



PROGRAM

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extracted the features, and organized these into three datasets based on their type and clinical usability. One dataset comprised basic spatio-temporal features: tapping angle, duration and speed, whereas the second feature set included two more spatio-temporal features: maximum lifting and maximum foot drop velocities. Frequency-based parameters describing tap-to-tap variability and rhythm regularity were further added forming the third feature set. The feature sets were fed to the Support Vector Machine, and the accuracy was assessed with 10-fold cross validation. Obtained results showed that frequency-based parameters contribute to better differentiation between the evaluated groups with accuracy of $83.94 \pm 1.17\%$.

BTI1.3

INFLUENCE OF TWO WEEKS BALANCE PRACTICE WITH FEEDBACK ON THE GAIT IN HEMIPLEGIC PATIENTS

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We hypothesized that practicing balance with feedback will improve the gait in hemiplegic patients. The practice consisted of two weeks 30-minute long Wii-Fit balance board gaming. The gait analysis was based on ground reaction pressures (GRP) recorded with the custom designed insoles. The data were collected at 100 samples per second from two insoles, each comprising five pressure (force) sensors. The sensors communicated with the host computer by a WiFi link. Custom software was developed in Matlab for automatic segmentation of the GRP data into segments belonging to swing and stance phases of each step. The examiner could correct the automatic segmentation if necessary. The outputs from the program were: pressure vs. time from all sensors and standard gait data (cadence, symmetry index, etc.). The results show that the exercise of the function with feedback has positive effects on the gait performance. The exercise period was only two weeks, and the group was small and heterogeneous; hence, a more extensive study is required for proving the significance.

BTI1.4

GYROSCOPE-BASED METHOD FOR EVALUATION OF GAIT SYMMETRY

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The hypothesis of the research was that MEMS based gyroscopes mounted on the lateral side of the thigh can be used for the assessment of the symmetry of the gait. To test the hypothesis we recorded gait characteristics with insoles in both shoes which measured the ground reaction force (GRF) distribution (five sensors per insole) and inertial measurement units (IMU) mounted on the lateral side of legs. We introduced the interval f1 when the angular rate in the sagittal plane is positive and f2 when the angular rate is negative. The symmetry of gait defined by the intervals f1 and f2 was compared with the symmetry calculated from the durations of the stance and swing phases. The analysis was performed by using the data collected in a short clinical study with twelve stroke patients. The IMU and GRF based estimated symmetries showed strong correlation ($r=0.87$, $p<0.001$). The differences between the IMU and GRF based estimated symmetries were within 4%. The results suggest that the IMU can be used instead of the GRF instrumented insoles for the assessment of the symmetry in the clinical environment.

BTI1.5

EFFECTS OF WII-FIT BALANCE BOARD EXERCISE ON THE POSTURE OF STROKE PATIENTS

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We studied the effects of the balancing exercise with visual feedback to the correction of posture in stroke patients. We included eight stroke patients into a 30-minute daily, two-week long clinical study where Wii-Fit balance board was the instrument to provide visual feedback. We assessed the posture before and after the treatment by four clinical tests: Berg balance test, Barthel index, Timed up & go and Functional reach test. We also analyzed the ground reaction pressures (GRP). We measured the GRP by using insoles comprising five MEMS sensors each. We developed a program that created maps showing ground pressure distribution. The program uses cubic spline interpolation of data. The maps of left and right sole were compared to assess the symmetry, and the maps before and after the treatment were used to examine the effects of the exercise. The clinical test scores suggest improved standing after the treatment compared with before the treatment. The maps of ground reaction pressure also show improvement, but more critical provide information for correcting the posture.

BT11.6

NEUROMUSCULAR STIMULATION AND ELECTRONIC STIMULATOR OUTPUT STAGE FOR GENERATING VARIOUS CURRENT WAVEFORMS

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The artificial stimulation of neuromuscular structures has found many applications in modern medicine. There are many devices, which are intended for the stimulation of neuromuscular structures, developed for commercial and scientific research purposes. The majority is based on generating rectangular current or voltage impulses. This form of stimulation has long been found in clinical practice. However, from scientific point of view, having an electronic stimulator which is able to generate arbitrary waveforms seems to be necessary in order to examine physiological response to various waveforms of the stimulus. In this work the design of PC-based electronic stimulator that is able to generate different current waveforms is presented.

BT11.7

PHYSIOLOGICAL DATA ACQUISITION SYSTEM FOR A BIOMEDICAL ENGINEERING EDUCATION

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This paper describes the physiological data acquisition system designed for the student laboratory exercises. The system has the functionality of electrocardiography and electromyography monitoring and also can be used as a photoplethysmograph. The system is portable and can be completely functional without the cable connections to other devices. It has an open architecture, which enables various types of expansions and modifications, which is suitable for student project realizations.

BT11.8

GLOBAL CONTRAST REDUCTION FOR BETTER LOCAL STRUCTURE VISUALIZATION IN DIGITAL RADIOGRAPHY

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