-Textile-based sensing -- 3.1 Conductive elastomer -- 3.1.1 Working principle -- 3.1.2 Attaching conductive elastomer to fabric -- 3.1.3 Motion tracking with conductive elastomer -- 3.1.4 New

development -- 3.2 Commercial elastic sensors -- 3.3 Other approaches -- 4 Muscle activity sensing with myography -- 4.1 Electromyography -- 4.1.1 EMG in upper-extremity stroke therapy -- 4.1.2 EMG in recovery progress evaluation of anterior cruciate ligament reconstructed subjects -- 4.2 Machanomyography -- 4.3 Force myography -- 4.4 Optical myography -- 4.5 Summary -- 5 Vision-based motion sensing -- 5.1 Microsoft Kinect sensor -- 5.2 Feasibility studies of using Kinect in rehabilitation -- 5.3 Kinect-based systems in rehabilitation -- 5.3.1 Kinect-based system with visual feedback only -- 5.3.2 Kinect-based system with performance quality feedback -- 5.3.3 Integration of Kinect and other sensing modalities -- 5.4 Beyond Kinect -- 6 Instrumented gloves.
6.1 Gloves based on IMUs -- 6.1.1 Calibration -- 6.1.2 Signal processing -- 6.1.3 Reference systems for evaluation -- 6.1.4 Accuracy evaluation -- 6.1.5 Repeatability and reliability evaluation -- 6.1.6 Classification of activities -- 6.2 Gloves based on flex sensors -- 6.3 Gloves based on optical sensors -- 6.3.1 FBG-based approach -- 6.3.2 Light-attenuation-based approach -- 6.3.3 Optical linear encoder -- 6.4 Gloves based on Hall effect -- Part II Human motion recognition and exergames -- 7 Measurement of basic parameters -- 7.1 Mechanics of body movements -- 7.1.1 Anatomical planes -- 7.1.2 Joints and their movements -- 7.1.3 Range of motion -- 7.2 Joint angle measurement with various sensing modalities -- 7.2.1 Joint angle measurement with IMU -- 7.2.2 Joint angle measurement with Kinect -- 7.3 Measurement theories -- 7.4 Evaluating a new measurement instrument -- 7.4.1 Root mean square error -- 7.4.2 Student's t-test -- 7.4.3 Pearson's coefficient of correlation -- 7.4.4 Intraclass correlation coefficient -- 7.4.5 Bland-Altman limits of agreement -- 8 Machine-learning-based activity recognition -- 8.1 Data pre-processing -- 8.2 Data segmentation -- 8.3 Feature engineering -- 8.3.1 Feature extraction -- 8.3.2 Feature selection -- 8.4 Supervised machine learning -- 8.4.1 Mathematical model for supervised machine learning -- 8.4.2 Cross validation -- 8.4.3 Common supervised machine-learning models -- 8.4.4 Performance evaluation for classification -- 8.4.5 Performance evaluation for regression -- 8.5 Unsupervised machine learning -- 8.6 Deep learning -- 8.7 Assessment of rehabilitation exercises -- 8.7.1 Activity recognition -- 8.7.2 Performance quality assessment -- 8.7.3 Clinical assessment -- 9 Rule-based activity recognition -- 9.1 Ad hoc rule-based studies -- 9.2 General-purpose rule-based activity recognition -- 9.2.1 Rule encoding method.
9.2.2 Real-time motion tracking -- 9.2.3 Fuzzy interference extension -- 10 Exergames -- 10.1 Commercial game-console-based exergames -- 10.1.1 Wii -- 10.1.2 Xbox -- 10.1.3 PlayStation -- 10.2 Custom-developed exergames -- 10.2.1 IMU -- 10.2.2 Kinect -- 10.2.3 Wii balance board -- 10.2.4 Mobile apps -- Part III Technology-facilitated rehabilitation -- 11 Technology-facilitated physical rehabilitation -- 11.1 Framework for physical rehabilitation -- 11.2 Motor control and motor learning -- 11.3 Interventions for improve motor function -- 11.4 Technology in physical rehabilitation -- 11.4.1 Augmented reality in physical rehabilitation -- 11.4.2 Smartphone use in physical rehabilitation -- 12 Technology-facilitated occupational rehabilitation -- 12.1 Framework for occupational therapy -- 12.2 Occupational therapy for return to work -- 12.3 Technology in occupational therapy -- 12.3.1 Assistive technology -- 12.3.2 Telerehabilitation -- 12.3.3 Exergames -- 12.4 Tracking of activities of daily living -- 13 Technology-facilitated speech rehabilitation -- 13.1 Common speech-related disorders -- 13.1.1 Aphasia -- 13.1.2 Dysarthria -- 13.1.3

Apraxia of speech -- 13.1.4 Dyslalia -- 13.1.5 Hearing impairment -- 13.1.6 Resonance disorders -- 13.1.7 Cognitive communication disorders -- 13.1.8 Expressive disorders -- 13.1.9 Fluency disorders -- 13.1.10 Articulation disorders -- 13.2 Standard speech and language therapy -- 13.3 Lee Silverman Voice Treatment -- 13.4 Computer-based speech therapy -- 14 Technology-facilitated pulmonary rehabilitation -- 14.1 Clinical scales and tests in pulmonary rehabilitation -- 14.1.1 The Borg Rating of Perceived Exertion -- 14.1.2 Dyspnea ratings -- 14.1.3 The Wisconsin Upper Respiratory Symptom Survey -- 14.1.4 Numeric rating scale as a measure of dyspnea -- 14.1.5 Medical Research Council dyspnea scale.
14.1.6 Functional independence measure -- 14.1.7 Cumulative illness rating scale -- 14.1.8 St. Georg's respiratory questionnaire -- 14.1.9 Feeling thermometer -- 14.1.10 The six-minute walk test -- 14.1.11 Short physical performance battery -- 14.1.12 Functional ambulation category -- 14.2 Exercise training -- 14.2.1 Endurance training -- 14.2.2 Interval training -- 14.2.3 Resistance/strength training -- 14.2.4 Upper limb training -- 14.2.5 Flexibility training -- 14.2.6 Neuromuscular electrical stimulation -- 14.2.7 Inspiratory muscle training -- 14.3 Pulmonary rehabilitation for COPD -- 14.3.1 Functional testing and measurement of physiological parameters -- 14.3.2 Telehealth -- 14.3.3 Technology-facilitated exercise training -- 14.3.4 Technology-facilitated self-management -- 14.4 Pulmonary rehabilitation for COVID-19 -- 15 Technology-facilitated cognitive rehabilitation -- 15.1 The impact of physical activities on cognition for children and young adults -- 15.2 Technology-facilitated detection of mild cognition impairment and dementia -- 15.2.1 Video-based detection of MCI -- 15.2.2 MCI-detection via fully-instrumented smart home -- 15.2.3 MCI-detection via minimally instrumented smart home -- 15.2.4 MCI-detection via non-mobility IADL tracking -- 15.3 Cognitive rehabilitation for older adults -- 16 Technology-facilitated mental health rehabilitation -- 16.1 Regular physical exercises and mental health -- 16.1.1 Psychological mechanisms -- 16.1.2 Inflammatory mechanisms -- 16.1.3 Psychological mechanisms -- 16.2 Rehabilitation for patients with autism spectrum disorder -- 16.2.1 Clinical scales in ASD studies -- 16.2.2 Social attention -- 16.2.3 Imitation -- 16.2.4 Cognitive load -- 16.2.5 Facial expression and emotion recognition -- 16.2.6 Physical exercise-based intervention.
16.3 Exercise-based intervention for patients with major depressive disorder -- 16.3.1 Clinical assessments in MDD studies -- 16.3.2 Supporting studies -- 16.3.3 Nonsupporting studies -- 16.4 Exercise-based rehabilitation for patients with post-traumatic stress disorder -- Conclusion -- References -- Index.

Sommario/riassunto

This book concentrates on sensing and measurement technologies for rehabilitation applications. The book looks at motion sensing technologies, human motion and exogames and healthcare applications including speech, respiration, and recovery from stroke or accident.